# Realist evaluation of the Integrated electronic Diagnosis Approach (IeDA)

for the management of childhood illnesses at primary health facilities in Burkina Faso

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**Intervention implemented by**

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# Executive Summary

## Background

Recent advances in Information and Communication Technologies (ICT) could potentially transform health care services in low- and middle-income countries. However, the experience with using such technology to improve adherence to the Integrated Management of Childhood illness (IMCI) guidelines is limited.

From 2014, Terre des hommes, in partnership with the Burkinabe Ministry of Health (MoH), implemented the Integrated eDIagnosis Approach (IeDA) package of interventions in primary health facilities of two regions of Burkina Faso with the objective of improving health care workers' (HCW) adherence to the IMCI guidelines.

An evaluation was performed by an independent team from the London School of Hygiene and Tropical Medicine (LSHTM), United Kingdom, and Centre Muraz, Burkina Faso. The aim of the realistic evaluation was to identify the potential mechanisms for change within the IeDA programme and specify how they are able to change existing social processes within primary health care facilities.

### Methodology

The realistic evaluation was embedded within the steeped wedge trial in order to explain some of the results of the trial and explore research questions identified during the trial. The methodology first focused on implementation evaluation and then on mechanism of change and context.

The implementation evaluation aimed to document how the implementation of IeDA was organised and achieved, and how the intervention was received. This implementation evaluation focused on fidelity, dose delivered (completeness), dose received (exposure), reach (participation rate) and recruitment.

The context evaluation aimed to document factors external to the

intervention that may have acted as moderators of implementation and outcomes, i.e. as facilitators or barriers to IeDA implementation and affecting REC use. In particular, we payed attention to potential unanticipated factors. Social, political, resources and logistical factors were screened and added throughout the study. Various sources of information were used: individual interviews and document review (project documents as well as national policy documents).

For the implementation evaluation, a set of process research questions were defined prior to the evaluation and according to the IeDA theory of change. Most of the information collected was triangulated from different sources. This was particularly important as the data were collected retrospectively hence subject to recall biases. A combination of electronically documents review and in-depth interviews were conducted in 2017.

In order to capture social phenomena such as management decisions and interactions between individuals, an in-depth qualitative research approach was adopted. Various sources of data were used by the investigator during data collection that took place between January 2016 and October 2017. The combination of several data sources proved valuable to the research. Direct observation in health centres generated elements of information that helped to identify new issues or verify assumptions. The analysis of project reports from health facilities helped analyse the implementation of IeDA and the vision of the project by managers. In addition, interviews and focus group discussions provided evidence in relation to the perceptions, in-depth

opinions and understandings of actors intervening in IeDA. In-depth interviews were conducted with 154 individuals including 92 healthcare workers from health centres, 16 officers from district health authorities, 6 members of health centre management committees. In addition, 5 focus groups (on average 11 people per group) were organised with mothers and carers.

### Results

The actual activities of the intervention can be summarised as follows: (i) Development and implementation of improved versions of the REC; (ii) Provision of a six-day training course on IMCI guidelines and REC; (iii) Development of a quality assurance mechanism; (iv) Monthly supervision of every health centre benefiting by the district health team; and (v) Development of a health information system. We also found important additional activities that organically appeared during the implementation of the intervention: the creation of a support system to respond to breakdowns and questions on the software and the tablet; district meetings at least once a year to enable district health teams and heads of health centres to discuss about performance and find concrete solutions; creation of eLearning modules on IMCI available on tablets for continuous knowledge development; an inclusive and team approach associating in the implementation process not only nurses but also any other staff who is directly or indirectly involved in managing child consultations; and good accessibility of top Tdh



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managers to district health teams and in a certain measure to Heads of health centres anytime support is needed.

Regarding the process of implementation, we noted a good coherence between the initial theory of change developed by the implementers (MoH and Tdh), the project management team's vision and district health teams and health centres team's practice. Indeed, in line with their vision, the project management team motivates the health centre staff involved in child consultations (e.g. nurses, midwives and nurse assistant) through

effective and regular support, dialog to identify their problems and needs in using the REC and full recognition of their role in improving child consultations.

Regading the implementation context, we found several potentially important elements in the context of primary health care in Burkina Faso in the two regions of Boucle du Mouhoun and Nord. First, all health centres in the two regions were staffed by at least one nurse (depending on health centre's size) who were all aware that management of childhood illnesses is an important priority at primary health care, which

was emphasized by the introduction of a national free healthcare policy on child health care during the course of the project. Second, the initial training of healthcare workers on IMCI needed to be complemented by regular supervisions and coaching after initial training. Third, staff turnover of nurses is very high in rural areas of Burkina Faso making challenging the progressive development of nurses' skills on IMCI. Finally, the capacity of district health teams to conduct supervisions is quite limited due to their budget restrictions and limited access to vehicles – volume of resources that will not increase in the near future.

During the later phases of the analysis, we found that the adoption process can be grouped according to their key mechanism and this led to the description of parallel CMO configurations, each with their own outcome.

Our analysis identified three CMO configurations that indicate causal pathways between sets of management practices and use of REC and we modified the MRT accordingly:

*The adoption of a computer-based decision support tool by health staff at primary health care will be enhanced by having a leadership focusing on building wide consensus from surrounding stakeholders (local*

**Table: the three CMO configurations related to IeDA**

| Context | Mechanism | Outcome (students) |
|---|---|---|
| C1. Availability of a support team to be responsive to healthcare staff questions. | M1. Promoting amongst healthcare workers "doing the right thing the right way" approaches | O1. Notions of quality in childhood illnesses routinised during consultations |
| C2. In health centres where the nurse is assisted by at least two other members (nurse assistants or outreach workers) and where management flexibility is allowed | M2. Clear distribution of roles before and during child consultations (including triage, weight and size measurements, consultation and counselling) | O2. Efficient organisation of the health team |
| C3. Strong consensus amongst stakeholders on the benefits of introducing REC | M3. Introducing at primary health care level the notion of individual accountability and responsibility and collective contribution to the wider system. | O3. Sustained use of REC as a routine practice |

*and national authorities) on the benefits of using such an innovation and having a wide of actors fully and truly engaged in the directions the project could take. This necessitates a system promoting flows of information between all levels of the health system where transparency of information is valued.*

*The introduction of such innovation needs to occur in an environment flexible enough to provide space to staff make decisions on the distribution of clearly-defined tasks within the team in order to better adapt their work to the new situation.*

*On the other hand, the innovation, REC, needs to be flexible enough to take into account the constant changing policy environment and the emerging needs and requests from its users.*

*The REC is adopted when perceived by users and district managers as being encompassed within a broader quality improvement strategy where health staff is sensitised to the importance of quality and their capacity to address quality issues at their own level.*

*The introduction of the REC needs to be accompanied by a supportive*

*atmosphere and environment (including community and policy makers support), which can be translated by peer support and district authorities support, and availability of support services responding to software or hardware issues. The supportive environment is based on reciprocity and acknowledges individual contributions to the wider system. Conditions for such environment to be promoted by a leadership that creates a decentralised decision space where initiatives are respected.*



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# Introduction

## Background

Despite a large reduction in under-five child mortality (from 180 per 1,000 live births in 1990 to 83 per 1,000 live births in 2015), sub-Saharan Africa failed to reach Millennium Development Goal 4 target of 60 deaths per 1,000 live births (United Nations Inter-agency Group for Child Mortality Estimation 2015). In 1999, the World Health Organisation (WHO) developed the Integrated Management of Childhood Illness strategy (IMCI) (Black, Morris et al. 2003). This strategy provides an algorithm to guide health workers through a systematic clinical assessment of sick children with the aim of improving the diagnostic classification and the treatment of these children (Boss, Toole et al. 1994, Nguyen, Leung et al. 2013, Rakha, Abdelmoneim et al. 2013) and hence reducing mortality (Jones, Steketee et al. 2003, Rakha, Abdelmoneim et al. 2013).

However, effective implementation of IMCI is often constrained by poor adherence to the guidelines (Bryce, Victora et al. , Derenzi, Parikh et al. 2008, Horwood, Voce et al. 2009). Previous studies have reported that adherence to the guidelines decreases over time due to inadequate initial training, shortage of staff and insufficient supervision (Chaudhary, Mohanty et al. 2005, Rowe, Onikpo et al. 2010). Takada et al. (2007) have noted that health care workers typically find the IMCI chart booklet burdensome and try to work from memory, resulting in a decrease in quality of care. Chaundhary (2005) demonstrated that the adherence of health workers improved with supervision. However, regular supervision of health workers after training is often lacking, (Horwood, Voce et al. 2009, Mugala, Mutale et al. 2010) partly due to the lack of resources.

Burkina Faso introduced the IMCI strategy in 2003. However, an

evaluation conducted in 2013 found that only 22% of nurses working in primary care facilities had been trained in IMCI (Kouanda and Baguiya 2013). Only 28% of children were assessed for three danger signs as recommended by IMCI, and only 15% of children were correctly classified (Kouanda and Baguiya 2013). About 30% of children were correctly prescribed an antibiotic for suspected pneumonia or oral rehydration salts (ORS) for diarrhoea and 40% were correctly referred (Kouanda and Baguiya 2013).

In 2014, Terre des Hommes (TdH), a Swiss non-governmental organisation, together with the Ministry of Health (MoH), launched the Integrated electronic Diagnosis Approach (IeDA) intervention with the objective of improving adherence to IMCI guidelines in public primary health centres in two regions of Burkina Faso. In this paper, we present the design of a mixed methods evaluation of this intervention.

