



Interventions Developed with the Intervention Mapping Protocol in Work Disability Prevention: A Systematic Review of the Literature

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Abstract

Purposes Intervention mapping (IM) is a protocol for developing effective behavior change interventions. It has been used for 10 years to develop work disability prevention (WDP) interventions, but it is not known to what extent and with what success. The main objective of this study was to review the effectiveness of these interventions. Secondary objectives were to review their fidelity to the IM protocol, their theoretical frameworks and their content. **Methods** A search strategy was conducted in MEDLINE, Web of Science, PsycINFO, Pascal, Francis, and BDSP. All titles and abstracts were reviewed. A standardized extraction form was developed. All included studies were reviewed by two reviewers blinded to each other. **Results** Eight WDP interventions were identified aimed at return to work (RTW; n=6) and self-management at work (n=2). RTW interventions targeted workers with stress-related mental disorders (n=1), low back pain (n=1), musculoskeletal disorders (n=1), cancer (n=2) and gynecological surgery (n=1). The fidelity to the IM protocol was weaker for the participatory planning group. Matrices of change, change methods, and applications were systematically reported. The main theoretical frameworks used were the attitude-social influence-self efficacy model (n=4) and the theory of planned behavior (n=2). Half of the interventions included a workplace component (n=4). Two interventions were reported as effective, and one partially effective. **Conclusion** The IM protocol is used in WDP since 2007. The participative dimension appears underused. Few theoretical frameworks were used. Implications are to better consider the stakeholders involvement, and mobilize theoretical frameworks with greater attempts to intervene on the work environment.

Keywords Intervention mapping · Return to work · Models · Theoretical · Program evaluation · Health program planning

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Introduction

The complexity of work disability prevention (WDP) is illustrated by the arena model stressing the number of stakeholders within different systems, namely the worker,

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the workplace, as well as the healthcare and compensation systems [1]. WDP interventions may be defined as interventions with the explicit goal to facilitate return to work of workers on sick leave, or to maintain at work workers with health problems. According to the UK Medical Research Council criteria [2], WDP interventions present all the characteristics of complex interventions given the number of levels of change they intend to achieve at the individual, organizational, and broader contextual (legal, political, economic) levels, among different categories of stakeholders. As such, WDP interventions are at higher risk of theory and/or implementation failure than simpler interventions, such as drug delivery or hospital-based rehabilitation [1, 3]. Theory failure is the inappropriate (or lack of) logic model of the problem to be addressed and/or the inappropriate (or lack of) logic model of change of the intervention (the mechanisms by which the intervention is likely to produce its intended effects) [4, 5]. Implementation failure occurs when the activities of the intervention are not implemented as expected or fail to be integrated on a sustainable basis in the usual (occupational) healthcare system [6, 7]. Such failures of WDP interventions have been described repeatedly in several countries [1].

Different frameworks in health promotion program planning have been developed to address theory and implementation issues in program development, such as the PRECEDE-PROCEED model, the RE-AIM model or the social marketing approach [8]. More recently, the intervention mapping (IM) protocol [9, 10] was developed to help develop, implement, and evaluate health promotion interventions by means of six steps described in Table 1. The main characteristics of the IM protocol are to promote an ecological perspective on the issues at stake (consider the individuals within the different layers of their environment), to develop a participative approach (include the relevant stakeholders all along the process) and to make explicit use of theories when defining the problem (logic model of the problem, step 1), the intended changes (logic model of change, step 2), and the way to achieve these changes (change methods and applications, step 3) [10]. These characteristics confer the IM protocol the potential to prevent both theory and implementation failures when developing and implementing WDP interventions, with better chances of effectiveness. However, it is not known to what extent this protocol has been used to develop WDP interventions, nor how effective these interventions were. As the IM protocol has been used only recently in WDP, it might be worthwhile for researchers and practitioners to figure out if the IM approach is feasible and helpful in this specific domain. Therefore, the main objective of this systematic review was to review the effectiveness of WDP interventions developed with the IM protocol, in relation to the fidelity of their development to this protocol. Secondary objectives were to

describe the content of these interventions, to review their theoretical frameworks, and to discuss the fidelity of their development process to the IM protocol. These objectives were formulated in the perspective to discuss the potential benefits and limitations of the IM protocol to prevent theory and implementation failures of WDP interventions.

