


BMJ Open Evaluation of a knowledge translation strategy to improve policymaking and practices in health promotion and disease prevention setting in French regions: TC-REG, a realist study

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ABSTRACT

Objective This paper presents the results of a realist evaluation of a knowledge translation (KT) intervention implemented in the field of health promotion and disease prevention at the local level in France.

Design Realist evaluation study.

Setting The target population comprised decision-makers and field professionals working in prevention and public health services operating in regions of France (ie, ARS (Agence Régionale de Santé: regional health agency), IREPS (Instance Régionale d'Education et de Promotion de la Santé pour tous: regional organisation for health promotion and education) and their partners).

Participants This evaluation was based on data collected from 2 seminars, 82 interviews, 18 observations and 4 focus groups over 18 months.

Intervention The TC-REG intervention aimed to increase the use of evidence in cancer prevention, health promotion and disease prevention across four geographical regions in France. The intervention combined various activities: Supporting access to and adaptation of usable evidence, strengthening professionals' skills in analysing, adopting and using policy briefs, and facilitating the use of evidence in organisations and processes.

Results The collected data was used to define favourable/unfavourable contexts for the use of scientific data and mechanisms to be activated to encourage the use of scientific knowledge. From these raw results eight final refined middle-range theories were defined. Organised around the mechanisms to be activated, these middle-range theories illustrate how to activate knowledge and under what conditions. These analyses provided a basis for the production of seven operational and contextualised recommendations to develop KT to inform regional policymaking regarding health promotion and disease prevention.

Conclusion The results obtained from the analyses led us to formulate two perspectives of an operational nature for the benefit of those involved in prevention and health promotion.

INTRODUCTION

Evidence-based decision-making and practice are major issues in public health. For

Strengths and limitations of this study

- The large amount of qualitative data allowed us to create a knowledge translation (KT) taxonomy and to develop eight middle-range theories illustrating how to activate mechanisms and under what conditions.
- This study provided a basis for the production of seven operational and contextualised recommendations to develop KT to inform regional policymaking regarding health promotion and disease prevention.
- The results obtained from the analyses described here led us to formulate two perspectives of an operational nature for the benefit of those involved in prevention and health promotion.
- A limitation of this work remains its potential for generalisation, as this work has been carried out in a particular field and country, the prevention field in France.

researchers, this means looking ahead to the dissemination of findings and integrating different types of knowledge and decision-making challenges.¹ It also implies a need for greater collaboration between the research community and decision-makers.² Even if decision-makers, stakeholders and researchers mostly agree that it is necessary to move forward with evidence-informed practices and policymaking, some barriers persist related to people, organisations, contexts and evidence's attributes.^{3–5} Gervais *et al*^{3,6} suggested that knowledge translation (KT) research concerning decision-making processes offers multiple explanatory factors, which can be classified in three categories. The first category relates to the specific properties of the evidence itself: nature, availability, accessibility, quality and credibility, intelligibility, ability to meet needs, adaptability and transferability.⁶ The second

category relates to the characteristics of decision-makers: beliefs or personal values, political leanings, sociodemographic characteristics, level of education, previous experiences, motivation and ability to interpret data. These characteristics may influence how new knowledge is addressed during the decision-making process.⁷ The third category relates to the characteristics of the organisations and local contexts in which knowledge producers and users perform their work³: openness to change; material, human and financial resources available for KT; social and political context in the external environment; style of management; leadership; staffing; and stakeholder coalitions. Multiple barriers to the adoption of evidence in the field of public health underline the non-linear process between knowledge production and knowledge use. These barriers prevent optimal production and use of evidence. To address this, it is necessary to assess how knowledge is produced and used; to enhance the understanding of decision-making processes and mechanisms; and to examine the abilities of public health services to integrate research findings into their decisions and operations. This assessment requires a systematic approach that includes the adaptation of scientific knowledge; the abilities of users to capture, understand and apply available evidence; and the presence of an organisational and supportive culture for use of this evidence. These are the major challenges of KT,⁸ defined as ‘the group of activities and interaction mechanisms that foster the dissemination, adoption and appropriation of the most up-to-date knowledge possible for use in professional practice and in healthcare management’.⁹

Over the past several decades, a growing body of literature has been published regarding KT.^{8 10 11} Facilitators and barriers related to KT have been studied in several contexts^{12–14}; several KT frameworks that provide a mapping of KT processes have been described.¹⁵ Although these frameworks are helpful for understanding the key elements involved in KT, they lack consistency regarding implementation of KT schemes in local contexts because they provide broad concepts without concrete examples of KT activities to implement. The literature highlights the insufficient dissemination of scientific knowledge^{16–20}; it also emphasises that, to be effective, KT modalities must be contextualised to the environment in which knowledge dissemination is required. Thus, the effectiveness of KT strategies depends on the context in which they are implemented.^{8 21–24} The contextualisation of KT strategies is therefore necessary to remove barriers to knowledge use.

This paper presents the results of a realist evaluation study of KT strategies implemented in the field of health promotion and disease prevention at the local level in France. By disease prevention we mean specific, population-based and individual-based interventions for primary and secondary prevention, aiming to minimise the burden of diseases and associated risk factors.²⁵

The TC-REG (‘Transfert de Connaissances en REGion’) intervention (referred to in this paper as the

intervention) is a knowledge translation plan implemented in four French regions consisting of an accompanying support process for the use of evidence in cancer prevention. The intervention combined various activities: supporting access to and adaptation of usable evidence, strengthening professionals’ skills in analysing, adopting and using policy briefs and facilitating the use of evidence in organisations and processes. The aim of the TC-REG study was to evaluate the reported impact of this support process to influence the decisions and preventive practices in four regions of France. This study documented the mechanisms, processes, the configurations (ie, Contexts/Mechanisms/Outcomes (CMOs))²⁶ and the conditions of reported effectiveness established as a result of this support to ensure KT.