Burkina Faso is composed of 13 regions and 70 health districts. The public health system is characterised by a three-tier service structure: (i) at the first level are the districts with 2,000+ health centres (Centre de santé et de promotion sociale (CSPS)) and the 104 district hospitals (Centre médical avec antenne chirurgicale (CMA)), (ii) at the next level are the nine regional hospitals (Centre hospitalier régional (CHR)), and (iii) finally the third level is comprised of the three national teaching hospitals (Centre hospitalier universitaire (CHU)) (DSS/DGISS 2012).

The IMCI approach was implemented only at the first level of the pyramid, i.e. in health centres. These facilities deliver a minimum package of services defined by the Ministry of Health comprising both preventive (e.g. vaccinations, antenatal care, health education, and promotion of

proper nutrition, hygiene and safe water) and curative measures (e.g. treatment of common illnesses, minor surgery, supply of essential medicine, maternal and child consultations). CSPSs are governed by a management committee (comite de gestion) composed of members of the community. The district health management team is in charge of supervising CSPSs and analysing routine data collected in them (Ministere de la Sante 2011).

### The Electronic Register of Consultations (REC) and the IeDA intervention

The "electronic register of consultations" or "Registre Electronique de Consultations" in French (REC) was designed in 2010 by Tdh (Deflaux 2010). The REC software, based on the CommCare software language, is installed on the open access CommCare platform developed by Dimagi (Deflaux, Agagliate et al. 2014). The REC guides health workers through the IMCI algorithm. By doing so it aims to improve adherence of nurses to the clinical protocol and to provide the local health district and the MoH with routine data on the management of childhood illnesses. The first versions of the REC were piloted in 2011 and 2012 in fifty-two primary health facilities located in two districts in the Nord region and perceived by 90% of users (nurses) as being a supportive tool during consultations (Yameogo, StollL et al. 2011). An additional pilot district, Yako, was added in the Boucle du Mouhoun region in 2014 and 2015. Following the pilot phase, the MoH requested Tdh to expand the implementation of the REC to the remaining health districts of both regions.

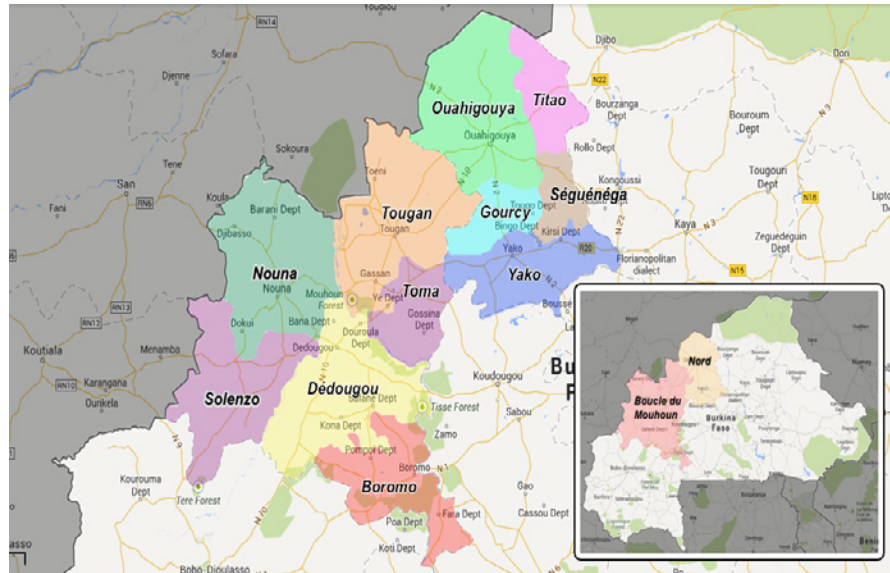In order to do so, Tdh launched in 2014 the IeDA intervention, which includes the following five

*Figure 1: Map of the two regions Boucle du Mouhoun and Nord and their districts (Source: Map Universal)*

components, delivered at district and health centre levels:

- An electronic Clinical Decision Support System (eCDSS) available on tablets and provided to primary health facilities. The eCDSS guides HCWs through the IMCI protocol during under-five consultations, from the clinical assessment of the child, through the classification, prescription, referral and counselling (Deflaux, 2010, Yameogo et al., 2011, Deflaux et al., 2014).
- A 6-day training course on IMCI guidelines, including 2 days on the use of the eCDSS, provided to HCWs.
- A quality assurance coaching system involving team meetings two to four times a year through which districts and their primary health facilities were encouraged to find appropriate solutions to improve the functioning of health facilities and the quality of health care.
- A supervision system including a monthly supervisory visit to primary health care facilities

and support to the health district authorities in their annual supervision scheme.
- A health information system based on under-five child consultation data collected through the eCDSS.

## The research methodology

The IeDA intervention is being evaluated using a mixed-methods study design composed of the following three interlinked studies (see Figure 1) (Blanchet, Lewis et al. 2016):

1. a stepped-wedge trial to evaluate the effect of IeDA on adherence to IMCI guidelines in primary health facilities;
2. a cost-effectiveness analysis (CEA) to assess the value for money of the delivery of IeDA;
3. a realistic evaluation to understand the implementation process, the mechanisms by which the IeDA intervention leads to change and to identify factors that may affect these mechanisms at health centre and community levels

These three studies are taking place in a total of eight health districts across the Nord and Boucle du Mouhoun regions, with the three districts where Tdh piloted the REC excluded from the evaluation.
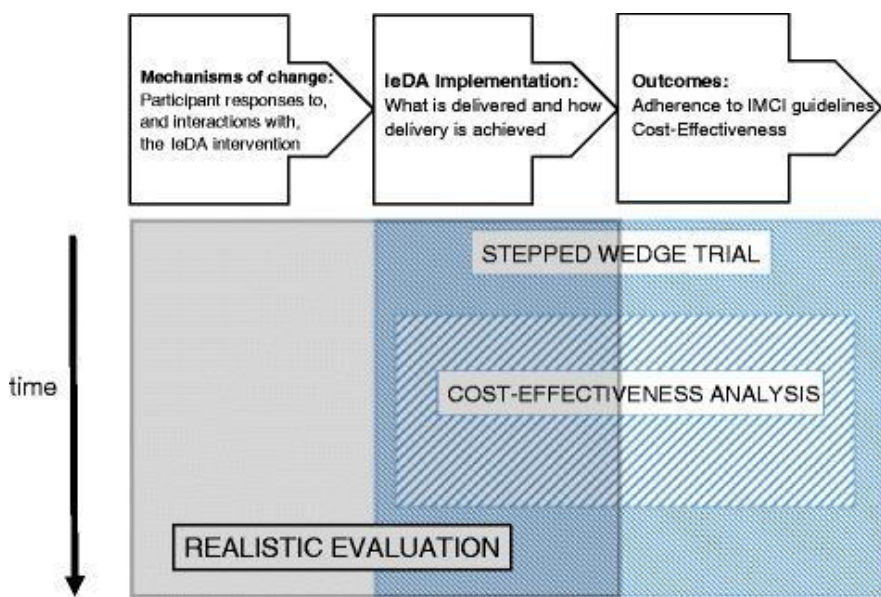


*Figure 1: Evaluation Mixed-methods Study Framework*

# Realistic Evaluation

## Principles of realist evaluation

We structured our study in four steps: the formulation of the middle Range Theory, the design of the study, the data analysis and presentation of the results. A realist evaluation starts from a middle range theory (MRT), which is understood as "theory that lies between the minor but necessary working hypotheses (…) and the all-inclusive systematic efforts to develop a unified theory that will explain all the observed uniformities of social behaviour, social organisation and social change" (Merton 1968). The MRT states how the intervention leads to which effect in which conditions. The MRT can be formulated on the basis of existing theory and past experience. If the latter is not available, exploratory-on site research can be done to unearth the models used implicitly by the stakeholders to make sense of the intervention, what Pawson and Tilley called "folk theories" (Pawson and Tilley 1997). Through individual interviews and focus groups discussions, the key elements of the problem and the intervention, the expected outcomes and potential moderating factors are to be identified (Donaldson 2007). Additional information was derived from programme documents. A literature review identified studies reporting causal chains, moderating factors and unintended outcomes, allowing a plausibility check of the preliminary MRT. The result is then again discussed with the stakeholders and results in the MRT that will be tested.

Regarding design and research methods, realist evaluation is neutral (Pawson and Tilley 1997): the hypotheses as expressed by the MRT are guiding the choice of data to be collected and the methods and tools to be used. Most theory-driven evaluations in healthcare use the case study design and combine quantitative and qualitative methods.

Pawson and Tilley (1997) call the working hypothesis that emerge during the analysis phase "Context-Mechanism-Outcome configuration" (CMOC). For Pawson and Tilley, issues of context and mechanism are crucial elements to consider in any realist evaluation as they help to explain 'what works, for whom and in what circumstances. For these authors 'what works' is not of itself a helpful question as: 'programs work (have successful 'outcomes') only insofar as they introduce the appropriate ideas and opportunities ('mechanisms') to groups in the appropriate social and cultural conditions ('contexts')'.

They summarise their approach to evaluation through the use of a formula: Context + Mechanism = Outcome (CMO) and subsequently focus considerable attention to describing the specific characteristics of contexts and mechanisms during the evaluation.