Methods

Literature Search

A search strategy was conducted in MEDLINE, Web of Science, PsycINFO, Pascal, Francis, and BDSP without limitation of language. The queries were developed using a sensitive approach designed to retrieve a high number of hits [11] (“Intervention Mapping” [Title/Abstract] in MEDLINE; “Intervention Mapping” TI OR AB in PsycINFO; “Intervention Mapping” all fields in Pascal and Francis; “Intervention Mapping” = TS (topic) in Web of Science; “Intervention Mapping” all fields in BDSP). The search was performed first on January 8, 2015 and updated at the end of the review on August 3, 2017. All titles and abstracts were reviewed to identify studies with the following inclusion criteria: (1) describe the development of a WDP intervention; and (2) use explicitly the IM protocol. WDP interventions were defined as interventions which explicit goal was to facilitate return to work of workers on sick leave, or to maintain at work (or promote self-management at work of) workers with health problems. Interventions focusing on wellness, healthy ageing, or health promotion of workers without health problems were excluded. The references included in the third edition of the IM textbook were also checked to identify other relevant studies [10]. Studies reporting effectiveness evaluation of interventions without describing their development process were not included at this stage. In a second time, another literature search was performed to identify “satellite” publications (including effectiveness evaluation studies) related to each included study. These were searched in the reference list of included studies and with search queries by authors’ names. Additional references were used during the data extraction to precise the development of interventions at each step of the IM protocol and to report their evaluation whenever it was performed (step 6). Four authors were contacted for additional information.

Data Extraction

As no validated data extraction form was found in the literature, a standardized data extraction form was developed (Electronic Supplement S1), in collaboration with one of the authors of the IM reference textbook (GK) [10]. To build the data extraction form, a list of 80 items corresponding to the

Table 1 Steps and tasks of the intervention mapping protocol (based on [10])

Step 1	Needs assessment
	<ul style="list-style-type: none"> Establish a participatory planning group Conduct the needs assessment Assess community capacity Specify programme goals for health and quality of life
Step 2	Matrices of change
	<ul style="list-style-type: none"> State outcomes for behaviour and environmental change State performance objectives Select important and changeable determinants Create a matrix of change objectives
Step 3	Theory-based intervention methods and practical applications
	<ul style="list-style-type: none"> Generate programme ideas with the planning group Identify theoretical methods Choose programme change methods Select or design practical applications Ensure that applications address change objectives
Step 4	Intervention programme
	<ul style="list-style-type: none"> Consult intended participants and implementers Create programme themes, scope, sequence, and materials list Prepare design documents Review available programme materials Draft programme materials and protocols Pretest programme materials and protocols Produce materials and protocols
Step 5	Adoption and implementation
	<ul style="list-style-type: none"> Identify potential programme adopters, and implementers Re-evaluate the planning group State programme use outcomes and performance objectives Specify determinants for adoption and implementation Create a matrix of change objectives Select methods and practical applications Design interventions for adoption and implementation
Step 6	Evaluation plan
	<ul style="list-style-type: none"> Review the programme logic model Write effect evaluation questions Write evaluation questions for changes in the determinants Write process evaluation questions Develop indicators and measures Specify evaluation design

tasks of the six steps of the IM protocol was extracted from the third edition of the reference textbook [10]. Other criteria recommended for a better reporting of interventions were included, such as the PICO criteria (population, intervention, comparison, outcome), and criteria recommended by the TIDieR checklist (who has done what, why, how, how

much, where, with what materials) [12]. The typology used by Durand et al. [13] was adopted to classify interventions using explicitly the workplace as a source of information, to gradually expose the workers to the demands of the real work environment, or to reduce the demands of the work situation. All included studies were reviewed by two reviewers

blinded to each other (JBF, MLB) who extracted the data separately before comparing their results.

Data Synthesis and Fidelity Assessment

There is no validated critical evaluation checklist of IM studies. In the frame of this review, the development process of the identified WDP interventions was assessed by comparing the information extracted from the articles (studies describing the development process of interventions and their related articles) to the expected content specified by the third edition of the IM textbook [10]. All correspondences and discrepancies were identified by each reviewer for each item of the data extraction form. After data extraction, all disagreements between the two reviewers could be resolved by returning to the articles, discussion and consensus without the necessity of a third party.

Secondly, a qualitative synthesis was performed to reduce the amount of information generated by the 80 items of the checklist. After the review of each included study, a

comparative analysis was performed to assess the content of each step of the IM protocol reported across the different interventions.

Results

Included Studies

The search strategy identified 678 records from which 332 duplicates were removed. 331 records were excluded after screening their titles and abstracts. Fifteen full texts were assessed for eligibility from which seven more studies were excluded. Reasons for exclusion are described in the flow-chart in Fig. 1 according to the PRISMA recommendations [14]. Eight WDP intervention/development studies were finally included in the review [15–22]. The other literature search performed secondarily to identify publications related to each included study identified 19 other references reporting their needs assessment [23–29] (n = 7), their