RAMESES II reporting standards for realist evaluations were used.²⁷

METHODS/DESIGN

Theoretical framework

The realist approach²⁶ is increasingly used for appraising the interactions among an intervention, its mechanisms and its contexts. The overall aim is to achieve a better understanding of an intervention’s success factors and how these may be replicated in other contexts. In realist evaluation, developed by Pawson and Tilley,²⁶ the effectiveness of the intervention depends on the underlying mechanisms that contribute within a given context. Realist evaluation involves identification of CMOs configurations. The aim comprises understanding how and why an intervention works. A middle-range theory (ie, a theory aimed toward describing interactions among outcomes, mechanisms and contexts and therefore CMOs configurations) is established to highlight the mutual influences of intervention and context.^{28 29} This approach is linked to the black box paradigm³⁰ and differs from the experimental paradigm, which evaluates effectiveness without analysis of the mechanism by which an intervention is successful, as well as without the influence of context. Realist evaluation determines whether an intervention worked in a manner consistent with its underpinning theory. The generative causality works via three assumptions³¹: (1) an intervention is not successful in isolate, and is not the source of a given outcome; (2) all interventions trigger a mechanism or a set of mechanisms that produce an outcome; and (3) all interventions are delivered within specific contexts.

Hence, realist evaluation involves identification of middle-range theories. Hypothesised and validated by empirical investigations, these CMOs configurations help to understand how an intervention causes change, considering both context and target group.^{28 29} The recurrence of CMOs is observed in successive case studies.²⁹ To consider context, realist evaluators observe successive cases, which Lawson (quoted by Pawson in 2006³¹) has described as ‘demi-regularities of CMOs’ (ie, regular, not necessarily permanent occurrences of an outcome

when an intervention triggers one or more mechanisms in a given context).²⁹ Analysis of these recurrences in different contexts allows the isolation of key elements that can be replicated in a family of contexts. This yields middle-range theories that become increasingly robust with progression among cases. ‘These middle-range theories, in certain conditions, predict possible intervention outcomes in contexts different from the one in which the intervention was tested’.^{29 32}

Applied to our case

As the realist principle is suitable for studying non-linear interactions in complex systems, we adopted this approach.³³ In our study, each region involved in the TC-REG intervention, with its own context, constituted a case. For each case, the intervention was studied to identify contributory mechanisms in a given context, along with the variation in outcomes. CMOs configurations were identified through analyses of successive cases. A cross-case analysis was performed to highlight recurrent CMOs configurations and thus identify key features for possible replication.

Mechanisms were identified qualitatively, in accordance with the definition of Ridde *et al.*: ‘a mechanism is an element of reasoning and reaction of an agent with regard to an intervention productive of an outcome in a given context’,^{34 35} and in accordance with the definition of Cambon *et al.*: ‘What characterises and punctuates the process of change and hence, the production of outcomes’.³⁶

In a realist approach, interventional elements contribute to the context. Contextual elements have been included among all elements collected qualitatively that satisfy the following definition: elements located in time and space that may affect the intervention and the outcomes produced. Therefore, this study distinguished between Ci (for contextual factors linked to the intervention) and Ce

(for external contextual factors that are not linked to the intervention).

The TC-REG intervention

The TC-REG intervention aiming to improve the use of scientific knowledge among decision-makers across four geographical regions in France. It combined various activities: supporting access to and adaptation of usable evidence, strengthening professionals’ skills in analysing, adopting and using policy briefs and facilitating the use of evidence in organisations and processes.

The intervention was elaborated through a collaborative process creating tailor-made KT plan implemented differently in four regions. It aimed to collectively become acquainted with and master the concept of KT, and to identify effective strategies highlighted in the literature and their conditions of transferability. As presented in [figure 1](#), two kinds of literature review were carried out simultaneously: a review of the existing literature with the aim of extracting knowledge on successful KT activities and effective mechanisms in KT, and the drafting of policy briefs (PBs) consisting of six summaries of systematic reviews presenting effective prevention practices concerning nutrition, alcohol, tobacco smoking, physical activity, emotional and sexual life and psychosocial skills. We also conducted an exploratory qualitative study (14 non-directive interviews) in the four regions to collect data on the pre-existing scheme as well as activities related to KT and the potential local barriers. Next, a seminar allowed us to consensually define the initial middle-range theory (CMO) based on the existing literature, the results from the exploratory study, the presentation of the PBs and the project team insights (Cf. [box 1](#)). Four different KT plans were designed during this seminar and implemented in each of the four regions over a 12-month period. Each KT plan aims to improve the use of scientific knowledge. This intervention ended in December 2019.

