

METHODOLOGY

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Configurations as a powerful analytical tool for examining global health interventions

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Abstract

In recent years, the evaluation of global health interventions has seen the concept of 'configuration' re-emerging through an approach rooted in critical realism. However, thanks to the work of Norbert Elias, this concept is longstanding and has been widely utilized in sociology. This methodological and reflective text aims to demonstrate how this concept is beneficial for examining global health interventions. After analyzing how the configuration is approached in health sociology, organizational sociology, and realist evaluation, we show its heuristic contribution through three empirical examples in global health. The text highlights the diverse uses and challenges of the configurational approach in the ongoing debate on generalization and causality in evaluating interventions.

Keywords Evaluation, Configuration, Sociology, Realism, Global health

1 Introduction

In the field of global health policy and systems research, the call for greater and more effective use of theories and conceptual frameworks seems to have been heard [1, 2]. In recent years, the concept of configuration has gained prominence in evaluation studies, particularly among scientists using case-study approaches and qualitative methods. However, this renewed use of the concept still shows significant proliferation (Fig. 1) and sometimes confusing diversity. Configuration refers to the dynamic arrangement of interconnected elements that collectively form a structured whole within a specific context. These elements can be of various natures (individual, social, institutional, etc.) and are connected by specific relationships, often shaped by the configuration's purpose or goal. Key elements of a configuration can originate from various sources, such as the literature, empirical data, or stakeholder interactions. The literature provides a theoretical or empirical foundation for identifying recognized components, while stakeholders can offer proposals based on their knowledge of the local context. These elements can be tested against new empirical data within more prospective configurations. However, configurations may also emerge entirely inductively from the empirical data collected. It is equally essential to examine and clarify the relationships among these elements and their effects through diverse methodological approaches.



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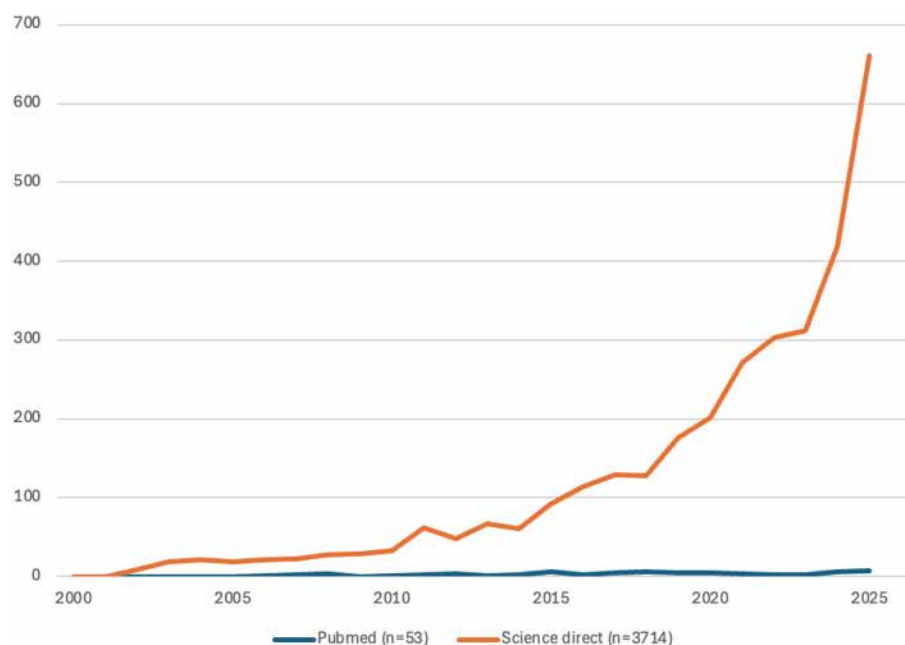


Fig. 1 number of publications using configuration-related terms in health contexts. A targeted search using keywords related to configuration and health was conducted in two databases with different disciplinary scopes, one health-focused (PubMed) and one broader, including social sciences (ScienceDirect), with terms searched in the title, abstract, and keywords. The number of publications using configuration-related terms in health contexts increased over time, with a marked rise in ScienceDirect from the mid-2010s onward

A configuration could be a heuristic concept for understanding the complexity of interactions between the dimensions of a phenomenon under study (i.e. a public health intervention). It seems that, depending on the discipline, objective or scientific background, there is still a myriad of practices whose ideal types need to be described. For example, unlike organizational studies that have abandoned the configuration concept in the last two decades after considering it essential [3], it is now widely used in evaluation. Yin [4] referenced Byrne's work [5], highlighting the value of comparing configurations to identify recurrences/patterns within a case (the term pattern is also widely used in the natural sciences). Thus, the purpose of multiple case studies is to compare, according to a systematic approach proposed by Yin [4], those configurations between different situations [6]. Ragin, a key figure in this approach, argued that "*the logic of the case study is fundamentally configurational*" [7]. According to Ragin and Amoroso (2019), configurations are "*combinations of characteristics or aspects of cases*," emphasizing the use of configurations in qualitative research to compare similarities and differences across cases [8].

Byrne's proposals [5] are part of several recently developed and still evolving evaluative approaches to analyze complex social phenomena, as the three studies discussed as examples below. The configuration serves as a heuristic tool to give meaning to the complexity that traditional evaluation approaches do not necessarily allow. In particular, the configuration enables modelling an intervention [9] or grouping a set of strategies, structures, and contexts [10]. The idea is that for the analysis of a case or the comparison between several cases using a myriad of empirical data, it is necessary to reduce its complexity by using the configurational tool: "*configurations are reflected by densely occupied regions of the data space*" [11].