For Pawson and Tilley, the context embraces a wide variety of elements such as: 'Programs are always introduced into pre-existing social contexts and…these prevailing social conditions are of crucial importance when it comes to explaining the successes and failure of social programs. By social contexts, we do not refer simply to the spatial of geographical or institutional location into which programs are embedded. So whilst indeed programs are initiated in prisons, hospitals, schools, neighbourhoods, and car parks, it is the prior set of social rules, norms, clues and interrelationships gathered in these places, which sets limits on the efficacy of program mechanisms'.

Mechanisms in their turn are not merely interventions or actions but theories: 'which spell(s) out the potential of human resources and reasoning' and can be translated into a programme of evidence-based

action. For the researcher, 'identifying mechanisms involves the attempt to develop propositions about what it is within the program which triggers a reaction from its subjects'.

Consequently, adopting a realist approach means two things:

- the researcher has to identify the potential mechanisms for change within a programme/ intervention and specify how they are able to overcome or change existing social processes.
- The researcher has to specify the social and cultural conditions necessary for the change mechanism(s) to operate as well as locating them in different contexts. There may be multiple combinations of mechanisms and contexts that could facilitate action in the desired direction.

The task for the researcher is to distil the key potential mechanisms and contexts and examine how they interact in practice. It is also important to note that the generation of particular 'change mechanisms' can fulfil different functions in different evaluation contexts. For example, realistic evaluation can be used in circumstances where it is possible to establish more control over the context. These may be circumstances where there is a considerable body of evidence about the performance of different interventions and what is sought is the opportunity to test the workings of those mechanisms within pre-specified and selected contexts. However, in other circumstances, there may be relatively little evidence about how a particular intervention will operate because it is new and its use is not restricted to contexts defined by the researcher. In these circumstances, the task for the

researcher is to first theorise possible C+M=O configurations and to explore the ways in which real-life experience reflect and differ from these theories. Here evaluation outcomes are focused on refined theories of action based on understandings gained from empirical research.

Focusing on the realist dimensions enables us to examine the particular significance of 'mechanism' and 'context' more closely. Specifically, it directs us to identify the specific mechanisms, defined as specific ways of introducing IeDA, that might be activated by the prospect of use of REC and the contexts in which these mechanisms might apply.

The evaluation environment we are working in is one in which relatively little is known about 'what works in what circumstances' in relation to the use of the REC and more generally the use of electronic computer-based decision support systems. Therefore, a core task for the research is to draw on existing data to theorise what seem to be likely 'change mechanisms' and to use the empirical study to explore the presence or otherwise of these C+M configurations, to examine the nature of their interaction and their consequences, both in terms of outcomes but also in terms of facilitating greater awareness of sustainability issues. Our aim is to make use of the early 'demonstration projects' (cases where we know the REC has been successfully used) to help us define the various C+M configurations and test these hypotheses through case studies carefully selected.

The emerging findings are compiled as conjectural CMOCs that indicate how the intervention led to particular outcomes in which context and by which mechanism. Their fit with the data is checked to ensure internal validity. The retained CMOCs are then compared with the MRT, which in turn is modified if necessary (Barnes, Matka et al. 2003).

## Formulation of our MRT

We formulated our MRT on the basis of an explorative study of the pilot districts where IeDA was first tested. During that study, interviewees indicated the importance of the characteristics of the innovation as a driver for use and the importance of the facility setting as a physical and organisational structure. We also found indications that the perception by communities was a determinant factor that influenced health providers' behaviour to adopt and use IeDA. A second source of inspiration is the realist synthesis of 36 peer-reviewed papers we conducted on the factors influencing the use of electronic Computer-based Decision SystemS (eCDSS). It highlighted the interrelation between the properties of the innovation itself with the organisational environment. The contextual factors that influenced negatively the use of eCDSS were: financial incentives; competing programmes; previous knowledge and use of IT; high clinician turnover; link of eCDSS to an ordering system; and individual patient preferences for treatment. The complexity, lack of a relative advantage, and incompatibility of eCDSS with workflow, current practice and beliefs of clinicians was associated with low use of eCDSS. Trialability and change valence did not influence eCDSS use.

## Implementation evaluation

The implementation evaluation aimed to document how the implementation of IeDA was organised and achieved, and how the intervention was received. This implementation evaluation focused on fidelity, dose delivered (completeness), dose received (exposure), reach (participation rate) and recruitment (Saunders, Evans et al. 2005).
*Fidelity* is about comparing what happened in practice in the four districts to what was planned in IeDA project documents (Moore, Audrey et al. 2015). We decided to prioritise

in the analysis a limited number of key interventions of IeDA, selected according to the intervention theory of change and the opinion of main stakeholders: tablets and REC availability, IMCI/REC training, supervision and the sequencing of these activities. (Bonell, Fletcher et al. 2012, Moore, Audrey et al. 2015).
*Dose* delivered is about identifying the activities and material most and least successfully delivered at all levels.
*Dose* received is defined in the present study as the number of participants to trainings, the number of healthcare (HCW) workers effectively supervised and those taking part in the Quality Improvement activities, and the REC utilisation rates.

*Reach* of IeDA is estimated through the rate of HCW having been invited to trainings, the rate of healthcare facilities supervised and the average technical issues disrupting REC utilization. To analyse recruitment, we gathered information about the actions conducted to create and maintain adherence and participation to IeDA activities and use of REC.

## Context evaluation

The context evaluation aimed to document factors external to the intervention that may have acted as moderators of implementation and outcomes (Pawson and Tilley 1997), i.e. as facilitators or barriers to IeDA implementation and affecting REC use (Moore, Audrey et al. 2015). In particular, we payed attention to potential unanticipated factors. Social, political, resources and logistical factors were screened and added throughout the study. Various sources of information were used: individual interviews and document review (project documents as well as national policy documents).



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## Mixed methods: embedded realistic evaluation

The realistic evaluation approach is defined by Pawson and Tilley (1997) as a series of principles and theories. However, the authors do not provide any guidance on how to translate these principles into research methods (Rycroft-Malone, Fontenla et al. 2010). Indeed, they advocate for methodological pluralism and the use of mixed methods.

Using more than one research method can generate a more accurate analysis of the phenomena being studied (Morse 2003). Mixed methods (MM) research is defined as "the combination of quantitative and qualitative approaches that provide a better understanding of research problems than either approach alone" (Creswell and Plano Clark 2007). The advantages of MM have been extensively described in the literature and be summarized as follows: (i) MM gives the opportunity of mitigating the limitations of both quantitative and qualitative research; (ii) combining quantitative with qualitative research enables the researcher to study phenomena from different perspectives using different paradigms; (iii) MM helps answer questions that cannot be answered by qualitative or

quantitative approaches alone; (iv) MM encourages collaboration between researchers from various disciplines; (v) MM is pragmatic as it opens the possibilities of methods (Johnson, Burke et al. 2007, Bergman 2008, Teddlie and Tashakkori 2011, Denzin 2012).

MM research can have four different objectives (Creswell and Plano Clark 2007):

1. triangulation: the objective of MM is to generate additional and complementary evidence on the same topic using different methods to better capture phenomena;
2. embedded: one data set provides the main set of evidence (e.g. quantitative data) and the second set (e.g. qualitative data) complements the first one;
3. explanatory: qualitative data contributes to provide explanations to initial results collected with quantitative methods;
4. exploratory: the results of the qualitative method help elaborate the questions and tools for the quantitative method that follows.

The mechanisms triggered are determined together with the way in which they produce the outcomes in each of these specific contexts. This leads to the definition of a theory detailing which mechanisms of the program work in which context to produce which outcomes and for whom. An MM approach is appropriate for realistic evaluations. This evaluation is concerned with providing an overall understanding of the nature of the theory-of-change model and how it actually operates. A quantitative and qualitative approach is required to explore the research questions and deal simultaneously with the inductive and deductive theoretical drives (Marchal, Westhorp et al. 2013).

Quantitative data and qualitative data are collected concurrently: quantitative numerical data is collected from questionnaires and clinical observation and qualitative data (text data, transcripts and memos) from open-ended questions included in semi-directed interviews, focus group discussions, documents review and observations. In this research, qualitative and quantitative methods are mixed throughout all phases of the project from the design stage through data collection to data interpretation.
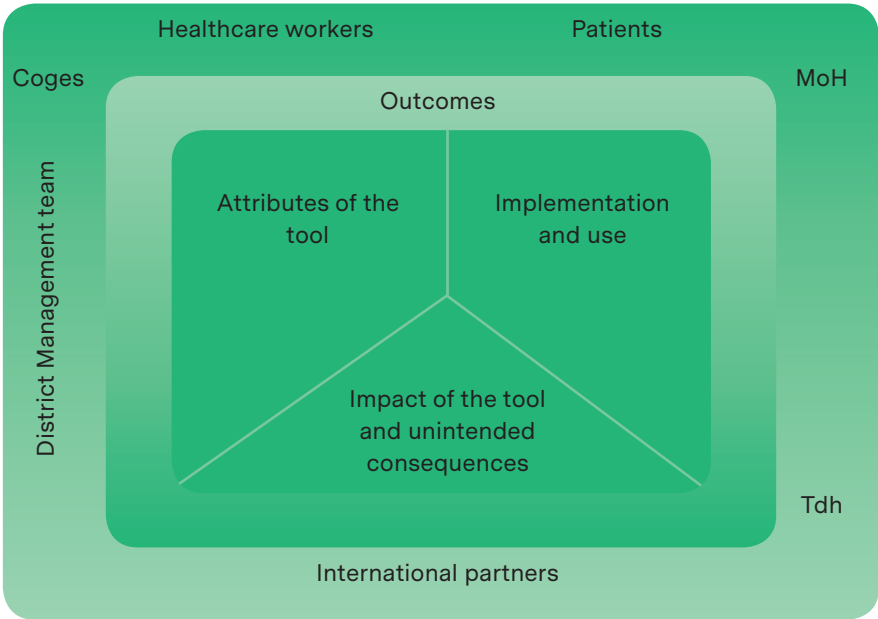
# Realistic evaluation design and research methods



Figure: Conceptual framework of the IeDA realistic evaluation (Adapted from Rycroft-Malone, Fontenla et al. 2008)

## Conceptual framework

The study's theoretical framework integrates various components, including the four areas that play a role in protocol-based care in general and related impact on stakeholder outcomes: patients, health staff, service providers and policy makers:

1. What are the properties of the REC tool?
2. How is the approach implemented and the tool used?
3. What is the impact of the approach and its unintended consequences?