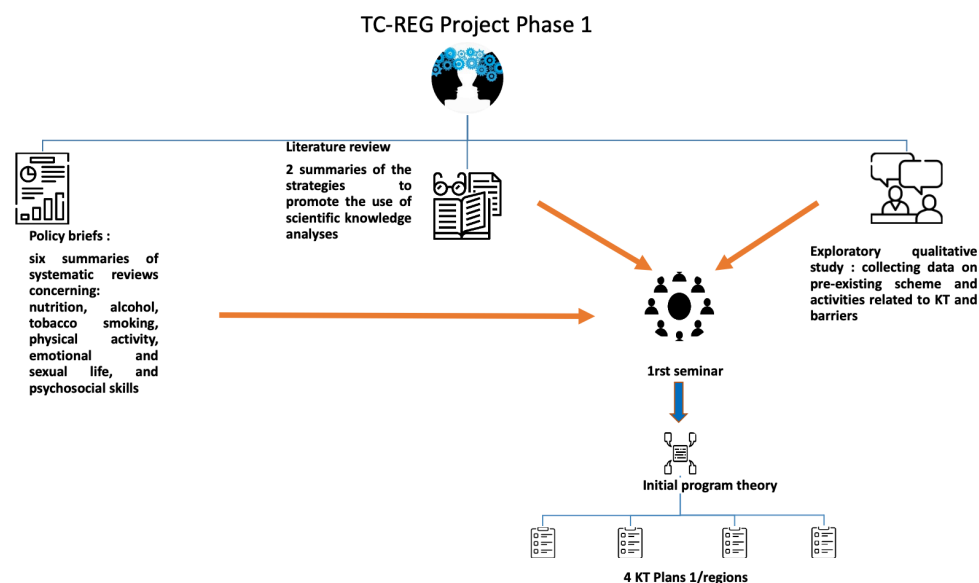


Figure 1 TC-REG project phase 1. KT, knowledge translation; TC-REG, Transfert de Connaissances en REGION.

**Box 1 The TC-REG initial middle-range theory****Initial middle-range theory**

The modalities of an effective knowledge transfer scheme combine levers that:

- ▶ Promote access to information and an adaptation of it (Ci)*.
 - ▶ Promote the development of capacities to understand and use them (Ci)*.
 - ▶ Allow the modification of organisational processes (Ci)* in order to facilitate their production and their appropriation in practice settings.
- These modalities of KT produce an increasing use of scientific knowledge (O)† by reinforcing:
- ▶ The perception of their usefulness (M)‡.
 - ▶ The motivation to use them (M)‡.
 - ▶ The ability to adapt them to the issues present in practical settings (M)‡”.

*Ci=contextual factors linked to the intervention.

†O=Outcome.

‡M=Mechanism.

In each of the four regions the following categories of activities were combined: (1) Supporting access to and adaptation of scientific and usable evidence, especially policy briefs, (2) Strengthening professionals' skills in analysing, adopting and using the policy briefs in the course of their practices and decision-making processes (eg, training, journal club and tutoring); (3) Facilitating the use of evidence in organisations and processes (eg, collaborative workshops, normative processes and incentives). An illustration of the KT plan for one region is detailed in online supplemental annex 1. The detailed activities implemented in regions and corresponding to these operational objectives have been transcribed into a standardised taxonomy published by Affret *et al.*³⁷

Initial middle-range theory

Drawing on the literature and experience of professionals locally involved in the intervention, the initial middle-range theory was established,^{26 31} then tested in each case (ie, region) through collection of qualitative data.²⁹

At this point, no external contextual factors (ie, Ce for external contextual factors that are not linked to the intervention) were identified, because there was no consensus on this topic among participants. This process was described in the published study protocol.³⁸

Population

This study was conducted in four regions of France (PACA, Brittany, Martinique, Normandy) and within different types of organisations and their partners: regional health agencies (ARS (Agence Régionale de Santé: regional health agency)), which are responsible for policymaking and prevention policies; and non-profit organisations (IREPS (Instance Régionale d'Education et de Promotion de la Santé pour tous: Regional organisation for health promotion and education)). IREPS develop health promotion and prevention programmes; they also provide methodological supports to field professionals

for the implementation of prevention interventions in different settings (eg, workplaces, schools, care settings, recreation and community centres and rural or urban areas). ARS and IREPS work collaboratively to implement prevention and health policies in local contexts.

This study focused on stakeholders who agreed to implement the intervention in the four regions. The sample of this study is composed of :

- ▶ ARS public health professionals: five agents per region (deputy directors in charge of prevention, heads of strategy departments and project managers);
- ▶ IREPS professionals: 10 people per region (directors, project managers and communication managers);
- ▶ Members of specialised prevention commissions within the Regional Conferences on Health and Autonomy and members of the Public Policy Coordination Commission, both dedicated to prevention in various regions of France (five people) and partners of IREPS and ARS.

These 65 persons will be named TC-REG project managers in this article.

For all interviews, professionals were selected according to the following criteria: (i) Participation in TC-REG study; (ii) Agreement to participate in the interviews; (iii) Agreement with this use of the data extracted from the interviews ; (iv) Diversity among institutes and professions (ie, managerial and non-executive positions).

Data collection

This study alternated between theoretical and empirical stages. Data collection consisted of qualitative investigations through interviews and observations. The results were discussed and enriched during a seminar on 18 October 2019 with the TC-REG project managers of the four regions involved. More details regarding this study are available in the published study protocol.³⁸

Based on the initial middle-range theory (developed during the seminar in May 2017, cf. box 1) and to collect CMOs related to the realist analysis, three series of interviews and one series of observations were conducted.

The first round of non-directive interviews aimed to collect and specify, with reference to the initial middle-range theory, the potential mechanisms to be activated and the external contextual elements (so-called Ce) missing in our initial middle-range theory. Thirty-six face-to-face interviews were conducted in October/November 2017. We asked the following question: 'What do you think about the use of data from science and what would you place in this category?' and 'Has your thinking evolved? How? How do you explain these evolutions?', which led to the identification of several mechanisms such as the perception of usefulness of the use of scientific knowledge, the perception of the ability to use them and the motivation to use them; and several contexts elements related to personal characteristics, organisation.

In the second round, the interviews were semi-directive and aimed to identify a list of KT activities (so-called Ci) actually carried out in the regions, thereby

determining a taxonomy that would enable them to be compared among regions. Ten semi-directive face-to-face interviews with the TC-REG project managers in the regions and four focus groups were conducted between February 2018 and August 2018. This round of data collection allowed precise determination of KT activities carried out in the regions, in accordance with the KT plans defined in August 2017, as well as collection of Cis.