In his first article in a management journal on the genesis of configurations, Miller [12] uses three terms: “*gestalts*, *archetypes*, and *configurations*”. He referred to the term *generic types* the previous year [10]. Configurations are presented as “*formal tools*” [13] useful for systematic case comparisons. The evocative, or even heuristic, power of the configurations’ visual aspect should not be overlooked [14]. They often make complexity visible, as seen in the popularity of Mintzberg’s organizational configurations (1979) and its famous graphic representations. The configurations are “*composed of tight constellations of mutually supportive elements*” [10]. They are designed as “*assemblies*” [5], as “*whole units*” [13] and “*finite in number and represent a unique, tightly integrated, and therefore relatively long-lived set of dynamics*” [15]. They represent a simplified account of a complex phenomenon, but they are not analytically simple, since the elements that compose them cannot be considered independently when explaining intervention outcomes. Therefore, using configurations shifts the analytical focus from isolated elements to their combinations and relations within a case [3].

Configurational causality views effects as resulting from specific combinations of causes. It shifts from single, independent causes to a perspective that recognizes causality as multiple and conjunctural, offering a more nuanced understanding than the successionist view [16]. Building on this, the assumption is that configurations form an inseparable whole (but only at a specific time since configurations are contingent and evolutionary) and can serve to even become causal attribute sets or configurations [17]. Therefore, causality is addressed by current proponents of comparative approaches using configurations [18]. In their view, a configuration is “*a given combination of conditions associated with a given outcome*” [13] thus approaching the old proposals in the field of evaluation concerning intervention theories [19].

The application of realism to the field of evaluation [20] brought configurations to evaluation stage, as proposed by the proponents of realist evaluation [21]. Realist evaluators used the approach in different ways [22]. Moreover, in his latest book, Pawson [23] makes relatively little use of the concept of configuration, which is not listed in the index. However, he does highlight its use in his chapter on Merton’s middle-range theory, explaining that the latter can be used to construct “*different explanatory configurations*”. This is part of continuity since linking interventions with their results is also at the heart of comparative qualitative analyses aimed at “*the establishment of ‘truth tables’ of configurations about outcomes*” [5].

A configuration guiding the analysis cannot, on its own, grasp complexity. The study of a phenomenon may require using several configurations. Miller [11] noted this analytical focus in his reflections on his first 1986 paper on the concept. He described configurations as “*complex systems of interdependency brought about by central orchestrating themes*.” Fiss and his colleagues [3] even invoked the existence of a “*configurational theory*,” noting that this would require a fundamental break with the predominant linear paradigm [24]. Unlike the contingent (reductionist) theory, this configurational theory proposes, in particular, a holistic synthesis, context-dependent configurations, and reciprocal, non-linear relationships among its attributes [25]. Mintzberg [26] also suggested a “*theory of structural configurations*”, although he referred to typology instead.

This article neither proposes a new configuration definition nor carries out a maturity analysis [27]. More modestly, it aims to illustrate the diversity of uses and the heuristic relevance in a global health context. Our aim is to clarify the use of the concept around

three examples to support researchers and evaluators who wish to engage in these approaches. We selected these three cases from our own research experiences to ensure that our reflective approach is directly rooted in our global health practices [28]. The cases were therefore selected using a heuristic approach (to demonstrate the diversity of configuration used for evaluation and causality analysis) with the aim of representing three varied areas of application related to our collaborative experiences. Furthermore, we aim to show that qualitative research can support a degree of generalisation based on original empirical data, provided it is conducted rigorously and grounded in conceptual or theoretical approaches. Our analysis is based on a global health context, but it can also be applied to other contexts. Our methodological approach is reflective and specific to population health intervention research [28]. Based on our empirical research, we describe how we have mobilized the concept to encourage collective and critical thinking for the future.

2 Configurations in the field of health sociology

The concept of configuration originated in sociology.

2.1 A historical overview of the use of configurations

Two uses of the concept are thus observable in the sociology of health. On the one hand, it is a descriptive use to describe new arrangements of social dynamics at the institutional level, and on the other hand, it is an analysis of trajectories or decisions taken relating to their health. These two uses reflect Elias' two interpretative approaches to configuration, which are considered structural and interactional, and explain the lack of standard definitions in the works [29].

In public health evaluation, Touati and Suarez-Herrera [9] argued that the sociologist Norbert Elias introduced the concept of configuration into evaluating complex interventions. However, Elias is never mentioned in reference works in the sociology of health. The few references relate instead to the process of civilization [30] to supplement analyses of medicalization or standardization [31]. One of the first authors to use the concept of configuration was the psychiatrist and psychosociologist Jacob Moreno in the 1930s. As part of the development of sociometry, he sought to establish statistics on *social configurations*, understood as individual relationships between members of the same group. The use of configurations then made it possible to distinguish the interdependent parts of the structure and the fact that the position of an element may affect the whole structure [32]. Elias deepened the configuration concept by highlighting the *chains of interdependencies* that connect individuals, groups, and institutions [30, 33]. Although he did not clearly define the concept, he referred to “*the structure of dependency relationships, which can be assimilated to a balance of tensions, between the parts (groups or individuals) of a group*” [29]. Elias also introduced the concept of “*figuration*” (in English and German), which is defined as a “*changing pattern*” [33]. The use of “figuration” and “configuration” reflects a terminological variation rather than a conceptual distinction. Both refer to Elias' notion of dynamic interdependencies that move beyond the individual–society divide [34].

