Using behavior change frameworks to improve healthcare worker influenza vaccination rates: A systematic review

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A B S T R A C T

Background: Influenza vaccination of healthcare workers (HCW) is important for protecting staff and patients, yet vaccine coverage among HCW remains below recommended targets. Psychological theories of behavior change may help guide interventions to improve vaccine uptake. Our objectives were to: (1) review the effectiveness of interventions based on psychological theories of behavior change to improve HCW influenza vaccination rates, and (2) determine which psychological theories have been used to predict HCW influenza vaccination uptake.

Methods: MEDLINE, EMBASE, CINAHL, PsycINFO, The Joanna Briggs Institute, SocINDEX, and Cochrane Database of Systematic Reviews were searched for studies that applied psychological theories of behavior change to improve and/or predict influenza vaccination uptake among HCW.

Results: The literature search yielded a total of 1810 publications; 10 articles met eligibility criteria. All studies used behavior change theories to predict HCW vaccination behavior; none evaluated interventions based on these theories. The Health Belief Model was the most frequently employed theory to predict influenza vaccination uptake among HCW. The remaining predictive studies employed the Theory of Planned Behavior, the Risk Perception Attitude, and the Triandis Model of Interpersonal Behavior. The behavior change framework constructs were successful in differentiating between vaccinated and non-vaccinated HCW. Key constructs identified included: attitudes regarding the efficacy and safety of influenza vaccination, perceptions of risk and benefit to self and others, self-efficacy, cues to action, and social-professional norms. The behavior change framework, along with sociodemographic variables, successfully predicted 85–95% of HCW influenza vaccination uptake.

Conclusion: Vaccination is a complex behavior. Our results suggest that psychological theories of behavior change are promising tools to increase HCW influenza vaccination uptake. Future studies are needed to develop and evaluate novel interventions based on behavior change theories, which may help achieve recommended HCW vaccination targets.

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1. Introduction

Vaccination of healthcare workers (HCW) against influenza is an important patient safety initiative recommended by health authorities and national organizations [1]. Influenza vaccination protects both HCW and patients, and is a cost-effective preventative measure [2,3]. However, HCW influenza vaccination rates remain suboptimal despite aggressive campaigns incorporating numerous strategies. In the United States, 61.5–72.0% of HCW reported being vaccinated against influenza in the 2012–2013 season [1]. Similar
trends have been observed in Canada, with 50% of hospital HCW and 74% of long-term care facility HCW receiving influenza vaccinations in the 2012–2013 season [4]. European Union data is also concerning with HCW vaccination rates ranging 6–54% [3]. The health and safety of patients and HCW remains at risk without effective interventions to increase HCW vaccination uptake.

Improvement of patient safety using behavior change theories as frameworks for designing interventions to increase HCW vaccination rates should be evaluated. Behavior change theories provide a framework to understand and influence specific health behaviors, including HCW influenza vaccination behavior. Numerous facilitating factors and barriers to HCW influenza vaccination have been identified [5–7]. However, there appears to have been relatively little emphasis on the use of behavioral psychology and health behavior change theories to inform interventions aimed at improving vaccine uptake. Healthcare institutions have relied on employing a variety of interventions to increase influenza vaccination such as reminders, education, incentives, promotion in the workplace, and easy access to free vaccination [8,9]. These initiatives have only resulted in small increases in HCW vaccination rates [10,11]. To date, the literature has not systematically examined whether interventions based on psychological theories can be an effective strategy to improve HCW vaccination rates.

The primary objective of this systematic review was to determine the effectiveness of interventions based on psychological frameworks of behavior change to improve HCW vaccination rates. The secondary objective was to determine which psychological frameworks have been used to predict HCW vaccination rates, including facilitators and barriers, as these may be used to develop and implement novel interventions in the future to improve vaccination rates.