The third round of interviews aimed to test our initial middle-range theory and to confirm Ce-Ci-M-O configurations, but also to identify new emerging configurations. These configurations were elaborated from the previous interviews and observations. During this round of interviews, we asked participants, ‘Since the beginning of the TC-REG intervention, do you use data from science? How? How do you explain that?’ Then we asked more precise questions aiming to evaluate the reported impact of the KT plans in terms of using scientific knowledge (the Outcome=‘O’). Initially, we planned to classify the outcomes into three categories of use (instrumental use; conceptual use; persuasive use³⁸), but since it appeared that these categories were in fact mechanisms leading to

the use of scientific knowledge, our sole outcome is the reported use of scientific knowledge.

This third round of interviews aimed to test our initial middle-range theory and identify CMO configurations, that is, to answer this question: through which mechanism(s) does the increased use of evidence take place and what activities and contextual circumstances can influence it?

In total, 36 semi-directive telephone interviews were conducted between April and June 2019.

The observations aimed to identify local contextual elements (Ce) and mechanisms (M) activated by the use of evidence-based data (PBs or other). Eighteen observations were conducted during the TC-REG project (table 1).

Data analysis

The data collected were coded and analysed with the NVivo software. Because the three series of interviews and the single set of observations comprised different types of information, they helped to iteratively establish information regarding the CMO configurations at stake. Data were analysed step by step, allowing an inductive–deductive

Table 1 Objective, data and qualitative investigation methods

Round	Objective	Sample	Data collected
First round of interviews October/November 2017	Specify: Mechanisms and contextual elements	36 interviews with TC-REG project managers in these regions: ▶ Brittany: 8 ▶ Martinique: 12 ▶ Normandy: 9 ▶ PACA: 7	O: The current use of scientific data. M: 13 Mechanisms. Ce: 7 Contextual elements related to: People/organisation.
Observations Throughout TC-REG project	Identify local contextual elements and mechanisms	18 non-participating observations: ▶ Brittany (n = 1) ▶ Martinique (n = 2) ▶ Normandy (n = 12) ▶ PACA (n = 3)	
Second round of interviews February/August 2018	Determine taxonomy of KT activities currently carried out among regions	10 semi-directive interviews with TC-REG project managers in these regions: ▶ Brittany n = 2 ▶ Martinique n = 2 ▶ Normandy n = 3 ▶ PACA n = 3 Four focus groups (one/region)	Ci: Determine KT activities carried out among regions according to transfer plan defined in August 2017.
Third round of interviews April/June 2019	Identify the evolution in the use of scientific data and Ci-Ce-M-O configurations	36 Semi-directive interviews with TC-REG project managers in these regions: ▶ Brittany: 7 ▶ Martinique: 10 ▶ Normandy: 10 ▶ PACA: 9	O: The use of scientific data and its evolution (PBs or other) Ci-Ce-M-O configurations

Ce, for external contextual factors that are not linked to the intervention; Ci, for contextual factors linked to the intervention; CMOs, Contexts/ Mechanisms/Outcomes; KT, knowledge translation; MRT, Middle Range Theory ; PBs, policy briefs; TC-REG, Transfert de Connaissances en REGion.

approach. The data were analysed by two researchers (LC and OA), then compared and reanalysed to reach a consensus between the two.

Data were coded to identify different levels of information. A first level of coding and analysis was used to identify and separate: (i) favourable/unfavourable contexts element to use scientific data, especially the data in PBs (Ce) and (ii) arguments evoked by the panel pro or cons the use of scientific data (foreshadowing the mechanisms to be activated, M).

Then, a second, more detailed level of coding allowed specification of the Ce and M to be activated in the use of scientific knowledge.

More precisely, the first round of interviews led to the identification of seven external contextual elements (Ce): The existence of training prior to the use of scientific data; The financial valuation of KT; A favourable organisational context ; A favourable political context; A technical and logistical context that makes access to the data easier; Previous experiences with the use of evidence from science; Work time freed up for the use of scientific data in the professional activity. Thirteen mechanisms were also identified: three linked to personal abilities, two regarding personal motivations and eight types of perceived usefulness.

The content analysis of the second wave of interviews identified a list of activities carried out in the four regions. This list was presented at the second steering committee meeting on 13 February 2019 to establish a consensus regarding the wording of the activities. In this way, 18 distinct KT actions were identified; these were grouped into 11 strategic categories, thus constituting a taxonomy. The elaboration of a standardised taxonomy helped us to use the same definition of the activities. More details have been described in Affret *et al.*³⁷

Before the analysis of the third round of interviews, the mechanisms and activities identified were grouped by type or theme (mechanisms were regrouped into eight categories and KT activities in four groups).

The third round of reviews allowed the researchers to identify the Ce-Ci-M-O configurations. For each mechanism (those identified following the second round of interviews or newly cited) mentioned by professionals as having evolved, the content analysis focused on the activities and contextual elements that had enabled its evolution. This round of interviews also served to identify the evolution of scientific knowledge use in these four regions (O).

The analysis was based on three nodes of analysis: (1) which mechanisms are activated by the KT plan, (2) for each mechanism, which activity in the KT plan was influenced (based on the KT taxonomy evoked before) it and (3) by each activity, which element of the context influenced it (in the list drawn up after the first round of interviews or newly cited).

This analysis allowed us to determine a list of different Ce-Ci-M-O, by region (the four) or by type of respondent (policymakers or field professionals). We then carried

out a transversal analysis of the different Ce-Ci-M-O in order to define the configurational recurrences or demi-regularities (ie, not perfect regularities but the repetitive Ce-Ci-M-O observed generating a perceptible uniformity³⁹) according this rule: activities (Ci) in which the association's frequency with mechanisms (M) was higher than the average of the associations; contexts (Ce) in which the association's frequency with mechanisms (M) AND with activities (Ci) was higher than the average of the associations. This allowed us to produce a shared list of interregional (most generalisable) Ce-Ci-M-Os.