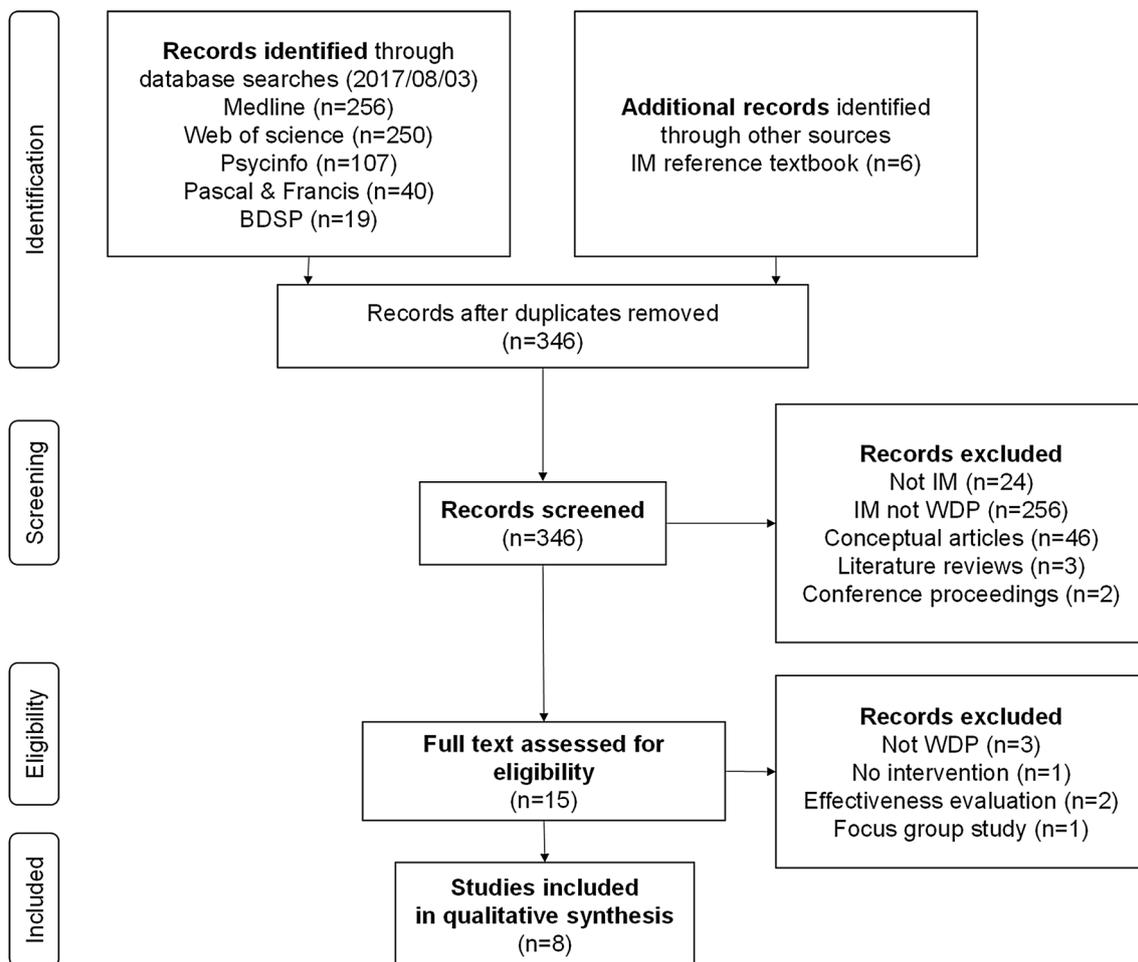


Fig. 1 Flow-chart of included studies

implementation/process evaluation [30–32] ($n=3$), their effect evaluation [33–38] ($n=6$) and their economic evaluation [39–41] ($n=3$).

The main characteristics of the included studies are summarized in Table 2. All the four authors contacted agreed to provide the requested clarifications. One author confirmed the absence of implementation of an intervention [15], another confirmed the absence of evaluation of an intervention [19], another answered that a published abstract was not followed by any intervention [42], and another that the intervention was still under way [16].

Six interventions aimed at RTW [15–17, 20, 21, 23], and two aimed at self-management at work [17, 18]. Five were conducted in the Netherlands [17, 18, 20–22], and the others were conducted in Canada [15], the UK [19], and Belgium [16]. Health conditions of the populations targeted by RTW interventions were stress-related mental disorders [20], low back pain [15], musculoskeletal disorders [21], all types of cancer [19], breast cancer [16], and gynecological surgery [22]. The two studies promoting self-management at work targeted employees with chronic diseases such as rheumatoid arthritis or diabetes mellitus [17] and employees with complaints of the arm, neck, and/or shoulder [18].

Fidelity Assessment

The 8 studies included reporting development studies and the 19 related studies were reviewed to assess the fidelity to the IM protocol. The step 5 (programme implementation) could not be assessed because of a lack of detailed information in the included studies. Among the 19 related studies, only three reported partial information for this step [30–32]. The overall results of the fidelity assessment are presented in Table 3, and the detailed results are presented in Electronic Supplement S2.