This perspective aims to objectivize interdependencies between and within groups [36]. The processual approach restored the historical dimension dear to Elias, enabling the accounting for the dynamics of interdependencies. The concept extended that of

“*schimogenesis*” developed by Bateson [37] to describe a process of relational differentiation between two groups and dynamics of Goffman’s interaction [38]. A few works referred to interdependence relationships to objectivize power dynamics and the emergence of unintended effects in community health promotion interventions [39]. It has also been applied to care configurations in situations of dependency [40]. It enabled distinguishing between the dependent person’s decision-making and guidance processes. In school settings, the concept has been mobilised to analyse care trajectories of children with mental health problems [41]. It contributed to efforts to model psychological disorders in schools using the configuration concept and the theoretical model “Durkheim-Mauss-Halbwachs” (“DMH”) [42]. This model enabled going beyond the social construction of illness to show how certain mental disorders emerge at a given social and historical moment. This perspective converges with broader sociological analyses of the historical formation of psychiatric categories [43].

While systems theory [44], network analysis [45] and assemblage theory [46] also address relational dynamics, the concept of configuration should be understood as a complementary analytical lens. Whereas systems approaches describe stabilised arrangements and networks map relational structures, configuration, rooted in Elias’ processual sociology, foregrounds shifting balances of tension and evolving chains of interdependence. Its heuristic value is particularly salient in contexts of instability or social change. As such, it provides a relational concept suited to analysing complex health phenomena at the intersection of institutional arrangements, social trajectories and power dynamics.

2.2 Configurations for analyzing mental health in extreme temperatures

We explored the links between climate change and mental health in two vulnerable communities in Bangladesh: (i) a slum in the capital (Dhaka), and (ii) a village, in the Satkhira district, located in the south-west of the country exposed to both extreme climatic events (cyclones, floods, extreme temperatures) and slow transformations (water and soil salinization, sea level rise, temperature rise, drought) [47]. A longitudinal survey conducted on three occasions (2022–2023) allowed us to differentiate between environmental conditions: during the hot season, after the monsoon, and during the rainy season. The three studies were conducted among the same 15 households at each site. We used the reflective ethnography method, which aims to investigate and triangulate the data with an inter-knowledge medium and then be able to analyze the effects of the investigator-investigated relationships on the shaping of the data. We used three data collection techniques: observation, in-depth interviews, and focus groups. In total, we conducted 89 interviews and six focus groups and wrote nearly 300 pages of field notebooks with colleagues at Brac University.

We sought to analyze and classify the different psychic trajectories during the data analysis. The existing epidemiological frameworks that examine the effects of climate change on mental health are static models that describe the direct (psychotrauma, stress during the occurrence of an extreme climatic event) and indirect (anxiety, depression) impacts [48]. They fail to explain the conditions for the emergence of psychological difficulties or to account for the causal pathways between environmental exposure and mental disorders. We then used the Durkheim-Mauss-Halbwachs (“DMH”) model, developed by Florence Weber [42], which summarizes a sociogenesis of mental disorders

based on typical configurations, which are extreme situations likely to emerge during periods of significant upheaval. The model develops a matrix with four configurations according to two social dimensions: (i) social regulation, understood as the internalization of the moral constraints of the group to which the person belongs, and (ii) social integration corresponds to the degree of integration of an individual or group with the rest of society. The model highlights four situations with excess or lack of regulation and social integration (Table 1). We applied the DMH model since these two fragile communities are facing a double change: economic (transition of low- to middle-income countries with the emergence of a middle class and economic solid inequalities) and environmental (acceleration of the ecological crisis for the rural area and environmental solid vulnerabilities in the slum linked to the topography of places and habitat).

The slum is an informal habitat that has developed for 25 years. It is in the heart of the capital and is surrounded by a water channel, the most fragile habitat in which we conducted our survey. The village has about 20,000 residents. The rural community lives mainly from agriculture (small-scale production), aquaculture (shrimp farming) and seasonal employment for men who migrate to the surrounding area. Yields are affected by climatic variation, and a very strong alternation between drought, floods, and strong winds undermines anticipatory strategies. The rural area studied appears, for a large part of the inhabitants, to be a pocket of hypo-integration of the rest of society.

The case is defined as the minimum unit of analysis: the person being investigated. Analyzing the cases makes it possible to highlight the regularities in psychological suffering that can be grouped into the four biopsychosocial configurations (Table 1).

In our study, the configuration is defined as the set of interdependencies between the person in a situation of psychological suffering and his family (or household, i.e. including remotely) and professional environment as well as his biophysical environment (obstacle or discomfort and opportunity), at a given period. In rural settings, environmental opportunities can suddenly collapse into constraints through resource scarcity, particularly in the context of climate change, whereas economic opportunities in slums often operate as constraints by trapping individual in precarity and harsh living conditions. But in both situations, there are biophysical and social dangers. Finally, the configuration is indexed to a given period and is provisional. Configurations – understood both as analytical concept and as social reality – are the level at which psychic suffering is generated. Accordingly, individual-level analysis is structured around trajectories, broken down into periods of routine without difficulty and periods of crisis [49].