2. Methods

2.1. Search strategy

Electronic databases were searched using a defined literature search strategy (Appendix A) developed by a team of experienced librarians. Relevant publications were obtained via searches of MEDLINE, EMBASE, CINAHL, PsycINFO, The Joanna Briggs Institute, SocINDEX, and Cochrane Database of Systematic Reviews from database inception to June 5th, 2014. Reference sections of included studies and relevant review papers were hand-searched for additional eligible studies.

2.2. Eligibility criteria

Randomized controlled trials, non-randomized controlled trials, time series, controlled before–after studies, quasi-experimental studies (including uncontrolled before–after), and qualitative or quantitative cross-sectional studies that applied a psychological theory of behavior change to improve and/or predict HCW influenza vaccination rates were considered for inclusion. Given the Medical Research Council’s guidance that complex behavioral interventions should be based on theory [12], studies that did not explicitly name a psychological theory were excluded at the full text phase. When no theory was explicitly named in the title or abstract of an article, the article full text was retrieved and reviewed. The study population had to consist of HCW, but the HCW could be from any HCW group (e.g., physicians, nurses, allied health practitioners, technicians). Medical and nursing students were included in the definition of HCW. Studies conducted in any healthcare setting, including acute care and long-term care, were included. All studies had to include influenza vaccination rates as an outcome. Only published, peer-reviewed studies were included; studies published solely in abstract form were excluded. Studies were excluded if they were not published in English or if they did not provide primary data.

2.3. Data extraction and coding

All articles captured by the search protocol were screened to remove duplicate entries. Titles and abstracts of the remaining works were independently assessed for eligibility by two reviewers (D.H. and D.Y.). If the title/abstract were insufficient to determine eligibility, the full text was reviewed. Disagreements were resolved by consensus following a discussion with a third reviewer (K.C.).

A data extraction form was developed and piloted for use in this study. Using this form, two reviewers (D.H. and D.Y.) independently assessed each full-text article and extracted the relevant information, including study methodology, setting, participants, psychological theory, intervention, predictors of vaccination, and outcomes. Disagreements were resolved by a third reviewer (K.C.) if the two primary reviewers could not reach consensus.

2.4. Risk of bias assessment

Risk of bias for each included study was assessed independently by two investigators (K.C. and D.H.) using the Public Health Ontario Meta QAT tool to guide the critical appraisal process. Risk of bias for Corace et al. [13] was assessed separately by impartial reviewers (J.A.S. and D.H.).

3. Results

The literature search yielded a total of 1810 publications from all data sources: 10 articles met inclusion criteria (Fig. 1). All included studies used psychological frameworks to predict HCW vaccination behavior. None of the studies that met inclusion criteria evaluated interventions to increase HCW influenza vaccination rates based on a psychological theory of behavior change. It was not possible to perform meta-analysis due to heterogeneity in study design and outcomes.

3.1. Study characteristics

Ten peer-reviewed, primary data, studies were included in this review (Table 1). The locations in which the studies were completed were geographically diverse, with studies being conducted in Australia, Canada, Israel, Greece, the Netherlands, and the United States. The definition of HCW was found to be representative of staff in hospital care settings; however the majority of studies relied on HCW in nursing roles as participants. Two studies consisted solely of nursing students [14,15].

Self-reported influenza vaccination uptake was the primary outcome variable measured, although some studies also incorporated an objective measure of vaccination uptake in the form of hospital vaccination records [13,16]. The majority of studies examined HCW vaccination for seasonal influenza virus, although Corace et al. investigated pandemic (H1N1) influenza vaccination [13]. The Health Belief Model (HBM) was the most common behavioral framework, applied in 60% of the studies identified [13,15,17–20]. Two studies used the Theory of Planned Behavior (TPB) [14,16] while the remaining used the Triandis Model of Interpersonal Behavior [21] and the Risk Perception Attitude framework (RPA) [22].