Step 1: Participatory Planning Group, Needs Assessment and Logic Model of the Problem

The very first task of the IM protocol is to establish a participatory planning group in order to include the views and field experiences of all the relevant stakeholders. No study mentioned clearly such a participatory planning group including all the relevant stakeholders (workplace, healthcare and insurance actors) during all the steps of the IM protocol. Six studies [15, 18–22] mentioned a participatory planning group either incomplete (workplace actors were missing in all but one study [21]) or actioned lately (i.e. only at the implementation phase). A needs assessment based on qualitative inquiries among the stakeholders and a literature review was conducted in all of the included studies. The description of a logic model of the problem as a final result of step 1 was described in six studies [16–18, 20–22],

of which two reported using specific theories. One study reported using the Attitude-Social influence-self-Efficacy (ASE) model [20] and another one the model of human occupation (MOHO) and the international classification on functioning, disability and health (ICF) [16]. Other studies did not mention specific theories at this stage, but rather different determinants of behaviors (knowledge, skills, opportunities, support, etc.) likely to fit in different theories [17, 18]. The use of theories at different steps of the development process of interventions is described in Electronic Supplement S3.

Step 2: Logic Model of Change

The development of a logic model of change with matrices of changes was reported in all the studies. The theories used were described in five studies [17–20, 22]. The most frequently used theories at step 2 were the ASE model [18, 20, 22], the theory of planned behaviour (TPB) [17, 19] and the social cognitive theory (SCT) [19]. All the studies intended to achieve behavior change at the worker level. Four studies intended to achieve change at the level of the workplace [15, 16, 20, 21].

Step 3: Theory-Based and Evidence-Based Change Methods

Seven studies reported theories underlying change methods at step 3 [15–19, 21, 22]. Three studies referred to the reference list of the IM textbook [17, 18, 22]. One study referred to participatory ergonomics, biopsychosocial and cognitive behavioral theories without further details [15]. One study referred to the ASE model [21]. Two studies referred to the social cognitive theory [19, 20]. One study referred to empowerment theory, theory of learning, theory of planned behavior, and the transtheoretical model of change [19]. One study referred to the model of human occupation [16]. Change methods and strategies (practical applications) were reported in all studies, and are detailed in Electronic Supplement S4.

Step 4: Programme Production

The providers involved in the delivery of the interventions belonged to different categories, in the workplace, healthcare, and insurance sectors. Four interventions included the workplace actors in the delivery [15, 16, 20, 21], either supervisors [15, 20] or other actors not specified [16, 21]. One interventions included healthcare practitioners [15], two included occupational physicians [16, 20], and two included insurance physicians [15, 21]. Three interventions included RTW coordinators [15, 20, 21]. Two interventions were located in the workplace

Table 2 Main characteristics of included studies

Author (date); country	Related articles	Health condition/population	Objectives	Intervention	Effectiveness (outcome); design
Interventions promoting return-to-work (n=6), presented in chronological order of publication					
van Oostrom et al. (2007); The Netherlands [20]	[32, 36, 39]	Stress-related mental disorders/workers sick-listed due to stress-related mental disorders	To reduce long-term sick leave and disability for sick-listed employees with stress-related mental disorders	Stepwise process involving the sick-listed employee and their supervisor guided by a RTW coordinator	Ineffective (duration of sick leave from the randomization until full RTW for at least 4 weeks); RCT [36]
Ammendolia et al. (2009); Canada (Ontario) [15]	None	Work-related low back pain/workers off work due to an occupational low back pain episode (acute and subacute)	To reduce the duration of time off work and improve the sustainability of RTW following work-related low back pain disability	Stepwise process guided by a RTW coordinator involving the sick-listed employee, their supervisor, the third-party payer, and the healthcare practitioner	Intervention not implemented
Vermeulen et al. (2009); The Netherlands [21]	[31, 37, 40, 41]	Musculoskeletal disorders/temporary agency workers and unemployed workers sick-listed for 2–8 weeks due to musculoskeletal disorders	To reduce long-term sick leave and occupational disability for temporary agency workers and unemployed workers, sick-listed due to musculoskeletal disorders	Stepwise procedure involving the worker, insurance physician, RTW coordinator, case manager of the vocational rehabilitation agency aimed at making a consensus-based RTW plan, with the possibility of a temporary (therapeutic) workplace	Effective (Sustainable first RTW: duration of sick leave from the randomization until full RTW for at least 28 consecutive days); RCT [37]
Vonk Noordegraaf et al. (2012); The Netherlands [22]	[28, 29, 38]	Gynecology/gynecological patients during the perioperative period with delayed full recovery after gynecological surgery	To develop a feasible and generally accepted eHealth intervention that empowers gynecological patients during the perioperative period about returning to normal activities and work, to obtain timely RTW, and prevent work disability	An eHealth program that provided personalized tailored pre- and postoperative instructions on the resumption of daily activities, including work, and tools to improve self-empowerment, and to identify recovery problems	Effective (duration of sick leave from the day of surgery until full RTW for at least 4 weeks); RCT [38]
Mumir et al. (2013); United Kingdom [19]	[27]	All types of cancer/individuals with most types of cancer and in most work situations including those considering retirement or a change of employment	To develop a work-related guidance tool for those diagnosed with cancer that enables them to take the lead in stimulating discussion with a range of different healthcare professionals, employers, employment agencies, and support services	Self-led intervention consisting in a work-related guidance tool to enable those diagnosed with cancer to take the lead and identify their work-related capabilities and limitations	Intervention not evaluated