In a hypo-integration situation, two configurations are associated with a regulatory failure caused by extreme climatic events (configuration 1) or hyper-regulation caused by environmental transformations that impact livelihoods (configuration 2). The situation of hypo-integration and hypo-regulation (configuration 1) is encountered in cases of silent forms of depression, where during the occurrence of extreme temperatures for mothers who take care of their children alone on too hot nights and who are agitated

Table 1 Configurations of the DMH model applied to the environmental crisis

	Lack of integration	Excessive integration
Lack of regulation	Configuration 1 (isolation situation and lack of regulation); e.g.: extreme heat	Configuration 3 (objective integration situation with no regulation); e.g.: addiction
Excessive regulation	Configuration 2 (hypo-integration pocket with hyper-regulation); ex: over-indebtedness	Configuration 4 (objective integration situation with expected regulation); e.g.: situational anger

during the day due to lack of sleep. The lack of regulation is then linked to the lack of mechanisms the group or society puts in place to regulate behaviours in such extreme conditions. On the other hand, when temperatures become physically tolerable again, the disturbances subside, and mothers and children leave this configuration to return to a normal situation. The hypo-integration and hyper-integration (configuration 2) can be found again when the fall in agricultural yields, linked to climate change, impacts the livelihoods of families who use loans from NGOs or their networks to feed children and are over-indebted. Configuration 3 describes a situation of integration with a lack of regulation encountered by the men of the slum facing the economic inequalities of the capital. Finally, situation four is experienced by some members of communities with a high social position who need more institutional recognition of the environmental and health situation of members of the community.

In this field, the concept of *configuration* is particularly useful for capturing the dynamic nature of mental health outcomes, while making visible the social mechanisms shaping individual trajectories.

3 Configurations in the field of the sociology of organizations

In the sociology of organizations, configurations occupy a vital place.

3.1 A historical overview of the use of configurations

Configurations have historically been used to examine how different factors (such as organization size, management strategies, organizational cultures, etc.) influence organizations' performance and functioning. The aim was to understand the complexity of organizational structures, decision-making processes, and individual and collective behaviours within companies or other organizations.

The concept of "configuration" is one of the central ideas of organizational studies, the origin of which must perhaps be traced back to Weber. Echoing Miller's comments in 1996, Short and his colleagues [50] claimed that writings on configurations remained underdeveloped. After a few decades of being sidelined, it seems that the configurational approach is resurfacing in the study of organizations, as evidenced by the book by Fiss et al. [3]. However, the classic works of the two leading authors in the European sociology of organizations, such as Crozier and Friedberg, never mention the concept of configuration [51, 52]. Studies on organizational configurations have been described as various names: typologies, *gestalts*, generic strategies, modes, archetypes, strategic groups, strategic scope groups, competitive groups, taxonomies. Profusion is undoubtedly the origin of the weak development of reflections on using organizational configurations, understood as a "*cover term*" [50]. Fiss [24] explained the importance of studying organizations as a whole, taking into account systemic issues, but recalling what we mentioned in the introduction, namely the importance of accounting for pattern recurrences rather than individual variables that explain particular results.

At a unique forum on configuration organized in the USA, Meyer et al. [25] defined organizational configurations as any "*multidimensional constellation of conceptually distinct characteristics that commonly occur together*." However, as Dess et al. and our empirical examples will also explain, configurations can be presented according to conceptually anchored typologies or taxonomies grounded in empirical data. Miller [11] also proposed a third approach (configuration as quality) without much clarity.

Finally, it is impossible to evoke the concept of configuration in the study of organizations without recalling its use by Mintzberg, who thus positions himself in the “*school of configuration*” [53], even if his latest work no longer seemed to call for it [54]. Indeed, in his famous (and discussed) [55] work on the structure of organizations, he proposed a typology of organizations around five structural or “*natural cluster*” configurations. Mintzberg [26] recently transformed it into seven [54]. Each configuration is an ideal type, a “*theoretically consistent combination of the contingency and design parameters*.” He presented the configurations as five forces (seven in 2023) that push organizations to fit into five different structures. For these configurations, and therefore these organizations, to be effective, he proposed a configurational hypothesis based on the internal coherence of the dimensions and its adaptation to the context.

3.2 Configurations to study the resilience of hospitals

As the COVID-19 outbreak became a pandemic in early 2020, hospitals worldwide faced more patients. Yet, in most countries, despite a historic hospital-centrism, these hospitals were previously weakened by neoliberal reforms, reducing their capacity to act, increasing their debts and adding a financial burden to patients. In France, for example, the pandemic came at a time when a social movement and strikes were being organized to combat these reforms; we were at the heart of an organizational crisis, analyzing the sociologists of the organizations [56]. In Brazil, neoliberal reforms across all sectors were underway, and the president’s mistrust of the scientific community was significant. The COVID-19 pandemic was therefore part of a context of polycrises [57]. In this context, we organized a series of studies in several countries to better understand how some hospitals were coping [58] with the pandemic.

The methodological strategy used was a study of multiple cases where the cases were hospitals. Qualitative data was collected over several months and during several pandemic phases. In total, hundreds of interviews were available, and beyond the intra-case analyses, the question of inter-case analyses quickly arose. How can we compare hospital situations across contexts that differ significantly using an interdisciplinary approach? Indeed, this research program has been built with colleagues from several countries and various disciplines: public health, epidemiology, anthropology, sociology, public policy, and psychology. Not all were used to interdisciplinary collaboration, the case study approach or the use of a conceptual framework. Thus, using the configurational tool was central to the analysis process within each case and, if not above all, to the comparison between cases to support the process of analytical generalization.