## Study design

In order to capture social phenomena such as management decisions and interactions between individuals, an in-depth qualitative research approach was adopted. According to Fitzpatrick and Boulton (1994 p. 107), qualitative research "is used where it is important to understand the meaning and interpretation of human social arrangements such as hospitals, clinics, forms of management or decision making". Qualitative research aims to generate concepts and theories that can be generalisable (Green 2006) - what Yin called "analytic generalisation" in opposition to "statistical

generalisation" (Yin 2003 p. 32). In real-life contexts, qualitative research and, more particularly, case study methodologies are known to be appropriate for understanding and interpreting complex causal links in natural setting interventions (Keen and Packwood 2000).

## Data collection

Various sources of data were used by the investigator during data collection that took place between January 2016 and October 2017. The combination of several data sources proved valuable to the research. Direct observation in health centres generated elements of information that helped to identify new issues or verify assumptions. The analysis of project reports from health facilities helped analyse the implementation of IeDA and the vision of the project by managers. In addition, interviews and focus group discussions provided evidence in relation to the perceptions, in-depth opinions and understandings of actors intervening in IeDA.

In-depth interviews were conducted with 154 individuals including 92 healthcare workers from health centres, 16 officers from district health authorities, 6 members of health centre management committees. In addition, 5 focus groups (on average 11 people per group) were organised with mothers and carers.

The sampling procedure was chosen according to the objectives of the study: generating theories and concepts rather than generalising findings to a wider population. Therefore, a purposive rather than a probabilistic sampling method was deliberately used by the investigator (Patton 1999, Bowling and Ebrahim 2005). Purposive sampling is used when researchers

"seek out groups, settings and individuals where … the processes being studied are most likely to occur" (Denzin and Lincoln 1994 p. 202).

For the implementation evaluation, a set of process research questions were defined prior to the evaluation and according to the IeDA theory of change (Oakley, Strange et al. 2006). Most of the information collected was triangulated from different sources. This was particularly important as the data were collected retrospectively hence subject to recall biases. A combination of electronically documents review and in-depth interviews were conducted in 2017.

## Data analysis

The initial coding was based on a preliminary list of codes inspired by the MRT and on additional ideas that emerged from the fieldwork. In a second round of analysis, some themes and patterns emerged. In order to structure them as CMO configurations, we found it useful to borrow categories from theory-driven evaluation (Chen 1990). We described

**Table 1: Number and profile of individuals interviewed during the realistic evaluation**

| Profile | Number |
|---|---|
| Healthcare workers | 92 |
| Health district officers | 16 |
| COGES | 6 |
| Carers | 5 Focus group discussions, 9 individual interviews |
| Drug stock managers | 3 |
| Village representatives | 2 |
| Community health workers | 6 |
| Regional health authority | 1 |
| Health centre maintenance officer | 2 |
| Traditional chief | 2 |
| MoH Officers | 6 |
| TDH | 3 |
| **Total** | **154 Interviews + 5 focus group discussions** |

the intervention in terms of content and application, and the intended and actual outcomes. We drew on our interviews, observations and document analysis to differentiate the vision (what the team wants), the discourse (what they say) and the actual practice (what they do). We described the organisational climate perceived by staff in terms of procedures, structures and incentives (Schneider, Gunnarson et al. 2004). In order to indicate how the intervention worked, we analysed both the context and the intervening mechanisms and attempted to identify the essential conditions.

In terms of implementation evaluation, we analysed the concepts of fidelity (How much has IeDA been delivered as intended? What has not been delivered?), dose delivered (What parts of IeDA were delivered most and least successfully to DHMT, primary healthcare facilities and healthcare workers?), dose received (Which content and activities of IeDA were attended best by participants?), reach (What proportion of the intended healthcare workers was effectively exposed to IeDA?) and recruitment (What was conducted to encourage adherence to IeDA activities and REC use?).

# Results

## The management vision

We analysed the views of the implementation team members at MoH and Tdh to understand their respective roles, the implementation process and the effect they aim to achieve. The vision is well shared between senior MoPH officers and Tdh managers: the introduction of the REC aims to support the scaling up of IMCI in Burkina Faso with the ultimate goal of improving adherence to IMCI protocol and quality of child health services at primary health care level. But this vision has evolved over time with the implementation of IeDA to encompass new dimensions. As well as improving adherence to IMCI protocol at health centre level, the vision of the project also included aspect related to centralisation and availability of patient data to decision makers for remote monitoring, targeted supervisions and tailored trainings. As managers describe it, it also fills a gap in the health information system in Burkina Faso and aims to influence the way health centres are managed. Data is put at the centre of the management processes and made available from 2017 to district managers and health centre managers in order to guide their decisions and tailor their supervision and coaching visits.

At the health centre level, there is clear consensus with management level on the IMCI adherence aspect of the project.

"When we use the REC, we have to follow each single step of IMCI. This means that we scan all the health problems of a child. This requires that we ask all the IMCI questions and help us have a global diagnosis. This is a better management of the child" (Nurse in health centre).

However, the vision of management on centralisation of data for better management is not really as being part of the vision of health centre staff (nurses and nurse assistants). They rather mentioned another data-related

aspect of IeDA that is central to them: the REC gives them access to patient medical history:

"If a child comes for consultation, we type his/her name and the name of his village, and we retrieve his history in a few seconds. This is impossible with the manual registry" (nurse, health centre)

### The actual intervention

Based on the analysis of interviews and project documents, we found that the list of activities that really constitute what the intervention is about goes beyond the original vision. The project has been very dynamic experiencing several stages of changes mainly guided by the feedback received from the users. Tdh has put in place dialog mechanisms with healthcare staff in order to ensure that the evolution of the tool and project take into account users' feedback.

The original activities identified by the implementation evaluation are as follows: (i) Delivery of IMCI and REC training; (ii) Provision of tablets and solar kits; (iii) IMCI/REC supervision session at facility level; (iv) Organisation of Quality Improvement sessions; and (v) Use of REC during child consultations.

Between May 2015 and December 2017, the intervention evolved. Several activities and tools were added during the year 2017 primarily to improve knowledge and data use for management and clinical care: (i) development of dashboards at health centre level; (ii) supply of a second tablet to larger health centres; and (iii) online learning modules on IMCI. The REC itself evolved several times during the project period experiencing several software improvements on the tablet and the backend of the tool (data analysis) resulting in several consecutive versions of the REC.

**Table 2: Number of healthcare workers trained on IMCI/REC in four districts**

| | Toma | Solenzo | Titao | Ouahigouya | All |
|---|---|---|---|---|---|
| HCW trained (N) | 32 | 44 | 31 | 26 | 133 |
| HCW, total | 63 | 46 | 49 | 50 | 208 |
| HCW trained (%) | **51%** | **96%** | **63%** | **52%** | **64%** |
| State enrolled nurses trained (N) | 9 | 9 | 6 | 5 | 29 |
| State enrolled nurses, total | 10 | 11 | 6 | 6 | 33 |
| State enrolled nurses trained (%) | 90% | 82% | 100% | 83% | 88% |
| Assistant degree nurses trained (N) | 9 | 11 | 9 | 6 | 35 |
| Assistant degree nurses, total | 10 | 10 | 8 | 11 | 39 |
| Assistant degree nurses trained (%) | **90%** | **110%** | **113%** | **55%** | **90%** |
| Outreach health workers trained (N) | 10 | 13 | 10 | 11 | 44 |
| Outreach health workers, total | 19 | 10 | 13 | 13 | 55 |
| Outreach health workers trained (%) | **53%** | **130%** | **77%** | **85%** | **80%** |
| Midwives trained (N) | 1 | 7 | 6 | 1 | 15 |
| Midwives, total | 7 | 7 | 6 | 5 | 25 |
| Midwives trained (%) | **14%** | **100%** | **100%** | **20%** | **60%** |
| Auxiliary midwives trained (N) | 2 | 1 | 0 | 3 | 6 |
| Auxiliary midwives, total | 17 | 8 | 16 | 15 | 56 |
| Auxiliary midwives trained (%) | **12%** | **13%** | **0%** | **20%** | **11%** |

### Intensity of implementation

We analysed the actual implementation of IeDA using the framework described in the method section. Each activity was analysed in terms of implementation. Between March 2015 and December 2017, all the health centres in the 17 districts were supplied with one tablet and one solar kit. In total, 608 health centres were covered. Regarding the provision of a second tablet, only 25 tablets were distributed as a second tablet with only one supplied during the year 2017.