Table 2 (continued)

Author (date); country	Related articles	Health condition/population	Objectives	Intervention	Effectiveness (outcome); design
Désiron et al. (2016); Belgium [16]		Breast cancer/breast cancer patients and survivors [23, 24]	To provide adequate care that empowers breast cancer patients to maintain or resume (labor) participation	A five-phased RTW intervention guided by a hospital-based occupational therapist is proposed: (1) assessing the worker, the usual work and contextual factors (2) exploration of match/differences between the worker and the usual work; (3) establishing long-term goals, broken down into short-term goals; (4) setting-up tailored actions; (5) step-by-step execution of the program as described in phase 4	Intervention yet to be implemented
Interventions promoting self-management at work (n=2), presented in chronological order of publication					
Detaille et al. (2010); The Netherlands [17]	[33]	Chronic diseases	To evaluate the effect on the determinants of self-management behavior at work (attitude and self-efficacy), and to improve mental and physical health quality (SF-12), and work satisfaction	Self-Management Program with 6 weekly self-management group sessions (2.5 h each)	Partially effective (ineffective to change self-efficacy at work; effective to change attitude towards self-management at work) ; RCT [33]
Hutting et al. (2013); The Netherlands [18]	[25, 26, 30, 34, 35]	Complaints of the arm, neck, or shoulder (CANS)/workers with CANS	To improve the self-reported disability of arm, shoulder, and hand, measured with the Disabilities of the Arm, Shoulder and Hand questionnaire (DASH)	Integrated program of self-management with 6 weekly self-management group sessions (2.5 h each) and an e-Health module accessible during 1 year	Ineffective (self-reported disability of arm, shoulder, and hand, measured with the Disabilities of the Arm, Shoulder and Hand questionnaire DASH); RCT [34]

Table 3 Fidelity assessment of included studies

Intervention Author (year of publica- tion)	Step 1		Step 2	Step 3			Step 4		Step 6
	Participa- tory planning group	Needs assess- ment Logic model of the problem	Matrices of change	Theory and evidence- based change methods	Change methods	Practical applica- tions	Worker com- ponent of the intervention	Workplace component of the interven- tion	Effect evalu- ation
Interventions promoting return-to-work									
van Oostrom et al. (2007) ^a [20]	Partially	Partially	Yes	Partially	Yes	Yes	Yes	Yes	Ineffective [36]
Ammendolia et al. (2009) ^a [15]	Partially	Partially	Yes	Partially	yes	Yes	Yes	Yes	Not evaluated
Vermeulen et al. (2009) ^a [21]	Partially	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Effective [37]
Vonk Noordergraf et al. (2012) [22]	Partially	Yes	Yes	Yes	Yes	Yes	Yes	No	Effective [38]
Munir et al. (2013) [19]	Partially	Partially	Yes	Yes	Yes	Yes	Yes	No	Not evaluated
Desiron et al. (2016) [16]	No	Yes	Yes	Partially	Yes	No	Yes	Yes	In progress
Interventions promoting self-management at work									
Detaille et al. (2010) [17]	No	Partially	Yes	Yes	Yes	Yes	Yes	No	Partially effective [33]
Hutting et al. (2013) [18]	Partially	Yes	Yes	Yes	Yes	Yes	Yes	No	Ineffective [35]
Overall fidelity assessment at each step									
Yes	0	4	8	5	8	7	8	4	
No	2	0	0	0	0	1	0	4	
Partially	6	4	0	3	0	0	0	0	

^aUse of the 1st version of the IM protocol [10]

[16, 20], in association with occupational health services [20] or the healthcare sector [16]. Two interventions were e-health interventions, either totally [22] or in association with group discussions [18]. One intervention was completely self-led [19]. Four interventions failed to mention their location, either partially [18] or totally [15, 17, 21]. Communication channels varied and could associate remote channels (postal mail, email, telephone calls, text messages, website, and forum) and direct human interactions (face to face or group discussions, workplace visits).

Providers, location and communication channels of interventions are summarized in Table 4.