As a first step, it was essential to reach consensus within this interdisciplinary team on the relevance of the configuration concept and on how to represent it conceptually and empirically. Those accustomed to working only empirically and inductively initially expressed reluctance, fearing the binding nature of the approach and its tendency to close. However, they also recognized the need to compare international and comparative research situations. In each country, the teams had to register their analysis according to this configurational approach but needed to allow themselves to do it. Only inductive or epidemiological studies were conducted within the program, allowing everyone to find their place from a pragmatic perspective without hindering collective work. This has not stopped some social scientists from wanting to go it alone, at the risk of discrediting the collective for the sole benefit of the individual.

As a second step, a collective effort was undertaken to agree on the study's conceptual framework in line with the protocol. It was necessary to decide how the framework could guide the proposal for a generic configuration that would serve as an analytical lens in each case studied. Thus, the elements that make up the configuration and whose interactions are part of the original conceptual framework are (i) the context of the hospital and the country; ii) the effects (positive or negative) of the pandemic on organizational routines; iii) the strategies implemented within the hospital to deal with these effects; and iv) the perception of the impacts (positive or negative) of these strategies on routines [59].

The relative simplicity of the configurational tool made it possible to organize empirical data and to identify positive or negative effects to avoid the naivety of necessarily positive resilience [60]. Teams could empirically report on as many configurations as they thought applicable depending on their specific context and the emergence of relevant data. To facilitate international comparison, we decided that these configurations should be part of a relatively limited number of themes (like so many configurations) (e.g. governance, planning, finance, etc.) and associated with the dimensions most often studied in analyses of the resilience of health systems, as noted by a conceptual analysis previously carried out [61]. Thus, each team identified between 4 and 19 different configurations.

In a third step, we collectively identified four most familiar configurations to the five countries and seven hospitals to facilitate case comparison. Each element of these configurations served as a thematic code for deductive qualitative analyses. Additionally, these configurations have been reported as a table or schema and a "Research Snapshot" standard sheet to facilitate analytical comparison and the dissemination and sharing of knowledge. They were mobilized during workshops to discuss the results among research teams and hospital professionals, showing that the configurational tool is a heuristic, not only in its analytical dimension but also in its knowledge transfer dimension [62].

In Canada, one study examined an integrated health centre (health and social services) comprising several health facilities, including a large hospital and six long-term hospital centres [63]. The context is a highly centralized mode of governance ahead of recurrent and long-standing budget cuts and ongoing staff recruitment challenges. When the pandemic began, the contamination risk management configuration led staff to fear infection. It also confirms the need for additional staff and a larger budget for the Infection Control and Prevention Service. One action strategy was to create an on-site laboratory for high-capacity screening. Local governance was strengthened. Numerous training courses on managing infectious risks were conducted, and more than 100 specialist coaches were employed. The logistics department was innovative and responsive. All this action strengthened the Centre's power to act and its ability to reduce staff risks. It led to a better recognition of the risk management team, which has demonstrated its ability to act diplomatically.

4 Configurations in the field of realist evaluation

The configuration concept also plays a central role in the realist approach to program evaluation.

4.1 A historical overview of the use of configurations

The ontological and epistemological reflections developed by the author of critical realism, Roy Bhaskar (1975), paved the way for the development of the realist approach in the field of evaluation, initially supported by Pawson & Tilley (1997). Proponents of critical realism postulate that reality is inherently complex, consisting of structures, powers, or mechanisms that, though invisible, produce tangible effects. The objective of scientific discovery is then to make statements “*about the way things act in the world*” [64]; that is, to formulate theories aimed at elucidating the existence and functioning of these mechanisms. Thus, this approach encompasses both the inherent complexity of the social world and familiarity with configurational approaches, and the same objective: to discover the regularities or recurrences of social phenomena.

In realist evaluation, the concept of configuration becomes essential. Configurations are theory. Their use is well-framed, as it invariably consists of at least three crucial elements: contexts (C), mechanisms (M), and outcomes (O). However, their application has often been adapted or extended to incorporate additional analytical elements or alternative causal configuration variants, depending on the evaluative purpose [22]. The founding authors of this approach chose these elements for their ability to represent “*any program or indeed any social process*” because they allow “*simplifying all processes down to an essential core of attributes*.” [65] This combination of elements is described as an “*explanatory formula, a conceptual matrix*” [65] or a “*metaphorical device*” [66].

At the outset of a realist inquiry, configurations are formulated as hypotheses derived from the program theory, understood as the set of beliefs or assumptions underlying a program’s activities. A realist analysis aims to test and refine these configurational hypotheses, comparing them with empirical data and the scientific literature. Realist researchers use configurations of different levels of abstraction. From empirical data, a multitude of specific configurations emerge. The rise in abstraction is achieved through the identification of recurring mechanisms and configurational patterns, which enables the construction of a middle-range theory [67] in a continuously evolving configurational form.