In terms of training, it was originally planned to train all HCW on IMCI/REC. by the end of 2017, Tdh and MoH managed to train 88% of the nurses (both State and Certificate), their primary target as they are the ones who are supposed to conduct child consultations and use IMCI, according to national MoH policies. Over the years, the training strategy

was extended to other cadres as the implementers realised that, on the ground, other cadres take over for consultations when nurses are not available at the health centre (on holiday, sick leave or training). The innovation is that the project managers did not hesitate to negotiate with MoH an exception measure for the project to adjust the national policy on IMCI, based on information from health centres on whom is involved in conducting consultations. As a result, the project managers included in the initial training midwives, midwives assistants and even outreach workers.

In terms of supervision, 90% of supervision was conducted as planned every month. All stakeholders reported that recruiting and retaining supervisors who had enough time to dedicate to supervision activities was highly challenging in most districts.

Following the launch of IeDA in each district, supervisors from the district health management team (DHMT) were assigned to conduct IMCI/REC supervision activities. It was reported that after a few months it would usually be noticed that those DHMT members did not have enough time to deliver IMCI/REC supervision activities. Hence, it was eventually decided that DHMTs had to assign other supervisors, for instance HCW from health centres.

In terms of Quality Improvement (QI), at district level, representatives from all health centres were invited to attend QI sessions two to four times a year. During these sessions, performances of health centres regarding REC use and IMCI adherence were presented and discussed.

# The political and policy context

## The political context

A *Coup d'Etat* occurred in September 2015 and caused a few interruptions in the implementation of IeDA activities. At that time, IeDA had been deployed in two new districts, Toma and Solenzo districts. All activities were paused for five weeks, which primarily impacted the supervisions and the training of healthcare workers. It also created uncertainties amongst project managers and health district managers on the future and how the IeDA project would be implemented, as the whole government was changed.

## The policy context

### Free healthcare policy initiative

During the course of the project, a new policy emerged, which would potentially directly affect the utilisation of health services at health centre level. A free healthcare policy for children under 5 was nationally launched in April 2016 (Ministere 2016) (Gouvernement Burkinabe 2016). This decree was one step towards Universal Health Coverage (UHC) for which willingness of the Government had been officially formulated in September 2015 with a Law establishing a compulsory Universal Health Insurance (Conseil National de la Transition 2016). Following the implementation of this policy, the number of consultations in health centres increased as shown in Figure 3.6. It is likely to have had a negative impact on the workload of health care staff in health centres and the systematic use of REC, which might have been the case in Toma district. The introduction of the new policy coincided by the start of the malaria season. According to nurses interviewed, the period of adaptation to the new workload lasted around 7 months as soon as the malaria season ended and hey had time to reorganise their services. In other words, the utilisation of REC was not deeply and durably impacted by the new policy.
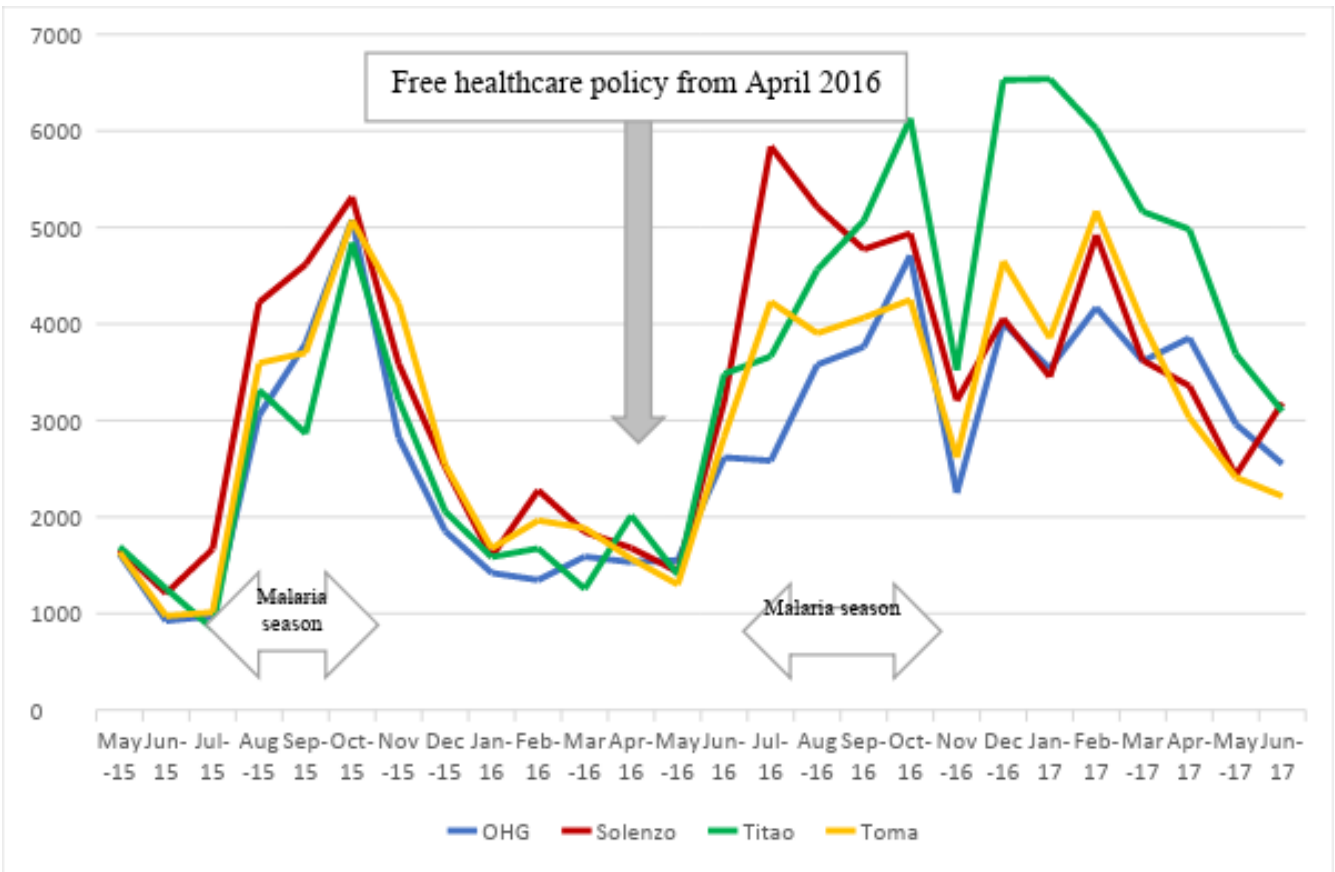


*Figure 2: Total number of consultations by district between May 2015 and June 2017*



### Staff turnover

IeDA was implemented in rural remote areas, where healthcare workers usually do not want to spend more than a few years and where staff turnover was anecdotally said to be high. For example, in Titao district, it was reported that up to 95% of newly transferred staff were healthcare workers coming straight from nursing school with no primary experience. During interviews, district managers estimated that newly arrived staff worked during an average of three years in the district before asking to be transferred to another district. Staff turnover was also seen as a challenge for Tdh who worried about training staff and sustaining the utilisation of REC in each health centre.

In July 2017, all health care workers working in the four districts where IeDA had been implemented, 31% of healthcare workers (62 out of 198) who were asked to use the REC had not benefited from the IMCI/REC training. This was exclusively explained by staff turnover: nurses who had been trained by the IeDA project had been transferred to other districts and replaced by staff who had not received the initial IMCI/REC training. To triangulate the information, all 40 health centres were surveyed to understand staff turnover. It was found that 36% of nurses had been changed within the last 12 years, period of time corresponding to the first IMCI/REC training. Anecdotally,

district managers confirmed that the rate is constant every year. This means that every 12 months, around 40% of the nurses or midwives move to another facility (most of the time outside the district).

The innovation attributes Health systems are viewed as complex systems (Institute of Medicine 2001, Plsek and Greenhalgh 2001). Complex systems are systems with a high number of elements or actors that interact with each other in ways that are not always predictable following the introduction of an innovation (e.g. a new health intervention) (Borgatti, Everett et al. 1990, Rihani 2002). Introducing an innovation into a complex adaptive system (e.g. a health centre) can produce extensive changes in various socio-technical aspects of the system, including tasks of individuals, relationships between actors or management mechanisms (Greenhalgh 2008, Blanchet 2013). An innovation is defined in this paper as "an idea, practice or object that is perceived as new by an individual or other unit of adoption" (Rogers 1995). The process generated by the introduction of an innovation is described by Rogers (1995) as an "innovation-decision process".

Diffusion of innovation theory can help explain how the continuation of activities is related to the attributes of activities as innovations. Beyond the description of an innovation as a newness, Rogers (1995) showed that innovations are characterised by five attributes:

1. relative advantage - individuals assess innovations by comparing the expected advantage of the new initiative with the benefits provided by the previous one that it replaced;
2. compatibility - an innovation is perceived as compatible when the new idea or technology introduced by the innovation is consistent with the mandate

of the adopters or the adopting system and does not require significant modifications from the adopters (Aubert and Hamel 2001, Denis, Hebert et al. 2002);

3. complexity - the perceived difficulty in understanding a new idea or using a new technology. A complex innovation can also be an intervention which involves a high number of actors (Grilli and Lomas 1994, Denis, Hebert et al. 2002);
4. triability - the notion that an innovation can be tested on a small scale (Yetton, Sharma et al. 1999); and
5. observability - the degree to which the results of the innovation are visible (Grilli and Lomas 1994, Rogers 1995).