For the four interventions associating the workplace, two were not implemented [15, 16]. One had no perspective of future implementation [15], and the other was still under way [16]. According to the typology of Durand et al. [13], the workplace was used with different objectives: as a source of information [15, 16, 20], to gradually expose workers to the demands of the real work environment [15, 20, 21], or to reduce the demands of the work situation [15, 20]. Only two

Table 4 Providers, location and communication channels of interventions

Author (date)	Providers					Location	Communication channels
	WPa	HCP	OP	RTWc	INSa		
Interventions promoting return-to-work (n = 6)							
van oostrom et al. (2007) [20]	X		X	X		Workplace; occupational health service	Postal mail; telephone; face-to-face discussions; group discussions
Ammendolia et al. (2009) [15]	X	X		X	X	No detail	Telephone; face-to-face discussions; group discussions in the workplace; worksite tour
Vermeulen et al. (2009) [21]	X			X	X	No detail	Postal mail; telephone; face-to-face discussions; group discussions
Vonk Noordegraaf et al. (2012) [22]						e-Health intervention	Website and a forum
Munir et al. (2013) [19]						Self-led intervention	Leaflet delivered in oncology clinics, by support nurses, support groups, and downloadable from a website
Désiron et al. (2016) [16]	X		X			Workplace; healthcare settings (no detail)	Face-to-face discussions; workplace visits
Interventions promoting self-management at work (n = 2)							
Detaille et al. (2010) [17]			GT			Not detailed	Group discussions
Hutting et al. (2013) [18]			GT			Not detailed; e-Health intervention	Group discussions; website

WPa workplace actor, HCP healthcare practitioner, OP occupational physician, RTWc return-to-work coordinator, INSa insurance actor, GT group trainer

studies used the workplace with the three objectives [15, 20]. The objective of reducing the work demands was not explicitly pursued but presented as a possibility in two studies [16, 21]. The detailed characteristics and components of interventions developed with the IM protocol are described in Electronic Supplement S5.

Step 6: Effect Evaluation and Economic Evaluation

One intervention was not implemented [15], one was not evaluated [19], and another was still under way at the time of the review [16]. Among the five other interventions, all the evaluation designs were randomized control trials (RCT) [33, 34, 36–38]. Two interventions were reported by the authors as effective [21, 22], one as partially effective [17], and two as ineffective [18, 20]. An economic evaluation was performed in two studies. One intervention [20] was not cost effective [39]. Another intervention [21] was more effective but also more costly than usual care, with a net societal benefit of the RTW program of 2073 euros per worker compared to care-as-usual [40, 41].

Discussion

Overview of the Main Results

Relatively few WDP interventions have been developed using the IM protocol, and the majority were implemented in the Netherlands [15, 17, 18, 20, 22]. The limited number (n = 3) of interventions reported by their authors as partially [18] effective [17, 20] with two other interventions not implemented [16] or evaluated [21] is unexpected, given the explicit use of the IM protocol to prevent such failures. The other main result of this review is the predominant use of psychological theories (the attitude-social influence-self-efficacy model and the theory of planned behavior) at the individual worker level, to the detriment of higher level theories (e.g. system theories, organizational change theories, network theories) likely to account for the social and political nature of WDP.

Participative Issues

The modest number of effective interventions may be related to identified fidelity issues regarding the first step of the IM protocol dedicated to the health needs assessment and the definition of the logic model of the problem. The importance of a truly participative planning group established during the first step is emphasized in the IM protocol as paramount for an extensive analysis of the problem to include the stakeholders' views and field experience, distinct from the scientific expertise of the researchers [10]. This early association between the research team and the stakeholders is believed to lead to a better definition of the problem (step 1), a more appropriate choice of its solutions (step 3), and eventually a better implementation and sustainability of the interventions (step 5) [43]. Thus, it is surprising that a participative planning group was reported partially in 6 studies, and not reported at all in 2 studies.

The partial involvement of the stakeholders mostly corresponded to their punctual utilization by the researchers to collect data and/or include participants, missing the opportunities of a more reciprocal partnership likely to benefit the intervention. The study reported by van Oostrom et al. [20] illustrates how the initial definition of the problem (prolonged work absence after stress-related mental disorders) and the objective of the intervention (early return-to-work) reflected both the scientific evidence and the social insurance point of views represented in the project group. However, the intervention proved eventually ineffective [36] and the authors discussed the possibility of a theory failure when defining the problem and/or its solutions [36], which definitions might have been modified by the inclusion of other stakeholders (workers, unions, human resources) in the planning group.