The results of the analysis of the series 2 and series 3 interviews were discussed during a seminar on 18 October 2019, which brought together two people per ARS and IREPS from each of the four regions. This discussion allowed validation of the final Ce-Ci-M-O configurations (middle-range theories) defined by the analysis. Figure 2 illustrates the timeline of the TC-REG project.

Patient and public involvement

The TC-REG study does not include any patient or public involvement in terms of setting research priorities, defining research questions or outcomes, providing input into the study design, or disseminating the results. The research participants answered interviews.

RESULTS

As outlined previously, the analysis followed a three-node frame:

Mechanisms activated by the KT plan

Qualitative evidence allowed the identification of links between components of the middle-range theories. The following three mechanisms were most frequently reported to be strongly involved in the use of scientific knowledge among professionals:

- ▶ Perception of strategic utility (ie, to legitimise practice):

That's it, we really need scientific data, proven data to support what they are saying to be taken seriously. (These verbatim were first transcribed in French, then translated by two native translators and then checked again by native French speaker researchers) Albert, IREPS

- ▶ Perception of instrumental utility (ie, to change or improve practice):

It gives us reliable elements to be able to adapt, to build our actions, well... I see it like that. Véronique, organisation

- ▶ Ability to master these data (ie, ability to use data easily and independently):

The data transmitted by TC-REG (the PBs) will be able to evolve as a support for work and validation of scientific data on the ground and to apply them concretely. Fannie, ARS

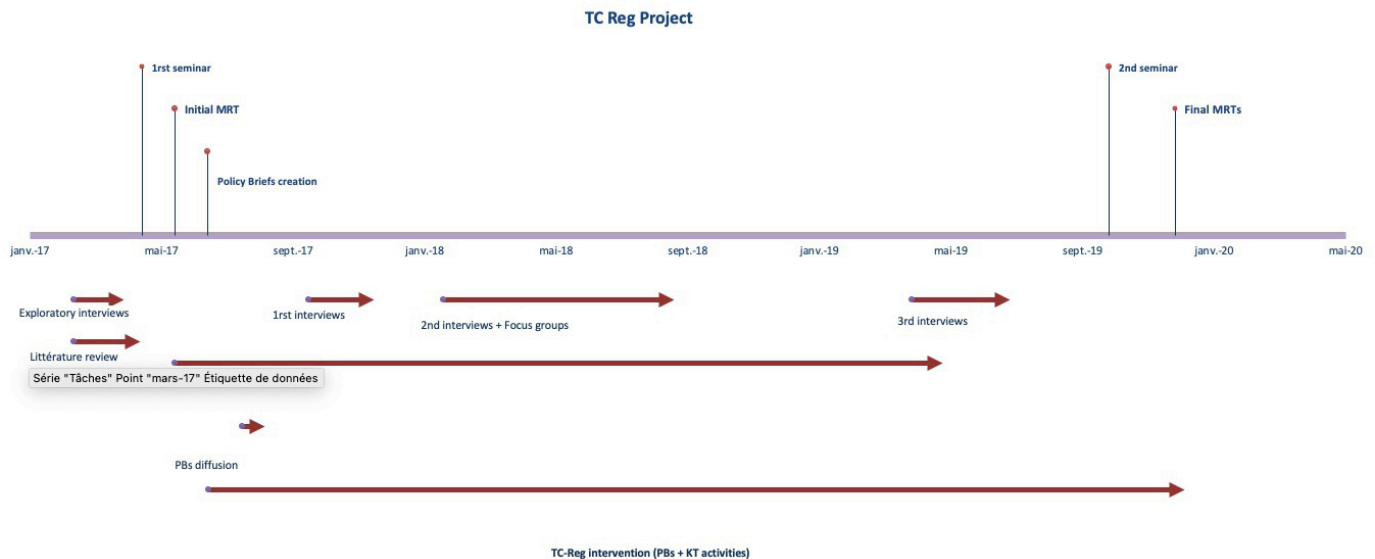


Figure 2 TC-REG project timeline. KT, knowledge translation; PBs, policy briefs; TC-REG, Transfert de Connaissances en REGION.

Five other mechanisms were identified but less often reported as important in the use of scientific data:

- ▶ The ability to understand the scientific data.
- ▶ The ability to identify and recognise the scientific knowledge.
- ▶ The motivation to use it.
- ▶ The perception of the conceptual utility of it (ie, useful to create new frameworks for analysing their practices).
- ▶ The perception of the processual utility of this knowledge in terms of partnerships, for example.

Activities of the KT plan influencing the mechanisms

The KT activities were grouped into four categories:

- ▶ Communication regarding scientific data.
- ▶ Adaptation to realities encountered in the field by the professionals.
- ▶ Support activities for the use of these data
- ▶ Support activities enabling changes in professional practice

Elements of the context influencing the activities and the mechanisms

Contexts that had an influence on activities were:

- ▶ Political will and organisational contexts facilitating or promoting the use of scientific knowledge
- ▶ Previous experience regarding the use of scientific evidence in practice.
- ▶ Gain in experience using scientific data
- ▶ Knowing where and how to find these data (dissemination channels)
- ▶ Previous training in the use of scientific data.

Final middle-range theories

From these raw results eight final refined middle-range theories were defined (see figure 3). These theories were framed, conceptualising the recurrence of the CMO

configurations or semi-regularities observed. Organised around the mechanisms to be activated, these middle-range theories illustrate how to activate these mechanisms and under what conditions they will be activated. These theories refine and enrich the initial middle-range theory.