The IeDA intervention and more specifically the technological innovation, the REC, the CDSS provided to nurses at the start of the project on small laptops and later on tablets was analysed in relation to Rogers' attributes: comparative advantage, compatibility, complexity, triability and observability.

### Comparative advantage

In terms of comparative advantage, the REC was compared by healthcare workers to the previous situation where only paper-based version of the IMCI was available. We know from the trial that IMCI paper-form was used for 68% (916/1,343) of the consultations in the control arm respectively, while the REC was used in nearly all consultations (97%, 674/694) The healthcare workers highlighted the advantages of the REC, which is described as a tool covering several functions. The REC has been well accepted by healthcare workers and has become a routine tool in their practice to the point that healthcare workers contribute to the maintenance of the tool, regular synchronisation and do not hesitate

sometimes to use their own money to cover internet costs.

The REC is, above all, an eCDSS tool that guides healthcare workers in their clinical decisions and help them respect the recommended IMCI protocol. Step-by-step decisions the clinicians need to make throughout the course of the consultation are guided by the software that forces the consultant to follow each step of the protocol in order to be able complete the consultation. The software developed for the project uses conditional logic where the following questions and steps depend on the answers previously registered by the healthcare worker and no skip option where every variable needs to be recorded to enable the healthcare worker to progress to the next step. The district officers as well as the healthcare workers recognised that the tool is well designed and enables the healthcare workers to directly have access to the protocol without searching for the right information.

"When using the REC, we have to follow each step [of the IMCI protocol], which means we are to screen all the potential problems of the child, even the ones not mentioned by the carer. The REC pushes us to ask the right questions." (healthcare worker)

"If you directly register the child in the REC, it [the REC] provides the classification, the medicine you need to prescribe, even the dose. So no need anymore to search in the documents [i.e. IMCI paper protocol]. So to me, it is much easier like this: you ask questions, record the answer and this is finished. You get the treatment and the prescription. Huge advantage!" (healthcare worker)

The community really perceived a change in the way consultations are delivered. The fact that the IMCI protocol is followed step-by-step takes more time than only focusing on

the single symptom expressed by the carer.

"The REC pushes us to be more scrupulous. So it takes more time and mothers complain about it". (Healthcare worker)

The REC is described by many interviewees as a living entity with its own autonomy and decision power. As a result, the "machine", brings its own independent opinion on the top of the healthcare worker's opinion.

"It is the REC that help quickly find the right products that are needed to treat my child when he is sick." (Mother)

"The machine gives more information than the nurse". (Father)

In a sense, the presence of the REC is reassuring for the community as it is a way to guarantee and triangulate the diagnosis provided by a nurse. To go further, it is as if the community had more trust in the REC viewed as generating a non-biased opinion:

"To me it is like a machine. It is a computer. This will diminish the errors. When I see some work done with a machine, I have no fear. I respect this work." (Father)

"In the REC, there is no lie". (Father)

"I think that it is in the REC that the healthcare workers see the diseases of the child. Every time you come back to the health centre, they find the information inside the machine". (Father)

Another advantage of the REC is the capacity to generate a **patient registry** and even the medical history of the child. The information from the previous consultation are recorded in the patient file. The paper-based filing previously used could not make this task possible. Thanks to the patient history function, the healthcare worker can refine his/her consultation and ask further questions to the carer. This function is well appreciated by the community who understands the



advantage of having access to the medical history of patients. Access to the medical history of the child is probably the most visible function from the perspective of the carer.

"Once they [the nurses] type the name of the child, they can see a lot of information as they already can tell the age". (Mother)

"When the child is here, you click here to see past treatments. You can see when he came and what reason. With the registry, it is very difficult. And we change registry all the time as soon as the pages are finished. But here, even one year later, you see everything." (Healthcare worker)

Another important function of the REC is the **centralisation and sharing of data** (including monthly reports). The patient registry is saved on the tablet, saved on a cloud and shared with district and national authorities.

"At the end of each week, data are sent to the district – very quickly – from the tablets without leaving the health centre. We can say that what we save is time." (Townhall employee)

The negotiations between the MoH and Tdh focus on adapting the REC database to the national health database, ENDOS (Entrepôt National

des DOnnées Sanitaires; District Health Information System 2 (DHIS2), which will be a critical key to scaling up.

In the eyes of the community, the REC has generated indirect benefits. Tdh provided solar kits to ensure autonomous **supply of energy** for the running of the tablet. The community made direct link between the introduction of the REC with supply of electricity at the health centre, which brings security around the health centre during the night.

"This tool is great since it was brought. Power is not in the village but light and the machine are here. The night guard can now sit down in the light and even if a patient comes during the night, there is light. It is great." (healthcare worker)

## Compatibility

In terms of **compatibility**, we investigated the compatibility with the infrastructure, the use of IMCI, the health team and the relationship patient/clinician.

In terms of infrastructure, the REC, which consists of a tablet, does not create any specific challenge for the health centres, whatever their size. More than being seen as an obstacle, the REC actually highlights in each facility the minimum equipment and drugs required to run child consultations according to IMCI standards. The introduction of the REC systematically generates amongst the health team an inventory of equipment missing or not functioning and the list of essential medicine. For example, in many health centres, after the IMCI training and the introduction of REC, we observed the creation of oral rehydration therapy (ORT) corners with plastic containers and oral rehydration solution (ORS).

"IMCI requires a consultation room dedicated to child consultations, which was possible in our health

centre but we needed to move around furniture." (Healthcare worker)

"At the start, we through that the REC was asking for drugs that we do not have in stock. We then realised that these drugs were part of the essential list of medicine. We had to order them." (Drug stock manager)

In terms of team organisation, health staff realised that the use of REC was easier with several health agents involved with an efficient use of several personnel. For example, one agent stays in the waiting room and take basic measures (weight and size). When possible, two agents manage the consultation as a team. One person close to the child and a second person guiding the consultation with the tablet through each step of the IMCI protocol and recording data on the tablet. In other health centres, usually large health centres, the consultation of children is conducted in one room in parallel to consultations for adults in a second room. We observed that the outreach health agents were mobilised for consultations, often in charge of the triage and measuring weight and size of the children outside the consultation room. We observed several times the involvement of one member of the health centre management committee when staff are overstretched.

There are situations when the use of REC was challenged by the population: when the agent was on his/her own and during the malaria season.

"If I take months such as September-October-November, when the waiting room is full of patients, people are vomiting, people are on the floor with fever, it is very challenging when staff is limited. The population would insult us if we are slow." (healthcare worker)

In terms of **patient/clinician relationship**, the REC introduced a new way of interacting with patients. One concern at the start of the project

was that the REC would increase the physical distance between the patient and the healthcare worker. In fact, we observed in several centres that one agent moves away from his/her desk to sit down next to the child in order to consult the child and ask questions to the carer. The healthcare workers noticed the satisfaction of the community in this new approach and feel a gain of trust from the community. The acceptance of the REC by the community cannot be better assessed when it is missing: when the REC is not functioning or out of battery, the community notice it, ask for explanations and demand the use of the REC during consultation time.

The strict adherence to the IMCI protocol also means that the prescription of drugs is not systematic, which contrasts with current practice in Burkina Faso where each patient expects to receive a prescription of drugs. This change of practice puts a lot of pressure on healthcare workers and requires from them perseverance and conviction.

"The person expects to be prescribed drugs like in the old times. This was routine practice during consultations. People are used to drugs. For people who are illiterate, you explain but they will go to another facility to ask for drugs. It is about trust between us and the patient." (Healthcare worker)

## Complexity

**Complexity** of REC was one of the main concerns from the national policy makers considering the limited level of computer literacy of their staff at primary health care level. It appears that the use of the tool is perceived as being easy to understand after initial training. We have also observed that new comers in a health centre are immediately trained by their peers on how to conduct consultation with the REC and use the tablet. All healthcare workers trained on REC recognise the importance of

coaching following the training and after practising in order to be able to ask questions, understand some of the troubleshooting methods when the software or tablet has issues and verify they are doing the correct tasks.

The **feedback loops** established by Tdh to understand users' perspectives is also well valued as after each software version healthcare workers can see the improvements made compared to the previous in order to facilitate their work. The healthcare workers really understand that they are the key players in this project and that their voice and views are recorded and analysed to improve the usability of the tool.

The utilisation of REC becomes very complex when the **system breakdowns**. It happened that in the middle of the consultation, the software froze or the system shut down deleting all information registered during the consultation. We also observed that in some health centres, nurses were using the paper registry as they had serious issues with the battery of the tablet. The point here is to highlight that the introduction has become so much part of routine practice that its absence due to a breakdown is noticed by the healthcare workers and disrupts the organisation of consultations.

## Testability

In terms of **testability**, we observed in a few health centres some resistance from heads of facilities. It was mainly due to the lack of self-confidence and literacy on using tablets and softwares. The coaching played a key role in accompanying individuals who had some reluctance in using REC and building their confidence. Coaches did not consider resistance as an exceptional event but rather assumed that resistance was the norm. As a result, any healthcare

worker complaining about the innovation was not excluded from the intervention but on the contrary, their concerns were embraced by the coaches in order to build their skills and later n their confidence.