Logic Models, Theoretical Issues and Change Methods

All the studies reported the use of matrices of change (step 2), theories underlying change methods, change methods and practical applications (step 3), either completely or partially. This result is important as the explicit use of theories is a cornerstone of the IM protocol. However, this positive finding is moderated by three limitations. First, the process followed by the authors to achieve logic models of change was not explicitly stated. The authors infrequently explained their motivation to select one theory among those available; the theories seemed mostly taken “off the shelf” irrespectively of the IM step, and possibly according to the authors' knowledge of available theories. This might particularly be the case for the ASE model particularly favored in the Netherlands [18, 20–22] where it was developed.

A second limitation is the preponderance of health psychology theories focusing at the individual level of the workers (ASE model, TPB) and to a lesser extent at the interpersonal level (SCT). Despite their relative ability to integrate barriers and facilitators of the environment, these theories are obviously insufficient to account for the many social, cultural, and political factors that shape the behaviours and the work (dis)ability of individuals in their environment [44]. Environmental theories were missing in the interventions included in this review, as were theories focusing specifically at the workplace level. Only two frameworks were identified that could help conceptualize the environmental levels: the model of human occupation (MOHO) and the International Classification of Functioning (ICF) used in one study [16]. This result was unexpected given the importance of the ecological perspective advocated for by the IM protocol, and necessary to address the social and political determinants of work disability. Furthermore, it is worth mentioning that the ASE model, as the TPB from which it is derived, are models of determinants of individual behavior. As such, they do not provide clear indications as to the mechanisms and methods likely to achieve the intended changes of these determinants. Last but not least, the parameters for effectiveness of behaviour change methods (defined as “the characteristics that a practical application must manifest for it to accurately reflect the theoretical method” [45] were not discussed but in one study [22]. It has been emphasized that the respect of such parameters is crucial for the change methods to produce their effects [45, 46]. Conversely, the absence of their consideration could contribute to the theory failure of the intervention and its lack of effect.

The Workplace and the Worker Issue

With regard to their providers and location (Table 4), only half of the interventions ($n=4$) included the workplace actors in the delivery [15, 16, 20, 21], of which only two were implemented [20, 21]. This is surprisingly low in view of their objective of return to (or stay at) work. This finding is congruent with another review of RTW interventions after breast cancer which results found that more than 80% of the interventions were provided by healthcare professionals [47]. This finding may be linked to the low representation of workplace actors in the planning groups of the interventions (mentioned in only one study [21]) and the dominant use of individual-level theories focused at the worker level. Conversely, several interventions relied on a self-help philosophy [17–19, 22], some of which [17, 18] adapted from the Stanford University Chronic Disease Self-Management program [48]. This is in line with societal values promoting the autonomy, the responsibility, and consumer rights of the individual. Empowering the workers is a promising venue in work disability prevention given the importance

of self-efficacy in the adoption of adaptive behaviors [49] within complex and sometimes discouraging environments [50]. It may appear more feasible, rapid and effective than attempting to change the behaviors of the other actors and the conditions in the environment. However, the over-reliance on the worker in the return to (or stay at) work process raises important questions. First, work participation/absence cannot be understood without a so-called “person-environment” model such as the ICF or the arena model [1]. Thus, missing the environment in developing and implementing WDP interventions is conceptually flawed from the start. Second, the evidence base supports the effectiveness of workplace-based interventions [51], and missing the workplace piece of the puzzle is likely to lead to a lower or lack of impact of the intervention. Third, it is unethical to place the burden of change upon the sole worker considering the role of the working conditions (physical and psychosocial) in important disabling conditions such as musculoskeletal or mental health disorders. Finally, the reduction of the social disparities in health and work participation requires population-level health interventions that shift the distribution of risks by addressing the underlying social, economic, and environmental conditions [52, 53].

Intervention Mapping in Work Disability Prevention

The limited number of effective interventions in WDP developed with the IM protocol raises several questions. It is possible that the IM method, despite its use in major domains of health promotion, needs to be adapted to the intersectoral nature of work disability prevention at the crossroads of the workplace, the healthcare and the social insurance systems. The workplace system is characterized by the variety of workplaces in terms of size, sector, activity and social relations which determine the implementation of return to work measures [54]. Disabled workers may receive support or face stigmatization on the part of their colleagues and/or their hierarchy [55, 56]. This variety poses implementation challenges within workplaces where different levels of change may be necessary (colleagues, frontline and upper management, human resource direction) [57]. How to reach a sufficient number of workplaces to improve WDP at a population scale is another challenge given the number of small and medium businesses. Last but not least, work organizations are evolving at a fast pace to keep in touch with the market demands, which limits the possibility of engaging employers on a sustainable basis [58]. Likewise, the healthcare and the social insurance systems are characterized by the variety of behaviors at the individual and organizational levels, likely to impede or facilitate the implementation of WDP interventions [57]. Beyond the limitations of each system are the challenges of intersectoral collaboration acknowledged in different countries [1, 59, 60]. Therefore, the behavior

change focus of the IM protocol needs to be expanded to organizational and political change, so that WDP issues are addressed appropriately.