1. Use of scientific knowledge (O) is facilitated if professionals **feel able to understand it (M)**. This perception is facilitated by activities that help to change practices (eg, training, support and seminars) (Ci), particularly if the organisational context facilitates these practices (Ce) (eg, creating trained team dedicated to these activities) and, if there is a political will to encourage it (Ce), and if the professionals gain experience from it (Ce).
2. Use of scientific knowledge (O) is facilitated if professionals **feel able to autonomously become acquainted with or master (M)** it in their practice. This perception is facilitated by activities allowing changes in practices (eg, training, support and seminars) that promote the use of scientific data (Ci), particularly when the organisation facilitates this use (Ce), when there is an institutional policy promoting the transfer of knowledge (Ce) and when professionals gain experience from it (Ce). This perception is also increased by communication/dissemination activities based on scientific data (Ci), when they are adapted to the reality and needs of professionals (Ci). These activities are more effective if professionals are familiar with the dissemination channels (Ce).
3. Use of scientific knowledge (O) is facilitated if professionals **feel able to locate and identify** such knowledge (M). This perception is facilitated by communication activities regarding these data (Ci), especially if the professionals know where to find these activities (Ce). It is also facilitated by support activities that can lead

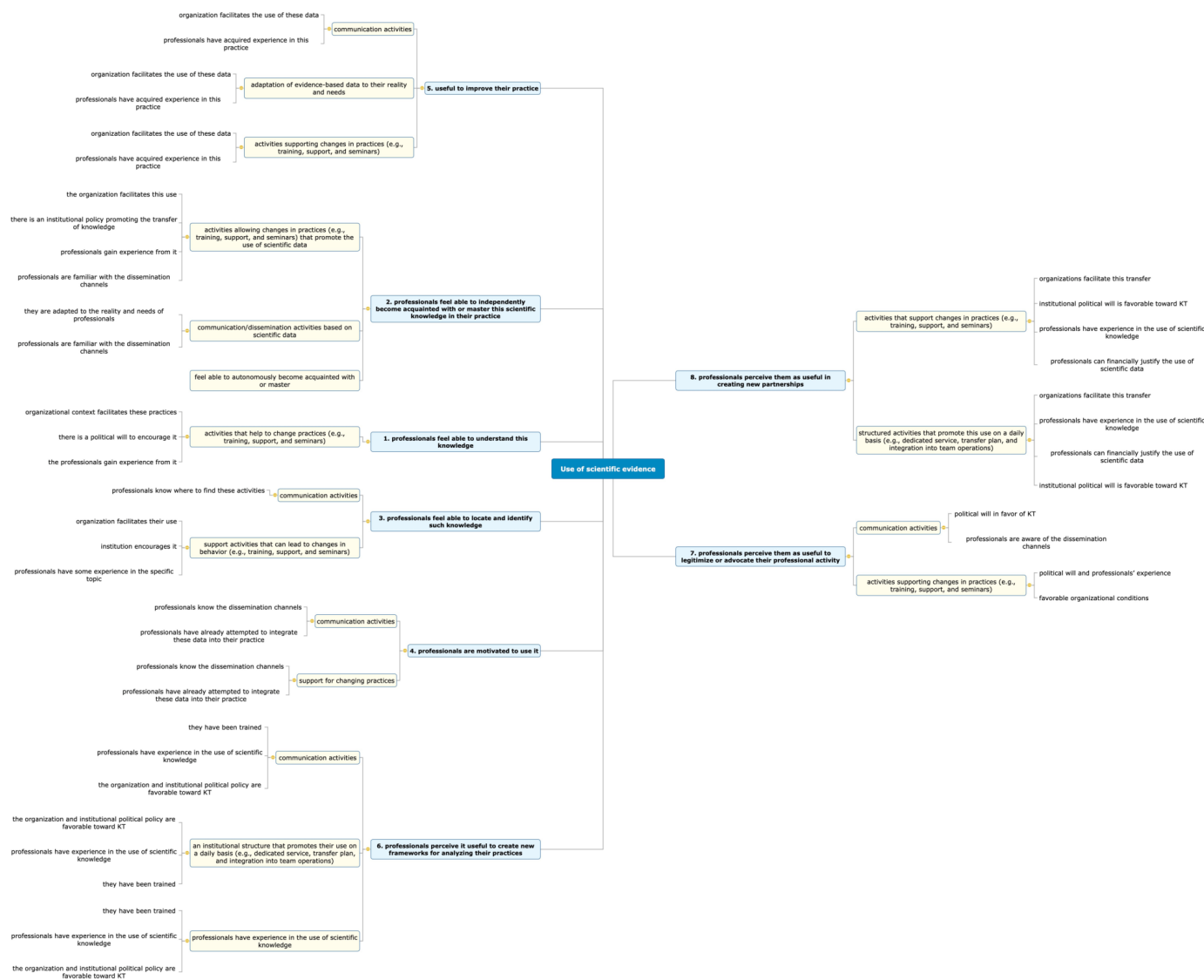


Figure 3 Final MRTs. KT, knowledge translation.

to changes in behaviour (eg, training, support and seminars) (Ci), especially if the organisation facilitates their use (Ce), if the institution encourages it (Ce) and if the professionals have some experience in the specific topic (Ce).

- Use of scientific knowledge (O) is facilitated if professionals **are motivated to use it (M)**. This motivation can be induced by communication activities (Ci) and support for changing practices (Ci), especially if the professionals know the dissemination channels (Ce) and have already attempted to integrate these data into their practice (Ce).
- Use of scientific knowledge (O) is facilitated if professionals perceive them as **useful to improve their practice (M)**. This perception is activated by communication activities (Ci), adaptation of evidence-based data to their reality and needs (Ci) and activities supporting changes in practices (eg, training, support and seminars) (Ci), particularly if the organisation facilitates the use of these data (Ce), the institution encourages

it, and if the professionals have acquired experience in this practice.