One limitation of the current version of REC is the absence of correction function. The information cannot be changed as soon as the section is validated. This lack of flexibility makes typing mistakes very unforgiven and may lead to incorrect diagnosis.

## Observability

In terms of **observability** (i.e. the possibility for the users to perceive visible benefits), interviewees listed quite a few aspects. First, the healthcare workers realised that the use of REC lead to a more **rational prescription of medicine** and reduced over-prescription, which is usually the result from community pressure. The presence of the tablet provides vis-à-vis the community arguments and a rationale for the healthcare worker for not prescribing drugs when not necessary (for example when the child has a simple cough).

On the other hand, the healthcare worker through the use of REC has a better understanding of and **adherence to the IMCI protocol** as skipping steps are impossible with REC. The healthcare workers have the feeling that they really follow the IMCI protocol as they should do. As a result, healthcare workers feel more confident in their own classification and prescription.

"Without the REC, there are many questions we used to forget. But here, all the questions are listed and you cannot skip any of them. So to me, I think that we better manage patients. For example, when a child comes with a simple malaria, you can without the REC forget to identify anaemia." (Healthcare worker)

For the district health team, the introduction of the REC does not only mean the introduction of a new technology but is really rather seen as the scaling up of the IMCI strategy.

"We have to say that before we introduced the REC, even if some IMCI training took place at some point, there were only two health centres [out of 28] that were using IMCI and within the health centre, only nurse had been trained in IMCI and tried to used it during consultations. So you can imagine the proportion of children consulted with IMCI was quite low. After the introduction of REC, which was preceded by an IMCI training for all agents, I can say that now all CSPS use IMCI during consultations and more than one agent per health centre." (District Officer)

"It is really a positive change because with the REC it is really the IMCI strategy that is rolled out, which means that we introduce the IMCI form during every consultation." (District Officer)

The REC is also a **dynamic tool**, which evolves with the policies and can support the dissemination of new policies at reduced cost. For example, during the course of the project in 2016, a revised version of the national IMCI protocol was introduced by MoH. The protocol was then supposed to be rolled out by the MoH, which requires dissemination of the document and ideally refreshers for all health staff. With the REC, a revision of the protocol in the software and the upload of the revised protocol on each tablet were the only tasks necessary to a full roll out of the revised protocol.

From the perspective of the healthcare workers, nurses or nurse assistants, the REC also represents a tool supporting continuous development through the eLearning tools. Indeed, in 2017 were introduced online training modules with short demonstration videos.

"For example, in terms of respiratory infections, to check whether a child has a stridor, you can click on the REC to watch a short video with a specific case of stridor. The REC provides a few more extra details on what information we need to check to confirm a stridor. They are plenty of details provided." (Healthcare worker)

Another new management practice introduced by IeDA is **team work**. The utilisation of the REC is more efficient when two staff are involved to conduct consultations. In several health centres, we even observed that peer support was organised in order to enhance individuals practice and knowledge. Peer support was suggested by the Quality Assurance activities and coaches as an approach to enhance quality.

The IeDA is seen by the health district officers as the introduction of a **quality of care** approach at primary health care level. The IeDA project through higher adherence to IMCI promotes a comprehensive assessment of the child health, moving away from a classification based on the most visible and apparent symptoms.

"With IeDA, it helps screen more comprehensively the health conditions of the child. It helps change the practice of health agents. Sometimes, there are consultations when, maybe. We don't take enough time to consult the child or ask all the right questions to the mum. But with that [REC], as everything is indicated, we have to follow each step and this contributes to improve the behaviour of healthcare workers. So this is a great advantage for us." (District Officer)

"When you see on the walls the ideas of changes and the solutions. You can see a weekly programme and the indicators displayed." (Head of health district)

The quality of care approach promoted by MoH and Tdh goes beyond the improvement of individual

practice and behaviour change. A real **support system** was put in place engaging each level of the health system in the implementation and promotion of quality of care practices. This required the involvement of a wide range of actors ranging from national actors from all levels and sectors of the health system (different departments at MoH including family medicine, statistics and information) and international donors and United Nations agencies as well non-governmental organisations and civil society organisations and individuals (opinion leaders, religious leaders). Many of these actors were involved and engaged at each stage of the project to share views on the next steps of the implementation and scaling-up of IeDA. The recognition of everybody's voice created an atmosphere of **mutual support and trust** within health centres and between health centre staff and district health teams. There is general perception that the IeDA has been implemented with genuine will from health staff to make it work.

"The culture of performance and quality needs to start from the institutional level. We need to be able to support the institutional level, which means the national, district and health centre levels." (Tdh)

The behaviour of health workers is also influenced by the new **accountability system** introduced de facto by the REC. Indeed, every healthcare worker needs to log in every time they use the REC. The information officer at the district level can easily retrieve this information in case of problem. This is a significant change in the Burkinabe public service culture as for the first time this information can be used to identify malpractice (if needed).

The high level of commitment from a wide range of actors generated more legitimacy for the project and created a devolution of powers and responsibilities within the health system to monitor the quality of the

services provided. Even most Heads of the health centres have a sense that it is their responsibility to monitor the quality of the consultations performed by their team. This integration of the governance system to the lowest level of the health system is a real achievement and contribution towards the routinisation of the REC at the primary health care system of Burkina Faso.

"I keep an eye on the ones who use REC and when I go around, I select the patients already consulted and check whether their name is recorded or not. If they are not registered, I call the agent and explain that all the patients need to be registered." (Head of health centre)

"The person who leads the consultation has to provide his personal details, which helps identify who is in charge of the consultation, so we know the proportion of consultations performed by nurses, as they are the ones who supposed to do it. And when there are problems, we can identify which person has difficult conduct correct consultations." (District Officer)

# Analysis

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*After categorising the primary data in the form of CMO configurations, a realist evaluation seeks to examine the link between these findings and the middle range theory it set out to examine. In practice, we searched the causal pathways between the adoption and utilisation of the REC and prescription and the various management practices and dynamics in health centres.*

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## A summary of the intervention and its outcomes

Our interviews and document review showed that the MoH and Tdh managers defined good performance as health teams who systematically used the REC, had a good score in correct classification and prescription and were able to improve over time through self-learning. In contrast (?), district health teams defined good performing health centres as health centres who were systematically using the REC, experienced limited service interruption due to system breakdown or drug stockout and were able to report their results in time. The district health teams, compared to MoH and Tdh managers, had less emphasis on quality of care but rather concentrated on the activities directly related to the district health teams' responsibilities for which they are accountable to the Regional Directorate and MoH.

The *actual activities* of the intervention can be summarised as follows: (i) Development and implementation of improved versions of the REC; (ii) Provision of a six-day training course on IMCI guidelines and REC; (iii) Development of a quality assurance mechanism; (iv) Monthly supervision of every health centre benefiting by the district health team; and (v) Development of a health information system. We also found important additional activities that organically appeared during the implementation of the intervention: the creation of a support system to respond to breakdowns and questions on the software and the tablet; district meetings at least once a year to enable district health teams and heads of health centres to discuss about performance and

find concrete solutions; creation of eLearning modules on IMCI available on tablets for continuous knowledge development; an inclusive and team approach associating in the implementation process not only nurses but also any other staff who is directly or indirectly involved in managing child consultations; and good accessibility of top Tdh managers to district health teams and in a certain measure to Heads of health centres anytime support is needed.

Regarding the *process of implementation*, we noted a good coherence between the initial theory of change developed by the implementers (MoH and Tdh), the project management team's vision and district health teams and health centres team's practice. Indeed, in line with their vision, the project management team motivates the health centre staff involved in child consultations (e.g. nurses, midwives and nurse assistant) through effective and regular support, dialog to identify their problems and needs in using the REC and full recognition of their role in improving child consultations. All these practices conducted by the project management team are applied to all health centres (good coverage) without any distinction of location and health cadres (good external fit) and these practices are reinforcing each other (good internal fit). Concerning the latter, this was achieved by Tdh and MoH by regular assessment of the situation and identification of models of good practice at health centre and district levels, identification of constraining factors to REC use and dissemination of good practice through local implementation teams. For example, the inclusion

of different cadres in the project is based on correct assessment of the context in rural Burkina Faso. IMCI is supposed to be exclusively used by nurses, according to MoH policies. However, the implementation teams realised at the very early stage of the implementation that a nurse (often the unique nurse in a health centre) has other responsibilities outside the health centres (e.g. training, meeting days at district health bureau) and cannot permanently be physically present at the health centre to conduct child consultations. As a result, the nurse delegates the responsibility of child consultations to other cadres who may be, depending on health centres, a midwife, a nurse assistant or a midwife assistant. As a result of this assessment, the project management team decided to extend the inclusion in project activities (including the initial IMCI/REC training) to all cadres working in health centres.