Other methods than IM are available to the researchers in health promotion planning and behavior change. The PRECEDE-PROCEED model, the RE-AIM framework and other models have been used for years [8]. More recently, the behavior change wheel has been developed with the aim to make an explicit use of behavior change theories [61]. Implementation science has expanded with several frameworks intended to guide the researchers [62, 63]. The comparative value of these approaches in WDP remains to be studied as regards the effectiveness and sustainability of the interventions developed, and the resources they require in terms of time, money and skills.

Although the IM protocol cannot be recommended as the only first option in WDP, it has been acknowledged as highly valuable to deal with the complexity of intervention development [19, 64, 65]. However, its use may be impeded by the complexity of the behavioral science vocabulary, and the constraints of the protocol (time investment, sustained funding, community involvement, and multidisciplinary skills of the research team). However, these constraints are not specific to the IM protocol; rather, they are associated with the specific requirements of complex interventions [2]. The use of the IM protocol could be expanded in WDP by systematic efforts to train scholars and researchers in behavioral science, to adapt its methods to the specific challenges of change in the workplace and intersectoral collaborations, and to advocate for sustainable funding allowing the researchers to conduct each step of the protocol.

Strength and Limitations of the Review

This is the first study to review WDP interventions developed with the IM protocol. Systematic efforts were made to identify not only the primary studies describing the development of interventions, but also the companion studies pertaining to their implementation and evaluation. The four authors contacted agreed to provide information. The review process followed a structured methodology to extract the data and compare the results of the two reviewers blinded to each other. An innovative data extraction form was developed. It may be used by other authors to reviews interventions in other conditions. This would allow easy pooling of information to further investigate the IM protocol in health promotion planning.

Limitations of this review must also be acknowledged. The literature search was restricted to the main databases and may have missed unpublished studies. The search for articles related to the interventions was not exhaustive and therefore certain references may have been missed. No protocol of the review was published prior to the review

being conducted. The complexity of IM terminology, the evolutions of the IM protocol with time, and the variety of interventions led to include heterogeneous interventions, the assessment of which was difficult to standardize. In case of incomplete information in the articles, we adopted an inclusive approach and assessed the items of the checklist as uncertain or incomplete. Thus, our assessment of included studies might be more favourable than other reviewers' judgement. However, non-reporting of IM steps does not necessarily mean that were not used by the authors; there may not have been enough space to provide all the details. This may particularly be the case for information about step 5 that was not developed enough to perform a fidelity assessment of the implementation phase. The information about the implementation was scattered in the different articles pertaining to the same intervention and proved difficult to extract and standardize. The extraction of this information was hard to perform due to the absence of a common terminology to describe the implementation process, actors, activities, and outcomes. Categories of actors such as adopters, implementers, and providers appeared to be not mutually exclusive. For these reasons, this step was not assessed which is a limitation of this review. Furthermore, the link between fidelity to the IM protocol and the effectiveness of the interventions is not straightforward, and may depend on evaluation design considerations (such as quality/risk of bias assessment for each of the effectiveness studies) not covered by this review. A more general limitation was that the different interventions could not be compared due to their heterogeneity regarding their population, objectives, and content.

Recommendations for Future Research

Researchers and stakeholders should be aware that the IM protocol is not a magic panacea to prevent theory and/or implementation failures of WDP interventions. They should be trained to the protocol before using it and report carefully the tasks conducted at each step, both to improve the methodological rigor of their endeavor and to allow its critical assessment. The main recommendation is to pay a special attention to the participative planning group, so as to associate all the relevant stakeholders from the beginning (especially workplace actors) and to make them contribute on a partnership basis throughout the planning process. It is advised that the conditions of success of such partnerships be studied in the field of WDP as it is in the field of community-based participatory research [66]. Another recommendation is to systematically identify and apply theories for understanding behavior and for changing behavior, and expand the use of theories beyond the hegemony of cognitive and social psychology. Theories in work psychology, sociology, political sciences, and management, among other disciplines, are likely to improve the conceptualization of

both problems and solutions. This certainly requires the inclusion of new competencies in the research teams and to renew the transdisciplinary efforts around WDP. Eventually, it is recommended to explore the value of alternative paradigms to the use of RCTs in the evaluation of interventions, likely to bring a different knowledge on the conditions of their implementation, effectiveness, sustainability and generalization (scalability). The theory-driven realist evaluation approach seems a promising venue to improve our understanding of what works, for whom, and under which circumstances [67, 68].

Conclusion

The IM protocol has been used since 2007 to develop 8 WDP interventions, of which two were reported as effective, and one partially effective. The participative dimension appears underused and underreported. Few theoretical frameworks were used. Implications are to better consider the stakeholders involvement, and to mobilize theoretical frameworks at the social and workplace levels with greater attempts to intervene on the environment [69–72].

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