Realist configurations must not become unconfigured by turning into *CMO catalogues* [68]. Indeed, configurations are assumed to “*set out the causal links*” [22]. Thus, it is not simply describing the contexts, mechanisms, and outcomes but interconnecting them to explain how they are generated. The realist evaluation is based on the principles of generative rather than successional causality, which is reflected in the way the configurations are designed:

We are not coming up with variables or correlates which associate one with the other; instead, we are trying to explain how the association itself comes about. Thus, the generative mechanisms constitute the regularity; they are the regularity [65].

4.2 Configurations for studying the use of medical technological innovation

Deaths of children under the age of five still represent a considerable burden, especially for those born in sub-Saharan Africa. Among the leading causes of death are contagious and infectious diseases, such as pneumonia or other respiratory tract infections [69]. Initiatives such as implementing the Integrated Management of Childhood Illnesses (IMCI) guidelines have been launched to improve the care of these children. IMCI is a set of clinical guidelines designed to prevent and treat the leading causes of severe diseases

in children, adapted to healthcare facilities with limited diagnostic capacities. Although some countries have shown encouraging results, the lack of diagnostic tools remains a significant challenge for identifying specific symptoms. Hypoxemia, a decrease in the blood's oxygen concentration, indicates the severity of many diseases. It is directly associated with the mortality rate [70], but it isn't easy to diagnose based on clinical signs. For example, using tools to measure blood oxygen saturation, such as pulse oximeters (POs), has long been recommended. However, they are not widespread in low-income countries, including West Africa.

The AIRE project (Improving the Identification of Respiratory Distress in Children) was launched in this context. Its objective was to improve the diagnostic capabilities of hypoxemic cases by making OPs available for routine use during IMCI consultations from the first level of the health pyramid. The project was deployed in two districts of Burkina Faso, Guinea, Mali and Niger, covering a total of 202 Primary Health Centres (PHCs). Several research questions have emerged regarding the fate of children, the cost of care, and the community's acceptability of the device [71]. Here, we will focus our reflection on the realist evaluation whose results are presented elsewhere <https://doi.org/10.1136/bmjgh-2024-017303>.

We focused our realist research on two main outcomes of the intervention: health workers' use and adoption of the PO. These outcomes were placed at the centre of the analysis and the construction of the configurations. We considered use an act that could be anecdotal, mechanical, non-permanent, coerced, or a first step. In contrast, adoption is the voluntary and sustainable integration of PO into clinical organizational routines. We then investigated the different mechanisms and contexts that could explain the emergence of one of these outcomes. Our research team organized a discussion session with NGO teams implementing the project in each country to develop our hypotheses. The aim was to reconstruct the various elements that, in their view, could explain the use and adoption of the PO. The teams relied on the ideas underlying the project's initial design (program theory) and on their initial observations and field feedback, given that the project had already been launched for a few months. Additionally, we have enriched these hypotheses with other elements from the scientific literature, including an article by Graham et al. [72] that presents the results, in the form of configurations, of a realist evaluation of the introduction of POs at the hospital level in Nigeria. We then formulated the hypotheses using a list of ICAMO configurations (intervention, context, actors, mechanisms, outcomes). We then systematically tested them using the empirical data collected in the four countries. These data were collected through semi-structured interviews with health workers in the PHCs at two separate times: approximately six months after the introduction of the PO (November–December 2021) and just after the end of the operational activities of the project (October–November 2022). Sixteen PHCs (four per country) were selected as research sites, each a case study. In total, more than 100 interviews were conducted.

Realist configurations consist of arrangements among one or more contexts (C), mechanisms (M), and outcomes (O). Mechanisms are at the heart of realist theory, constituting the central element that triggers the outcomes and, therefore, binds the different elements together [73]. For our study, we opted for configurational analysis using the ICAMO model [74]. Adding the "I" (Intervention) to the configuration encourages the description of the intervention and distinguishes it from the context. At the same time,

the integration of the “A” (Actor) aims to identify the different groups of subjects targeted by the intervention and to assess how they react to it. We included an intervention element as the project involved multiple activities at the PHC level, and it was essential to distinguish which specific activity triggered the mechanisms.

The configurations are dynamic, representing this dynamism in multiple ways as part of a realist assessment. The importance of the context first highlights the contingency of the configurations [75]. Moreover, this approach integrates feedback loops into the analysis, emphasizing that the configurations are not linear but interconnected and can generate each other. Thus, an outcome in one configuration can become a context in another. For instance, in our case, the adoption of the PO presupposes its use, implying that the explanation of the adoption is based first on that of the use.

Our analysis revealed a set of specific configurations. New configurations emerging from the field were added to the initial hypotheses. Comparisons were made between the four PHCs of the same country and between the different countries to identify regularities. We identified several cross-cutting configurations, the various elements of which were found between the PHCs and between countries, which allowed us to achieve a higher level of abstraction. Here is a simplified example of two configurations:

- *Configuration 1: In a context where PO is not part of the standard diagnostic tools (C), training on PO (I) enables health workers (A) to become aware of its usefulness in saving lives (M), thereby promoting its use (O).*
- *Configuration 2: When health workers using PO (A) can directly observe the usefulness of their diagnosis on children in care (C), in particular when oxygen therapy is available at the PHC (Ca) or when referencing has been facilitated and has improved the health of the child (Cb); they are aware that the PO is indeed helping to improve care (M1) and feel relieved that they have been able to take care of the need (M2), which encourages its adoption (O).*

The first configuration is directly linked to one aspect of the intervention: training health workers in using the PO. It is important to note that this awareness induced by the training is triggered only among the trained staff, which may not apply to all staff in the project. However, this awareness can be temporary if the concrete benefits of the device are not reinforced. Unfortunately, this is not always possible, as treatment for hypoxemia is mostly only available at the hospital level. In addition, transport to the hospital is often complicated due to the need for ambulances available. Thus, in the PHCs where staff can observe the usefulness of the PO (which presupposes that they use it, the effect of configuration one thus becomes a context of configuration 2), whether in the case of Ca or Cb, the trained staff confirm in practice the usefulness of the PO, and those who had not been trained but were using the PO for other reasons (configurations not shown here) are becoming aware of its usefulness. This mechanism triggers a more sustainable effect and encourages long-term voluntary use of the PO when contexts allow these benefits to be observed.