Realistic evaluation improves external validity of a case study by describing the *implementation context*. During the study, we found several potentially important elements in the context of primary health care in Burkina Faso in the two regions of Boucle du Mouhoun and Nord. First, all health centres in the two regions were staffed by at least one nurse (depending on health centre's size) who were all aware that management of childhood illnesses is an important priority at primary health care, which was emphasized by the introduction of a national free healthcare policy on child health care during the course of the project. Second, the initial training of healthcare workers on IMCI needed to be complemented by regular supervisions and coaching after initial training. Third, staff turnover of nurses is very

**Table: the three CMO configurations related to IeDA**

| Context | Mechanism | Outcome (students) |
|---|---|---|
| C1. Availability of a support team to be responsive to healthcare staff questions. | M1. Promoting amongst healthcare workers "doing the right thing the right way" approaches | O1. Notions of quality in childhood illnesses routinised during consultations |
| C2. In health centres where the nurse is assisted by at least two other members (nurse assistants or outreach workers) and where management flexibility is allowed | M2. Clear distribution of roles before and during child consultations (including triage, weight and size measurements, consultation and counselling) | O2. Efficient organisation of the health team |
| C3. Strong consensus amongst stakeholders on the benefits of introducing REC | M3. Introducing at primary health care level the notion of individual accountability and responsibility and collective contribution to the wider system. | O3. Sustained use of REC as a routine practice |

high in rural areas of Burkina Faso making challenging the progressive development of nurses' skills on IMCI. Finally, the capacity of district health teams to conduct supervisions is quite limited due to their budget restrictions and limited access to vehicles – volume of resources that will not increase in the near future.

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## CMO configurations

During the later phases of the analysis, we found that the adoption process can be grouped according to their key mechanism and this led to the description of parallel CMO configurations, each with their own outcome.

The first CMO can be summarised as: *with the support of a support team responsive to healthcare staff questions and needs (C1), promotion amongst healthcare workers of "doing the right thing the right way" approaches (M1) in order to routinise notions of quality in childhood illnesses during consultations (O1).* The project is trying to influence practice of health care workers by moving away from "simply doing". The awareness from MoH and Tdh that reducing the child mortality with the same level of resources from government can only be achieved by improving quality of care, which in the context of the project relates to correctness of classification and

prescription. This also concerns the shift from output indicators to quality and outcome indicators, which implies an organisational culture change within MoH staff. So many practice changes expected by the implementers can be achieved through the introduction of innovative management approaches. The project management team set up an initial training programme, which guides every health staff through the IMCI guidelines emphasizing on the importance of good practice and quality of care. In addition to the initial training, regular supervision was put in place to complement initial training with in service-supervision. This was accompanied by quality assurance sessions where staff in health centre were asked to find solutions as a team. There was also much attention for a clear role distribution. The notion of teamwork was emphasized by the project management team recognising the value and role of each member, whatever the title and background. In summary, both "hard" and "soft" management mechanisms were used to influence the organisational culture. The former includes task distribution between health care staff by task - pre- (e.g. triage, child measurements), during (e.g. consultation and prescription), and post- (e.g. counselling) consultation tasks - and between clinical and administrative activities. The latter

include initial IMCI/REC courses, peer pressure/support mechanisms and personnel development opportunities through eLearning modules. Availability of a support team to be responsive to healthcare staff questions and needs is an important context element and make possible the combination of all these management processes.

The second CMO configuration can be summarised as follows: *a health centre team where the nurse is assisted by at least two other members (nurse assistants or outreach workers) and management flexibility is permitted (C2) can be better organised and efficient (O2) when the roles of each member are well distributed before and during child consultations (M2).* Key practices in this set include creating open discussions and dialog between all health team members on how the consultation should be organised considering the introduction of a new tool, the electronic tablet, and quality assurance session. In order to be more efficient, a triage is conducted in the waiting room by a nurse assistant or an outreach agent who identifies the children in critical condition and take child measurement (e.g. size). This reinforces open relationships between health centre staff and contributes to solving practical problems and build solidarity between staff members. The quality

# Discussion and Conclusion

assurance sessions are built around specific concrete issues experienced by the health centre team and elaborate realist solutions and action points, which achievement depends on how the members will work as a team. In turn, it stimulates the feeling of perceived organisational system and team mechanism. The leadership and management style introduced by Tdh is perceived by health centre staff to be effective and supportive. In ensuring that all staff have access to improved working environment, their work tools are repaired, and their requests listened contributes to create reciprocity and organisational commitment. This is in turn contributes to good performance in terms of utilisation of the tablet and adherence to the IMCI protocol.

The third CMO configuration can be formulated as *after creating strong consensus at all levels on the benefits of using REC (C3), sustaining the use of REC as routine practice (O3) requires introducing the notion of individual responsibility and accountability (M3).* The members of the health centre, the primary users of the REC, have the feeling of belonging to a system that is wider than their health centre and contributing to a bigger enterprise than their own district. This is the result of early and ongoing engagement with a wide range of actors ranging from national and district authorities to opinion leaders at community level (Yukl 1999). REC users feel strong and wide consensus on the necessity of testing and using REC – a unique message sent by a multiplicity of key stakeholders influencing the environment of healthcare workers. The introduction of the notion of individual accountability in public services through personal login on the software also contributed to enhance a sense of individual responsibility and contribution to the wider system.

In terms of context, availability of well-trained staff in IMCI and REC

and no disruption of availability of the tablet are considered as essential context elements in the three configurations.

## The new MRT

Our analysis identified three CMO configurations that indicate causal pathways between sets of management practices and use of REC and we modified the MRT accordingly:

*The adoption of a computer-based decision support tool by health staff at primary health care will be enhanced by having a leadership focusing on building wide consensus from surrounding stakeholders (local and national authorities) on the benefits of using such an innovation and having a wide of actors fully and truly engaged in the directions the project could take. This necessitates a system promoting flows of information between all levels of the health system where transparency of information is valued.*

*The introduction of such innovation needs to occur in an environment flexible enough to provide space to staff make decisions on the distribution of clearly-defined tasks within the team in order to better adapt their work to the new situation. On the other hand, the innovation, REC, needs to be flexible enough to take into account the constant changing policy environment and the emerging needs and requests from its users.*

*The REC is adopted when perceived by users and district managers as being encompassed within a broader quality improvement strategy where health staff is sensitised to the importance of quality and their capacity to address quality issues at their own level.*

*The introduction of the REC needs to be accompanied by a supportive atmosphere and environment*

*(including community and policy makers support), which can be translated by peer support and district authorities support, and availability of support services responding to software or hardware issues. The supportive environment is based on reciprocity and acknowledges individual contributions to the wider system. Conditions for such environment to be promoted by a leadership that creates a decentralised decision space where initiatives are respected.*

The introduction of the innovation is combined with a multiplicity of management practices including role distribution, team work, problem solving approach and task monitoring (hard) and training, supervision, support and recognition (soft).

Based on the mechanism of perceived organisational support, such combinations lead to a reorganisation of the health team and the distribution of roles before and during the consultation, and positive atmosphere that includes recognition of each team member, organisational commitment and sense of belonging. Every new comer starting in the health centre or the district are fully integrated into this new organisational culture and benefit from the same support and recognition.

Conditions for such management changes to work include open dialog at all levels of the system, a minimum of resources to cover the support services and supervision and regular discussions focusing on solving problems faced by health centre teams.

This study offers interesting insights on how the introduction of one computer-based decision support tool combined with management support practices created new work practices.

## Lessons for policy and practice

This project reinforces the point that in a successful diffusion of innovations (such as in the case of IeDA), it is necessary to combine the introduction of technology with support and management mechanisms. It also shows that in management of healthcare workers, it is important to mix different management practices. It also important to highlight that managers' attitude plays a great place in the success of the intervention: open dialog and respect are crucial dimensions. This is aligned with the findings from other studies.

Regarding the mechanisms, our findings relate to the analysis of Evans and Davis (2005) who situated the underlying mechanisms of high commitment management at the level of the internal social structure of the organisation. Such practices improve knowledge, practice and skills but also exert effects at the level of relationships between team members but also with line managers (in this case, the district health managers). Weak ties are strengthened, reciprocity is established and shared mental models contribute

to a stronger organisational culture (Granovetter 1973, Eisenberger, Hutchinson et al. 1986). Finally, a balanced management approach is costly, especially in management time (supervision, dialog, problem-solving sessions). It requires reasonable financial resources and a management capability to deal not only with administration but also with the less tangible issues of relationships, organisation culture and motivation of staff.

## Methodological lessons

We used a realist evaluation approach as we see health facilities as primarily being social entities. Pawson argues that realist evaluation is well suited to investigate change in such social system (Pawson and Tilley 1997). However, appealing as it is, realist evaluation poses a number of challenges for the researcher.

The most critical issue is the attribution paradox. In complex systems, the behaviour of people is determined by many interlinked factors. Health professionals act under influence of their professional norms, social pressure, management interventions and their intrinsic

motivation. Assessing the exact contribution of a set of management practices to overall performance is virtually impossible. What realist evaluation can do is to stimulate the researcher to describe a detailed picture of the causal web that includes the multiple determinants and to categorise these as intervention, underlying mechanism and context. In our case, we argue that open dialog, training and support services are essential, but we don't know which among these sets is the most important and in which setting.

The MRT is used in realist evaluation to clarify key findings. An MRT cannot cover all possible explanations of change. A realist evaluator does not pretend to provide the ultimate evidence that the intervention works. Rather, the MRT aims at enlightening the decision-maker, a process of utilisation of research that may be the most frequent in case of social research. In such cases, a pragmatic position should be taken whereby one tries to refine the MRT as much as practically possible with the explicit aim of providing options for improvement or scaling up rather than reaching a perfect understanding of the intervention as such.

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