- Use of scientific knowledge (O) is facilitated if professionals **perceive it useful to create new frameworks for analysing their practices (M)**. This perception is activated by communication activities regarding these data (Ci) and by an institutional structure that promotes their use on a daily basis (eg, dedicated service, transfer plan and integration into team operations) (Ci). This consideration is more effective if professionals have experience in the use of scientific knowledge (Ce), especially if they have been trained (Ce), and if the organisation and institutional political policy are favourable toward KT (Ce).
- Use of scientific data (O) is facilitated if professionals perceive them as **useful to legitimise or advocate their professional activity (M)**. This perception is facilitated by communication activities regarding these data (Ci), particularly when there is a political will in favour of KT (Ce) and when professionals are aware of the

dissemination channels (Ce). This perception is also promoted by activities supporting changes in practices (eg, training, support and seminars) (Ci) that are supported by political will and professionals' experience (Ce); these are added favourable organisational conditions (Ce).

8. Use of scientific data (O) is facilitated if professionals perceive them as **useful in creating new partnerships (M)**, particularly within the research community. This perception is made possible by activities that support changes in practices (eg, training, support and seminars) (Ci), as well as by structured activities that promote this use on a daily basis (eg, dedicated service, transfer plan and integration into team operations) (Ci). This perception is more effective when professionals can financially justify the use of scientific data (Ce), when the institutional political will is favourable toward KT (Ce), when organisations facilitate this transfer (Ce), and when the professionals have experience in the use of scientific knowledge (Ce).

Taking up in this way each activity present in these refined middle-range theories it is possible to draw up practical recommendations for the field professionals for the development of KT. We have thus elaborated seven operational and contextualised recommendations to develop KT to inform regional policymaking regarding health promotion and disease prevention.

Recommendation 1: favourable professional environment for KT

Use of scientific evidence is facilitated if the institution in which professionals work shows a clear political will in this area and if the environment makes it easier to understand and to use making it more practical and more rewarding.

Recommendation 2: learning experience

While the use of scientific evidence in practice requires a significant initial investment (eg, cognitive and temporal), the study shows that more use of scientific data by professionals leads to more routine implementation. This constitutes a learning experience.

Recommendation 3: short-term utility and independent appropriation

The mechanisms most strongly involved in anchoring KT use are linked to the possibility of direct use of scientific evidence in the activities of professionals. Indeed, professionals are more inclined to use scientific data when they perceive these data as useful to legitimise, advocate or concretely modify their practices, as well as when they feel able to mobilise these data independently. This perception is accentuated if these data are accessible, in accordance with their needs (adapted) and if they have been trained in the use of these data.

Recommendation 4: promoting the perception of scientific data usefulness

Communication/dissemination of scientific data promotes perception of its usefulness, ability and motivation to use scientific data, if the environmental working

conditions allow for their use. Evidence-based dissemination activities are particularly crucial in:

- ▶ Motivation to use scientific evidence, as well as ability to identify and master it.
- ▶ Perception of the instrumental utility of scientific evidence in daily practice.
- ▶ Perception that use of scientific evidence will bring a new way of presenting their activity (conceptual utility).
- ▶ Perception that use of scientific evidence will legitimise their activities, supported by confidence in its added value (strategic utility).

Recommendation 5: an adapted knowledge

Data transformation and adaptation activities have a reported impact on the capability to use the data and the perception that they allow for concrete changes, if the professional environment is favourable to such changes. Data transformation and adaptation activities for stakeholders, such as inclusion of evidence-based data (via typical communication tools: adaptation and dissemination of evidence through video vignettes, explicit and oriented guides, scientific documents, creation of bibliographical selections (evidence-based actions) and multidisciplinary and multi-professional co-construction of KT tools and processes), most notably influence:

- ▶ Ability to use scientific data in practice.
- ▶ Perception that use of scientific data will enable professionals to change their practices (instrumental utility).

Recommendation 6: structural activities as facilitator

These activities facilitate the use of scientific data influence, the perceived usefulness of scientific data, particularly in framing practices and mobilising new partnerships with research or other organisations. Structural activities to facilitate KT (eg, institutional communication regarding a KT programme or plan; use of the KT programme to develop specific partnerships; identification of a style guide for KT activities; development of a support service for KT development; evaluation of promising practices, modification, reinforcement or activity orientation of an existing KT plan; establishment of internal coordination meetings (how to use evidence) or systematic reminders of the importance (interest and added value) of using scientific data in team and/or project meetings or in professional or financial documents) influence:

- ▶ Perception that use of scientific data brings a new way of presenting activities (conceptual usefulness).
- ▶ Perception that use of scientific data will allow the development of new partnerships (process utility) with the research community.

Recommendation 7: activities to support KT influence the understanding and perceptions of the usefulness of these data

When the organisational and political environment within the institution is favourable, activities supporting KT will influence the capacity to understand and use scientific

data and the perception of the usefulness of these data at multiple levels (ie, entering into new partnerships, as well as legitimising and/or renewing one's practices).

Activities to support KT (eg, specific communication meetings on evidence-based science, awareness on the use of evidence-based data (meetings or seminars) and training to analyse and use scientific knowledge; analysis and exchange workshops; methodological support; existence of a proactive advocate for the deployment of KT (encouragement, mobilisation, reminders and support regarding the development of KT); methodological support for deployment of KT; creation and dissemination of methodological tools based on scientific data (guides and repositories) to support autonomous use; development of a methodological guide to assist in the implementation of KT, and to facilitate the use of tools developed based on evidence (whether from PBs)) influence:

- ▶ Capacity of professionals to understand, become acquainted with, and identify evidence from science.
- ▶ Their motivation to use evidence from science.
- ▶ Their perception that use of scientific evidence will enable changes in practices (instrumental utility), legitimise activities and convince others of its added value (strategic utility).
- ▶ Their perception that use of scientific evidence will enable development of partnerships with the research community if this interaction activity is supported and rewarded financially.