3.2. Health Belief Model

The Health Belief Model (HBM) [23] has been applied to a broad range of health behaviors. This framework has been used to
understand a number of preventative and health promotion behaviors (e.g., diet and exercise)\textsuperscript{[24]}, in addition to influenza vaccination\textsuperscript{[6]}. According to the HBM, HCW vaccination behavior can be understood using five key constructs: (1) perceived susceptibility of self or others to influenza, (2) perceived severity of influenza to self or others, (3) perceived benefits of influenza vaccination for self or others, (4) perceived barriers to influenza vaccination, and (5) cues to action (i.e., internal and external cues which are motivators for vaccine uptake).

HBM variables were identified as modifiable factors that predict vaccination among HCW\textsuperscript{[13,18,19]}. Variables from the perceived benefits category were frequently found to be significant predictors of vaccination\textsuperscript{[13,15,18,19]}. These included beliefs that vaccination is safe and protects one’s family (OR 13.23)\textsuperscript{[13]}, reduces personal risk of infection (OR 15.30, t-test 5.68, \( p < 0.001 \))\textsuperscript{[15,19]}, and reduces risk for patients (OR 6.52)\textsuperscript{[18]}.

Perceived susceptibility was the second most common HBM category used to predict HCW vaccination. Risk to patients was most frequently reported in this category (OR 4.72, OR 5.63, and OR 7.44)\textsuperscript{[13,18,19]}, followed by high personal risk of infection (OR 8.76)\textsuperscript{[13,19]}, and low personal risk of infection (OR 0.001, OR 6.37, and OR 6.75)\textsuperscript{[17–19]}

Numerous cues to action items were also predictive of vaccination uptake. Knowledge of influenza vaccination recommendations (OR 1.59 and OR 1.78, and t-test 6.14; \( p < 0.01 \)) and agreement with the content of vaccination guidelines (OR 11.70)\textsuperscript{[15,18,19]}, along with encouragement from supervisors and doctors (OR 3.63)\textsuperscript{[13]} were significant predictors. In addition, media attention (OR 2.87)\textsuperscript{[19]} and knowledge that individuals close to HCW (e.g., family, romantic partners) feel vaccination is important (OR 7.33)\textsuperscript{[13]} were also predictors of receiving influenza vaccination.

Perceived severity of influenza virus and perceived barriers to vaccination were less frequently found to be significant predictors. Fear of influenza (OR 3.18)\textsuperscript{[13]} and not worrying about side effects (OR 4.94 and OR 10.03)\textsuperscript{[13,18]} were significant predictors of HCW vaccination uptake in these categories.

In all studies, vaccinated HCW significantly differed from unvaccinated HCW on all HBM constructs evaluated. Vaccinated HCW were more likely to report that they were susceptible to influenza, that it was a serious disease, and had positive perceptions about the efficacy of influenza vaccination. In contrast, unvaccinated HCW tended to report little perceived need for vaccination as they believed they were in good health. Many unvaccinated HCW noted perceived barriers to vaccination and lack of benefits, citing a lack of availability or too little time to get vaccinated and concerns about potential side-effects. These findings were similar to Raftopolous\textsuperscript{[20]} who studied a group of HCW that were mostly unvaccinated (97%). While these HCW reported perceptions of the severity of influenza as a serious disease for at-risk groups and perceived benefit of vaccination with respect to protecting patients, the most common reasons for not being vaccinated was a belief that they had a low personal risk of infection, did not belong to an at-risk group, were already healthy, and had busy schedules that did not accommodate getting vaccinated.

3.3. Theory of Planned Behavior

The Theory of Planned Behavior (TPB)\textsuperscript{[25]} has been applied to an extensive range of health behaviors\textsuperscript{[26]}. According to TPB intentions predict behavior: Intentions to perform a given behavior are determined by attitudes (i.e., one’s subjective evaluation of the behavior and outcomes of the behavior), subjective

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**Fig. 1.** Overview of study selection.
norms (i.e., one’s assessments of whether close others would approve of the behavior) and perceived behavioral control (i.e., one’s assessment of whether one is ready and able to enact the behavior) [25].