5 Discussion

Throughout this paper, we have presented three examples illustrating the use of configurations to strengthen evaluation and gain deeper insights into outcomes. By examining how specific combinations of elements interact, these examples demonstrate the

potential of the configurational approach to unravel the complexity inherent in health systems. Additionally, we have shown how configurations are applied can vary depending on the research approaches.

The issue of extrapolating results (applicability, transferability, external validity) from configurational analyses is particularly acute in evaluation, particularly when using the methodological strategy of multiple case studies. Without revisiting the old debates between positivists and constructivists on the notion of external validity and generalizability, it is undoubtedly helpful to recall the recommendations of Yin (2012) and Ragin [76] on this subject. Yin proposed to analyze another type of generalization, which he calls analytical generalization, which “depends on using a study’s theoretical framework to establish a logic that might apply to other situations” [77]. In qualitative research, there is no longer really any debate on this subject; the consensus has long been established. It is not a question of venturing into a statistical generalization, thus extending the results to the whole population based on a statistically representative sample, but instead of seeking an analytical generalization which proposes “applied to wider theory based on how selected cases ‘fit’ with general constructs” [78]. This paper’s empirical cases used the configurational tool in various contexts and from specific theories and conceptual frameworks, including from sociology. Their application in different contexts or their uncovering in different environments confirms the relevance of using the configuration to support the analytical generalization process. Our examples could also be useful from a pedagogical perspective, both for teaching students and for explaining the evaluation process to those requesting such studies.

The configurational approach makes distinct and significant contributions to the design, evaluation, and decision-making processes in global health programs. For program design, it provides a framework to anticipate the conditions that may favor or hinder the success of an intervention and to adapt it by considering the combinations of factors required to achieve the intended objectives. By analyzing interactions between contextual, social, institutional, or technical elements, it supports the development of interventions better tailored to local dynamics while accounting for the diversity of contexts and stakeholders. For evaluation, configurations enable the capture of the complexity of interactions among various factors, offering a more refined and dynamic analysis of the conditions that led to the success or failure of an intervention. This approach highlights the key elements that influence outcomes, providing actionable, transferable insights. Regarding decision-making, configurations contribute to the accumulation and transfer of knowledge by enabling the synthesis and systematization of lessons learned from evaluations. By structuring this knowledge in a configurational format, they facilitate the capitalization on past experiences and their dissemination to researchers, policymakers, and practitioners, thereby strengthening the adaptability of policies and interventions across diverse contexts.

Following Yin’s advice, which calls, first, and for each case, to show the “*relationships between a particular set of concepts, theoretical constructs, or sequence of events*” and, second, to apply “*the same theoretical propositions to implicate other situations, outside the completed case study, where similar concepts, constructs, or sequences might be relevant*” [77]. In other words, finding similar configurations across different sites, yet grounded in an identical conceptual framework, lends the latter a certain construct validity. This was proposed by Sarah Curtis and her colleagues [78] in line with Miles

and Huberman: “the implications are that theory will drive the selection of these cases, and also that the careful examination of the cases may lead to elaboration or reformulation of theory.” This is similar to Gerring’s view [79] that generalizability involves “jettisoning the case study framework for a large-C framework.” In the context “flexible design”, Robson [80] explained it very well, and it echoes our studies in the health field, that in “realist terms, the study may provide convincing evidence for a set of mechanisms and the contexts in which they operate generalizable from, say, the particular intensive care unit studies to many other units.”

However, we are not faced with immutable laws that repeat these configurations infinitely and systematically. Indeed:

We cannot generate nomothetic laws that are always and everywhere applicable in the social sciences. No method can construct theories with that character. However, comparative case-based methods enable us to give accounts with more than a unique ideographic range, and individual case studies can contribute to this. The scoping requirement is to carefully consider the limitations of our knowledge claims in time and space [81].

We find the classic distinction between etic/emic or deductive/inductive; the combination of the two is possible but not explained by these authors. This distinction is close to that between “centred configurations” constructed from empirical data and “abstract configurations” proposed by more general theories [65]. Nevertheless, our examples shows that the back-and-forth between hypothetico-deductive and inductive processes can be fruitful when using the configurational tool.

