

## Paper-based and web-based intervention modeling experiments identified the same predictors of general practitioners' antibiotic-prescribing behavior

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### Abstract

**Objectives:** To evaluate the robustness of the intervention modeling experiment (IME) methodology as a way of developing and testing behavioral change interventions before a full-scale trial by replicating an earlier paper-based IME.

**Study Design and Setting:** Web-based questionnaire and clinical scenario study. General practitioners across Scotland were invited to complete the questionnaire and scenarios, which were then used to identify predictors of antibiotic-prescribing behavior. These predictors were compared with the predictors identified in an earlier paper-based IME and used to develop a new intervention.

**Results:** Two hundred seventy general practitioners completed the questionnaires and scenarios. The constructs that predicted simulated behavior and intention were attitude, perceived behavioral control, risk perception/anticipated consequences, and self-efficacy, which match the targets identified in the earlier paper-based IME. The choice of persuasive communication as an intervention in the earlier IME was also confirmed. Additionally, a new intervention, an action plan, was developed.

**Conclusion:** A web-based IME replicated the findings of an earlier paper-based IME, which provides confidence in the IME methodology. The interventions will now be evaluated in the next stage of the IME, a web-based randomized controlled trial. © 2014 Elsevier Inc. All rights reserved.

**Keywords:** Intervention modeling experiments; Behavior change; Randomized controlled trials; Intervention development; Prescribing; Primary care

### 1. Introduction

Improving health care is not only about developing new treatments and therapies but also requires that existing knowledge of effective interventions be put into clinical

practice. This can be challenging. Without active implementation, there is a danger that potentially useful research evidence will languish in obscurity (the “bench to bookshelf” phenomenon) or will diffuse only very slowly into practice [1]. Although some interventions have been shown to be effective in changing the behavior of health professionals [1–4], the literature provides little information to guide the choice, or to optimize the components, of these interventions for use in different contexts [5,6]. Interventions can be effective (eg, reminder systems, audits), but the evidence is conflicting and the reason for this is largely unknown [2]. However, many interventions are developed without an explicit theoretical rationale for why and how

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**What is new?****Key findings**

- A web-based intervention modeling experiment (IME) replicated the findings of an earlier paper-based IME on general practitioners' antibiotic-prescribing behavior.
- The constructs that predicted both simulated behavior and intention were attitude, perceived behavioral control, risk perception/anticipated consequences, and self-efficacy, which matched those identified in the earlier paper-based IME.

**What this adds to what was known?**

- The IME methodology has been used for paper-based experiments, but there had been no replication studies to test the methodology itself. This study replicated an earlier paper-based IME and was expected to identify the same predictors of behavior, which it did.

**What is the implication and what should change now?**

- The IME methodology is a robust choice for exploratory work developing and evaluating complex behavior change interventions before evaluating them in a full-scale trial.

the intervention might be expected to have an effect, which may help to explain why the effectiveness of behavior change interventions can appear somewhat hit and miss. To address this, the UK Medical Research Council framework for developing and evaluating complex interventions has argued for more and better theoretical and exploratory work before a full-scale trial as a means of improving intervention development [7].

One way of carrying out this exploratory work is to use an intervention modeling experiment (IME) [8]. In an IME, key elements of the intervention are delivered (using a randomized design) in a manner that approximates the real world but where the measured outcome is generally an interim outcome, a proxy for the clinical behavior of interest. To date, IMEs have been conducted using paper-based materials [8–10], but this may limit their efficiency, acceptability, and ecological validity. Web-based IMEs (WIMEs) have the potential to provide much richer simulations of clinical encounters (eg, through presentation of video clips of patient–physician consultations) and allow easy measurement of key process variables such as time taken to make a decision.

To evaluate the robustness of the IME methodology, we conducted a web-based IME study [11] that replicated an

earlier paper-based IME, which evaluated theory-based interventions to reduce antibiotic prescribing for upper respiratory tract infections (URTIs) in primary care [9,10]. We will refer to the earlier study [9] as “the paper-based IME” throughout this article; we will call the web-based study “WIME.” This article describes the process that we used to identify predictors of prescribing behavior in the WIME, a comparison of these with the predictors identified in the paper-based IME [9], and how we used predictors from WIME to develop a new intervention.

**2. Specifying the target behavior and selecting a theoretical framework**

The IME methodology has been described elsewhere [9–11]. Briefly, there are three stages. The first stage usually involves qualitative work to provide information on the range of perceptions and beliefs among future participants [eg, general practitioners (GPs)] about the behavior of interest (eg, managing patients with URTI without using antibiotics). These beliefs are used in the second stage to develop theory-based questionnaire items relevant to the behavior, together with clinical scenarios that can be used to simulate situations in which the target behavior may be performed. The responses of individuals to the questionnaire and scenarios are used to identify predictors of the behavior of interest, and an intervention that targets these is developed, based on the identified theories and their evidence base. The final stage of the IME is to evaluate the new intervention in a randomized trial, again using a questionnaire and clinical scenarios. This article describes stage 2 of an IME, identifying predictors of GPs' antibiotic-prescribing behavior and developing an intervention. Stage 1 was done in the earlier work [9], and stage 3 will be the focus of a future publication.

As we were seeking to replicate, as far as possible, the paper-based IME, we were interested in the same target behavior as that used by Hrisos et al. [9]: “*managing patients presenting with uncomplicated URTI without prescribing an antibiotic.*” The authors identified three theories that included factors predictive of GPs' prescribing behavior for URTI: theory of planned behavior (TPB) [12], social cognitive theory (SCT) [13,14], and operant learning theory [15]. The TPB [12] proposes that people are more likely to perform a behavior (eg, eat a healthy diet or follow a guideline recommendation) if they feel motivated (intend) to do so, if they believe that performing that behavior will result in a valued consequence (have a positive attitude), if they believe that other people think that they should do the behavior (high subjective norm), and if they believe they can overcome any significant barriers that may prevent them from performing the behavior (high perceived control). SCT [13,14] proposes that people are more likely to perform or change their behavior if they

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