Attitude was found to be the strongest predictor of intention to get vaccinated and intention to vaccine was the strongest predictor of self-reported vaccination uptake [14,16]. In a study by Cornally et al. [14], attitudes toward influenza vaccination, subjective norms, and perceived behavioral control were significantly correlated and explained 41.9% of the variance in intention to get vaccinated, with attitude ($r = .56, p < .01$) and subjective norms ($r = .47, p < .01$) emerging as the strongest contributors. Future intent to vaccinate and past vaccination behavior had a statistically significant association ($p < .05$).

Godin et al. extended TPB to include four additional variables: anticipated regret, moral norm, descriptive norm, and professional norm [16]. Anticipated regret refers to an individual’s anticipated feelings of regret if they do not adopt the behavior, while moral, descriptive, and professional norms refer to feelings of obligation toward adopting the behavior, estimates of the percentage of close individuals that will adopt the behavior, and evaluations of the behavior based on professional convictions, respectively [27]. The strongest determinants of influenza vaccination uptake, after controlling for past behavior, were intention (odds ratio [OR] = 2.84), anticipated regret (OR = 2.30), professional norms (OR = 2.14) and work status (OR = 2.11). This model correctly predicted 85% of HCW vaccination. The determinants of intention, after controlling for past behavior, were attitude ($\beta = .32, p < .001$), professional norms ($\beta = .18, p < .001$), moral norms ($\beta = .18, p < .001$), subjective norms ($\beta = .09, p < .001$), and self-efficacy ($\beta = .08, p < .001$). This model explained 89% of the variance in HCW intention to get the influenza vaccination.

### 3.4. Other psychological theories

The other models we investigated were Risk Perception Attitude (RPA) [28] and the Triandis Model of Interpersonal Behavior [29]. The RPA framework is based on the principles of Social Cognitive Theory [30] and uses perceptions of risk to self and self-efficacy to understand how health information is used. Similarly, the Triandis Model of Interpersonal Behavior builds on The Theory of Planned Behavior. In this model intention is influenced by cognitive factors.
(e.g. knowledge about vaccination), affective factors (e.g. one’s attitudes about vaccination), and social factors (i.e. social norms related to the behavior). The probability of HCW vaccination behavior is influenced by intention and habit (e.g. past vaccination behavior), which are both influenced by facilitating conditions (i.e. contexts that allow or provide reminders for a behavior to be performed).

3.4.1. Risk Perception Attitude

Real et al. [22] used Risk Perception Attitude (RPA) to classify HCW into four categories based on perceived risk and efficacy beliefs. Responsive (e.g., high perceived risk and high self-efficacy), avoidant (e.g., high perceived risk and low self-efficacy), proactive (e.g., low perceived risk and high self-efficacy), and indifferent (e.g., low perceived risk and low self-efficacy) [22]. This approach was successful in discriminating non-vaccinated from vaccinated HCW. Self-reported vaccination rates varied as a function of RPA group (\(F_{2,269} = 3.98, p < .01\)). Participants in the avoidant and indifferent groups reported significantly lower rates of vaccination than those in the responsive and proactive groups, suggesting that individuals with higher self-efficacy are more likely to report receipt of influenza vaccination. The avoidant group also reported higher rates of ambivalence toward vaccination, and influenza-related absenteeism, than any other RPA group.

3.4.2. Triandis Model of Interpersonal Behavior

Johansen et al. used the Triandis Model of Interpersonal Behavior to investigate influenza vaccination history over a 10-year period [21]. Each component of the model (facilitating conditions, habit, intention, cognitive factors, affective factors, and social factors) significantly differentiated vaccinated from non-vaccinated HCW. However, only habit (\(r = .80, p < .001\)) and intention (\(r = .48, p < .001\)) emerged as strong, positively correlated predictors of past vaccination uptake. Respondents who believed that the influenza vaccine can cause influenza, or believed that side effects were frequent, had lower habit and intention scores and were less likely to report having been vaccinated in the past.