To compare uses, we sought to understand when we used the configuration concept in the study. Two moments stand out. On the one hand, the initial phase of the research during the formulation of hypotheses (realist evaluation or sociology of organizations) with an evaluative aim of the process studied, and, on the other hand, during the analysis, the configuration then appears because of the research (health sociology). In the case of the sociology of health, it represents a result emerging from the analysis (inductive moment). Then, using a model makes it possible to generalize the configurations uncovered (hypothetico-deductive moment). In the sociology of organizations and realist evaluation, the dominant is hypothetico-deductive since the configuration is associated with a conceptual model or a theory of intervention to analyze the situations, which makes it possible to define specific configurations adapted to the context (deductive moment). Table 2 compares the different dimensions and uses of the concept of configuration described by Elias, comparing it with the applications from the three fields presented. It shows how configurations are mobilised across different disciplinary traditions to analyse dynamic interdependencies, trajectories, and outcomes. The comparison highlights that configurations may operate at multiple analytical scales – from individual trajectories to organisational routines and intervention outcomes – while supporting different forms of analytical generalisation.

The strength of using the configurational tool in these different approaches is the inter-study comparability and its adaptation to the specific context. In this sense, it strengthens the external validity of qualitative studies [6]. The main difference with Elias [33] concerns the historical and processual approach, which is difficult to find in an ongoing process analysis, as we have done in our three studies. Finally, using the configurational tool for evaluation offers a contextualized approach, going beyond generic models. Rather than a rigid framework, the configurations enable the study of each situation’s

Table 2 Comparison of three examples of the use of the configurational approach

	Sociology health	Sociology of organizations	Realist evaluation
Study context	Environmental disruptions and mental health	Hospital Resilience and Pandemic	Medical technological innovation
Setting the configuration	Configuration type = person + personal and institutional environment + biophysical environment, indexed at a given point in the trajectory	Organizational configuration = hospital and country context + effects (positive or negative) of the pandemic on routines + hospital strategies + perception of the impacts of these strategies on routines	Realist configuration = arrangements between one or more interventions (I), contexts (C), actors (A), mechanisms (M), and outcomes (O)
Model used	DMH model of mental disorders	Organizational model	ICAMO model
Methodology	Ethnographic (interviews, focus groups and observations)	Multiple case studies (cases = hospitals), qualitative survey and conceptual framework	Intervention theory, theoretical hypotheses and configurational analysis with qualitative investigation
Analytical approach	Inductive then deductive for generalization with round trips	Deductive and round trip for generalization	Abductive and retroductive
Central dimension(s)	Social integration and regulation	Context, effects, strategies, impacts	Context, mechanisms, outcomes
Interdependence	Between the different actors and the environment	Between context, effects, and strategies	Between interventions (I), contexts (C), actors (A), mechanisms (M), and outcomes (O)
Analytical scale	Between different groups of individuals	Intra-case and inter-case analysis International organizations	Intra and inter-cases comparison
Generalization process	Case (inductive) -> configurations -> 4 DMH configurations (round trip)	Basic configuration -> Case (inductive) -> generic configurations (hypothetico-deductive) -> 4 recurring configurations	Theoretical generalization through the formulation of a middle-range theory
Degree of complexity and level of analysis	2 levels: - n cas - 4 DMH configurations	2 levels: - n configurations - 4 recurring configurations	3 levels: - n specific config - n semi-regularities - 1 MRT
Uses	- Analysis of the links between mental health and climate change - Comparison of the field of mental health by context	- Analysis of hospital resilience - Inter-country comparison	- Evaluation of the effects of the intervention - Configurations are the theory and serve for the accumulation and transfer of knowledge

complexity and dynamics by adapting to its context. They allow a heuristic choice of the dimensions of the most relevant configurations that reflect the world's complexity in real situations. The configuration tool is also of significant interest for operationalizing actions in the field. Indeed, identifying the configurations specific to each context and highlighting the underlying mechanisms (for Realist approach) makes it easier to define targeted interventions adapted to local realities. This approach is the heart of the realist evaluation for better operationalization [65]. Conceptual maturity is linked to highlighting recurring themes and transversal or specific configurations. The central concept of interdependence, developed by Elias [33], is evident across our three fields of study. Not only for descriptive use, but also for understanding causality in complex processes such as the shaping of mental health in the context of climate change, the resilience of hospitals during a pandemic, or the effects of technological innovation in hospitals. Causality is no longer considered a linear relationship but a complex process where the

mechanisms vary according to the contextual elements involved [23]. The configuration is an attempt to reduce the data by restoring positions within a dynamic structure that reflects the dimensions of the phenomenon studied. It is the different elements and their internal relationships, which are concisely depicted in a configuration, that push individuals to extreme and psychological suffering; it is the hospital contexts, for example, of training and the modalities of adoption of a clinical intervention, that produce effects on the reduction of infant mortality. Similarly, communication strategies reduce patients' isolation in a pandemic context but can have adverse effects on professionals.

6 Conclusion

We used the configuration concept in different domains and contexts, focusing on external validity and transferability. The individuals involved with the configurations will ultimately be able to state that they use them to describe their reality. The objective of this article was to show that qualitative approaches, rigorous and grounded in relevant theoretical or conceptual frameworks, can increase the generality of empirical results. While the proponents of realism have allowed a certain renewal of these approaches in the field of evaluation [20], other configurational approaches could also be fruitful for ongoing reflections and debates on generalization and causality—recurrent, if not permanent, reflections!

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Author contributions

This is a collaborative article between the four authors. VR coordinated the writing of the entire article. SL wrote the section on the realist approach, JMG and JS wrote the section on sociology, and VR wrote the section on hospitals. All authors contributed to the entire article.

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Data availability

All the data used in this article are presented in the text.

Declarations

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This is a reflexive article between the 4 authors for which no ethical approval is required.

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