These recommendations and facilitators are made possible and catalysed by professionals' experiences of evidence-informed practices and by the official (ie, political, organisational or institutional) position, which should be explicitly favourable toward and encourage use of such practices.

DISCUSSION

The aim of this study was to experiment and characterise the factors associated with the success of a KT plan in health promotion and disease prevention settings in the local context in France. Success was defined as the plan's ability to (i) enable public health stakeholders to address the challenges of KT and (ii) bring about changes in public health policy and practices (ie, integration of evidence-informed public health and collaborative practices). We sought to explain the parameters and conditions of these strategies to determine their transferability into other contexts by expansion of the results obtained in the first seminar into eight more precise final theories.

Notably, by specifying the middle-range theories in the French context, the results were consistent with numerous studies regarding KT.^{19 24 40} Indeed, they confirmed the need to (i) combine KT strategies,^{24 40–42} (ii) make actions sustainable,⁴³ (iii) transform institutions beyond simply raising the awareness of professionals,⁴⁴ (iv) adapt the evidence to ensure it could be transferred to each type of audience^{41 45–47} and (v) support change.⁶

More specifically, our study underlines the particular weight of three major types of activities: (i) those which help to change practices and promote scientific data use (eg, training, support and seminars), (ii) those which adapt scientific data (adapted emails, policy-briefs, advocacy, etc), (iii) and those providing support for changing practices by an institutional daily promotion of institutional structure (eg, existence of a proactive referent for KT roll-out, development of a methodological guide to help KT implementation, development of methodological guides to assist in the use of tools developed using evidence, introducing specific exchange on evidence in current meetings). Moreover, they confirm four of most influencing contextual parameters to support KT: (i) the political will in institution,⁴⁸ (ii) the professionals' experience in evidence use⁴⁹, (iii) the organisational facilitators promoting evidence use (linked to person (adopter), specific practices or supports help)^{42 48} and (iv) an immediate benefit in the use of evidence.²

In addition, this study highlighted the key mechanisms to be activated to enable changes in practice in the KT strategies. They can be grouped into three dimensions: (i) capacities: finding, understanding and appropriating evidence; (ii) attitudes: motivation and feeling that evidence is useful; and (iii) the perception of a direct interest in the use of evidence: changing practices, legitimising the activity, advocacy and formation of new partnerships. With reference to the interventional system concept,³⁶ which emphasises that mechanisms are the key functions of interventions, the results of these interventions must be transferable into other contexts. Our results confirm that the success of KT results from 'combinations of knowledge, relationship and organisational characteristics contribute to KT success' which are 'dependent on the type of ecosystem partnership involved'.⁵⁰

Strengths and limitations

Our study highlighted some crucial information from the analyses. The large amount of qualitative data allowed us to create a taxonomy³⁷ and to develop eight refined middle-range theories and seven recommendations that will be valuable for knowledge and decision-making challenges.

Due to the specificity of our study we made several adjustments to the initial protocol. Two rounds of interviews were initially planned. During the first seminar on May 2017, we were only able to develop a very generalist initial middle-range theory. Indeed, neither the exploratory survey nor the experience of the professionals mobilised in the seminar allowed us to define a more detailed level of KT activity, mechanisms or external contextual elements of influence, which could be used to develop several theories. Furthermore, we did not find any taxonomy in the literature sufficiently operative to structure regional action plans. Because of these observations, we reviewed our investigation strategy in three rounds of interviews, rather than two. We developed a taxonomy of KT activities that allowed comparison of

identical activities among regions.³⁷ These developments strongly mobilised the research team, thus mobilising the project's resources. Thus, the last seminar could not be carried out.

The limit of this work remains its potential for generalisation. The work has been carried out in a particular field and country, the prevention field in France. It would be interesting to check whether these middle range theories are verified in other fields and other countries where the KT development might be more advanced. These investigations could lead us to refine our middle range theories or open to other configurations. Indeed, we can hypothesise that other difficulties would have to be overcome and therefore other mechanisms to be activated.

Moreover, the follow-up was carried out over 18 months. No doubt that some activities will eventually prove to be not very effective and others will surprise by their effectiveness because they have a longer latency. In fact, both professional practices and their impact take a long time to modify. Moreover this impact could be difficult to observe due to the complexity of what is at stake. There is therefore a real interest in verifying the stability of these middle range theories over time.

Finally, we have not analysed the potential synergy between Ci and Ce either, even if the observations show some leads. For example, we can observe that some external contextual elements (Ce) such as 'pre-trained professionals' echo activities (Ci) 'training of professionals in CT'.

Notwithstanding these limits, the work carried out nevertheless offers concrete paths for the development of KT by having allowed the groups of activities to specify the conditions for their success and opens the way for further development in terms of research.

CONCLUSION AND PERSPECTIVES

This study used a realist methodology to reveal the factors associated with the success of a KT plan, and elucidated the mechanisms by which such strategy can bring change in public health policy and practices. We sought to explain the parameters and conditions of these strategies to determine their potential transferability into other contexts through three types of mechanisms to be activated: (i) the capacities (finding, understanding and appropriating evidence) of field professionals; (ii) the attitudes, (motivation and feeling that evidence is useful); and (iii) the perception of a direct interest in the use of evidence (changing practices, legitimising the activity, advocacy and formation of new partnerships). We suggest they are the key functions of KT in prevention, which could be activated if a combination of activities and organisational characteristics are gathered.

Compliance with ethical standards and ethics approval

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee,

it follows the relevant French legislation of the research category on interventional research protocol involving the human person. An informed consent was obtained from all individual participants included in the study.

The English in this document has been checked by at least two professional editors, both native speakers of English.

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