3.5. Models predicting influenza vaccination based on behavior theories

Five studies developed models to predict HCW vaccination using socio-demographic variables and constructs from a variety of behavioral theories. One study's multivariate model, combining sociodemographic, Health Belief Model (HBM), and Behavioral Intention Model [31] (BIM; a precursor to the Theory of Planned Behavior) variables, correctly predicted 94% of self-reported HCW influenza vaccination (AUC = 0.94) [19]. Another used sociodemographics, HBM, BIM, and the Attitudes and Self-Efficacy Model [32], which adds a measure of self-efficacy, to correctly predict 95% of HCW influenza vaccination uptake (AUC = 0.95) [18].

Corace et al. predicted 95% of pH1N1 vaccination uptake among a large sample of HCW (AUC = 0.95) [13]. This model consisted of sociodemographic, influenza risk factor, vaccination history, and HBM variables. HBM variables were significant predictors of vaccination even with the base model variables (sociodemographic, influenza risk factor, vaccination history) included [13].

Shahrabani et al. [15] tested a probit model to predict vaccination uptake in the past year using sociodemographic information, knowledge of influenza vaccination, health motivation, and the five HBM variables. After controlling for sociodemographics, only the cues to action and perceived benefit categories explained HCW vaccination uptake.

Godin et al. [16] used their extended model of the Theory of Planned Behavior (TPB) to predict HCW vaccination uptake and intention. After controlling for past behavior, these models correctly classified 85% of HCW vaccination status and 89% of the variance in intention of HCW to receive influenza vaccination (AUC = 0.89).

3.6. Risk of bias assessment

Risk of bias was assessed using the Meta QAT (Table 2). The overall risk of bias of the included studies was moderate. Many studies included weaknesses in research methodology such as non-representative samples and reliance on self-reported vaccination status.

Among all included studies, we noted the potential for recall and social desirability bias due to the retrospective nature of the survey measure [13–17,23,27]. Study quality was also reduced if self-report was the only vaccination measure [15,18,19]. Small sample sizes and biased sample pools were also noted as potential sources of bias [14,17,19–21]. In one study, the authors combined participants who reported being vaccinated and participants that reported intention to get vaccinated into the same group during their analysis [22]. This introduces potential error in the dependent variable as studies have indicated that although intention to vaccinate is often correlated (and sometimes strongly) with vaccination behavior, intention cannot be considered to be interchangeable with behavior [33,34].

4. Discussion

The primary objective of this systematic review was to examine the effectiveness of interventions based on psychological theories of behavior change to increase influenza vaccination uptake among HCW. The secondary objective was to examine the use of these theories to predict HCW influenza vaccination uptake. While this review did not identify any intervention studies that met inclusion criteria, a number of studies made use of a variety of behavioral frameworks to predict influenza vaccination uptake. The Health Belief Model was most frequently employed in this regard, followed by the Theory of Planned Behavior. It is concerning that data supporting the use of behavior change frameworks (i.e. prediction of vaccination behavior) has not translated into uptake of research involving behavior change frameworks to design interventions to improve HCW vaccination behavior.

Our review found that models developed using HBM constructs, along with other behavioral variables, were successful in predicting influenza vaccination uptake among HCW. In addition, Health Belief Model, Theory of Planned Behavior, Risk Perception Attitude, and Triandis Model variables were successful at differentiating vaccinated from non-vaccinated HCW. This supports the use of HBM as an appropriate theory which may be used to inform future intervention studies. The Theory of Planned Behavior was also successful at predicting influenza vaccine uptake however this was only observed in one of the two studies that used the Theory of Planned Behavior as a framework. Nevertheless, the Theory of Planned Behavior is intended to explain deliberative, planned actions and is thus likely well-suited to influenza vaccination behavior. Risk Perception Attitude and the Triandis Model are also promising theories, however, additional research into the utility of these theories may be required as this review only identified one study of each respective model.

Across the included studies we identified a number of constructs that were important in predicting HCW vaccination uptake and differentiating vaccinated and unvaccinated HCW. Specifically, attitudes regarding the efficacy and safety of influenza vaccination, perceptions of risk and benefit to self and others [13,18,19], self-efficacy [21,22], cues to action [15,18,19], habit [21], social-professional norms [16], and anticipated regret [16]
consistently differentiated vaccinated from unvaccinated HCW. These constructs offer promising targets for future interventions aimed at increasing HCW influenza vaccination.

This research was intended to support the development of future influenza interventions among HCW by identifying theoretical frameworks that can be used to design and implement evidence-based interventions. Historically, interventions to increase influenza vaccination uptake amongst HCW have focused on information and education [35]. Still, a large proportion of HCW continue to oppose vaccination regardless of facts, evidence, and information presented. Knowledge is necessary but not sufficient to initiate behavior change [36]. Vaccination is a complex behavior and must be understood in terms of the multi-factorial components, such as attitudes, beliefs, self-efficacy, motivation, perceived threat, and socio-cultural influences that are embodied in many other health behaviors [36]. There is a paucity of research examining theory-based interventions to increase influenza vaccination uptake: Of the 173 studies we identified for full text review only 10 studies used behavior change theories to predict HCW vaccination; no theory-based interventions were identified. By exposing this gap, we hope that interested researchers will begin to examine this under-studied area. The included studies have only begun to apply behavior change theories to understanding and predicting influenza vaccination. Other models (e.g., Social Cognitive Theory, the Transtheoretical Model) that may be applicable to increasing HCW vaccine acceptance have yet to be explored. Our review has identified a number of theories that are effective at predicting actual vaccination uptake. Thus, future work should design interventions, implement, and evaluate interventions based on these theories.

Clearly, there is a need to close the gap between research evidence and practice in this area. This work highlights potential models that can be used to inform interventions to increase HCW vaccination uptake, however the efficacy of interventions informed by theories of health behavior change remain to be evaluated. Given the success of these frameworks to predict vaccination behavior, it may be appropriate to apply these models to help guide and inform interventions to increase HCW vaccination uptake. Additional research is needed to pilot interventions based on these frameworks and evaluate their effectiveness. Real et al. [22] successfully identified HCW based on key behavioral determinants (self-efficacy and risk perception) and suggested that future interventions should be targeted toward the specific needs of the target population [22]. Similar arguments have been made with respect to evidence-based interventions to affect behavior change in healthcare settings [37].

Table 2
Risk of bias assessment (meta QAT).

<table>
<thead>
<tr>
<th>Study</th>
<th>Assessment of relevance</th>
<th>Assessment of reliability</th>
<th>Assessment of validity</th>
<th>Assessment of applicability</th>
</tr>
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<tr>
<td>Corace et al. (2013)</td>
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<tr>
<td>Cornally et al. (2013)</td>
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<td>Godin, Vezina-I, &amp; Naccache (2010)</td>
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<tr>
<td>Hopman et al. (2011)</td>
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<tr>
<td>Johansen, Stenvig, &amp; Wey (2012)</td>
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<tr>
<td>Loojmans-van den Akker et al. (2009)</td>
<td>Not Applicable</td>
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<tr>
<td>Raftopolous (2008)</td>
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<td>Shahrabani, Benzoni, &amp; Yorn Dim (2008)</td>
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</table>

Note: gray = yes, white = unclear, black = no.
4.1. Limitations

A number of limitations must be considered when interpreting these results. First, any non-English publications examining behavioral frameworks to improve HCW influenza vaccination uptake are not captured in this review. The eligibility criteria for this review included a requirement that studies explicitly name a psychological theory of behavior change. It is possible that articles were excluded that applied, but did not explicitly name, a psychological theory of behavior change. This could result in a review of only a subsample of the total number of studies that aimed to apply such a theory; thus, introducing potential bias and reducing the comprehensiveness of this review. However, there are several challenges to including studies that do not explicitly state a theory, including: (1) making inferences regarding which theories the authors intended to apply, if any, based on potential constructs; and (2) many theories have overlapping constructs which makes it difficult to infer which theories, if any, were intended to be applied based on the constructs alone. Thus, including studies that did not explicitly state a theory could add significant error to our results. All but one of the included studies provided comprehensive coverage of the constructs of their respective, explicitly named theories. Namely, Ballestras et al. assessed all constructs but the “cues to action” construct in their application of the HBM [17].

Secondly, the majority of included studies used cross-sectional or questionnaire/survey designs that relied on self-reported vaccination uptake as a primary outcome of interest. These studies can be vulnerable to bias as self-reported vaccination behavior has been criticized of being unable to be a true measure of actual vaccination as HCW may overestimate influenza vaccination behavior via self-report when compared to vaccination records [38].

Third, studies that employed random sampling had low response rates, while participant recruitment in others was voluntary. Volunteer bias may partially explain the particularly strong relationships between vaccinated HCW and the behavioral-psychological constructs measured.

Lastly, the use of the terms “predict” or “prediction” in the cross-sectional designs of the papers included in our review does not allow us to infer causation, but rather limits us to associations between the theoretical constructs and vaccination behavior.

5. Conclusions

At present, there is a paucity of evidence-based behavior change interventions to increase influenza vaccination uptake among HCW. However, we have identified several studies that have been successful at predicting influenza vaccination uptake using established models of health behavior change. To our knowledge this review is the first to examine the use of theories of behavior change to inform influenza vaccination intervention and prediction among HCW. This review highlights that psychological theories of behavior change can help researchers, clinicians, and decision makers better understand HCW vaccination behavior, which may be used in turn to inform the development of evidence-based interventions. This work identifies valuable opportunities to bridge the behavior change and infection prevention and control disciplines to improve HCW behaviors, including vaccination rates.

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Conflict of interest: The authors report no conflicts of interest.

Appendix A. Medline search strategy

<table>
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<td>1</td>
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</tr>
<tr>
<td>2</td>
<td>Influenza, Human/</td>
</tr>
<tr>
<td>3</td>
<td>Influenza, Human/Lp [Prevention &amp; Control]</td>
</tr>
<tr>
<td>4</td>
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<td>5</td>
<td>(1 and 2) or 3 or 4</td>
</tr>
<tr>
<td>6</td>
<td>(flu or influenza or H1N1) and (vacc* or immuniz* or immun* or shot? or jab?):mp.</td>
</tr>
<tr>
<td>7</td>
<td>limit 6 to (“in data review” or in process or “published not medline”)</td>
</tr>
<tr>
<td>8</td>
<td>exp Health Personnel/or Allied Health Personnel/or Emergency Medical Technicians/or Infection Control Practitioners/or Medical Staff/or Nursing Staff/or Nurse Practitioners/or Physicians/</td>
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<tr>
<td>9</td>
<td>(((health* or hospital or acute care or primary care or medical or infection control) adj2 (worker? or staff or personnel or practitioners? or provider? or technician?) or HCP?) or doctor*) or physician? or nurs* or paramedic* or clinician* or pediatrician* or general practitioner* or pharmacist* or hospitalist* or midwif*:mp.</td>
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<td>10</td>
<td>8 or 9</td>
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<tr>
<td>11</td>
<td>((theor* adj2 (“reasoned action” or (planned adj1 behavior?) or “normative conduct” or “social cognitive” or “self efficacy”)) or (model? adj2 (“habit-goal” or transtheoretical or “health belief” or “habit goal” or (behavior? adj1 change?)) or “health action process”?):mp.</td>
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<td>12</td>
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<td>11 or 12</td>
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<tr>
<td>14</td>
<td>(((behavior? or habit? or practice?) adj2 (chang* or alter* or modif*)) or positive devian* or (psychology or psychological*) adj3 (framework? or intervention* or theor*)):mp.</td>
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<tr>
<td>15</td>
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References


