# Chapter 6: "Anatomy" of Public Health: Indicators and Self-Reference

## Introduction

We may say that public health "feelings and intuitions", understood as an orientation towards the health of populations, can be traced back to the Greeks and even earlier. We can find ancient views that seasons, miasmas, emanations from swamps, stagnant waters, human waste not properly disposed of, for example, could have negative effects on people's health. The environment was thus long ago recognized as important for the health of populations.

Habits of hygiene, such as regular bathing in clean water and good cleaning practices, were important for healthy lives. Fresh and good-quality food was also seen as important. The links between health, behavioural and environmental factors have thus been imprinted in the minds of many cultures for centuries. In one way or another, all societies, even the most primitive ones, adopted and valued principles for obtaining and keeping good health. Good health is of high value. We are not saying anything new here, are we?

Fast-forwarding, by the second half of the eighteenth century, with, if not abundant, the already well-established presence of doctors in European societies, the relevance of environmental and behavioural factors (including hygiene) for the health of individuals and populations were seen in a different light. Doctors now could study and identify the possible problems related to those factors. Medicine was gaining the position of having voice on those matters – a voice the governments of the time

listened to, and perhaps accepted the advice. The convergence of medical attention and the interest of those in power were amplified as societies faced devastating epidemics. Besides that, armies had to be kept in good health and fighting order, and cities needed to be places of reasonable living conditions.

Meanwhile, however, medicine and its rather "enigmatic" language of organs, tissues, humours, normality, abnormality, and so on, became increasingly distant from the conversations politicians and city managers were having. They could nevertheless learn more about health risks and how to protect populations. In this case, the actions to be carried out were mostly outside the realm of medical acts concerned with sick individuals. It was easier for politicians to recognize the value of improvements in cities' dwellings, for instance.

Furthermore, even appreciating the medical profession as of public interest, and the need for regulating their training and licensing, the benefits medical professionals could bring for the political powers depended on the numbers and distribution of professionals in the territory, regardless of the effectiveness of treatment those professionals were delivering (which we now know was low).

Medicine thus entered into public decision-makers "Seeing like a State".[1] But with medicine developing so that only doctors could understand what doctors were talking about, and public powers unable to make decisions on matters of the body – constitution, anatomy, physiology and other bodily functions – medicine remained excluded from the "Seeing like a State" endeavour, confined within the space of meanings it had developed for itself.

The potential social fruits of medical practices could be incorporated into the thinking of political systems, as long as it could be incorporated

1 *Seeing Like a State* is a book written by the anthropologist James Scott (1999). He was not influenced by the Social System Theory and does not refer to it in his studies. However, his book, critical of public initiatives' lack of consideration of local diversity, sheds interesting light on the processes, development and outcomes of public sector initiatives. His work does not focus on health topics though.

into the schemes of public administration. So they did. The political systems recognized the need for politicians to have closer links to medical practitioners so that they could discuss and reach agreements. Public health was therefore born out of: (1) the necessity for medical professionals to find a way of dealing with politics, to protect themselves from nasty surprises and threats from that direction; (2) the necessity for political systems to use, appropriate and capitalize on the prestige and social recognition of doctors (even if the outcome of interventions were still not convincing), and in the process implement intentions to improve life conditions for everyone in the society. The picture can thus be summarized as follows: politicians and doctors had a lot to talk about, but they needed intermediaries who could translate their different languages into something both could recognize. Public health found its place then; where it still is.

Fast-forwarding again, we can now move to the present context where public health is established in key departments in any Ministry of Health, any Faculty of Medicine, and any university around the globe. It also is at the heart of major international players like the World Health Organization (WHO), the United Nations Children's Fund (UNICEF), the United Nations Population Fund (UNFPA), Joint United Nations Programme on HIV and AIDS (UNAIDS). It conquered spaces in development agencies and multilateral banks providing support throughout the developing world. Public health has also found a solid position across non-governmental organizations orientated towards health and related topics.

Public health has acquired a characteristic language that can be understood all over the world. That language, we can say, has become universal. Any public health professional from anywhere in the world would be able to talk to any other and reach a good deal of understanding based on the terms they can deploy in those conversations. In this language a particular vocabulary is at the centre of communications; we are talking about health indicators.

This chapter is dedicated to discussing and reflecting on the health indicators and addressing them from the Social System Theory perspective, according to which we can say that indicators are instrumental for

the creation of public health self-reference as well as the self-reference of the health systems where the health indicators are communicated. In the sections to come we will dive into the health indicators and their utilization. We call this chapter "'Anatomy' of Public Health" having in mind that indicators indeed show the "spine", "muscles" and "tissues" of the health of the public.

## The form of problem

The Health System Performance Assessment (HSPA) framework, published by WHO in 2022, advocates the notion that health systems have four functions: resource generation, governance, service delivery and financing. The service delivery function is further divided into three broad sub-functions: public health, primary care and specialist care. In particular, public health is acknowledged for having diverse definitions and complex conceptualizations due to the possibility of including (or excluding) a large number of activities and fields of concern and expertise.

We adopt instead the brief definition as described in previous chapters where public health is essentially defined as working with the binary distinction of *at risk/not at risk*, attributable to any given collectivity in relation to health and health services. Risk is measurable and attributed to an identified collectivity, which is denominated as *exposed* to (or affected by, or subject to) health risk factors of some type or recognizable determinants of ill health or constraints in the provision of healthcare. Obviously public health communications find connectivity on the *at-risk* side of the distinction, whereby all communications are concerned with prevention and preventive measures. Populations deemed *not at risk* are not of much interest for public health interventions, except in few cases where the aim is to keep the collective in the *not-at-risk* position. In this sense, and we will address this in more depth later in this chapter, all public health indicators become instrumental and orientated to distinguish the *at-risk* segments in the population. Particularly in the concluding remarks of this chapter we have an important discussion about the concept of *risk*.

In the conceptualization presented in the introduction of the book, as opposed to public health and its collective focus, health service delivery concentrates on the individual patient, the object of attention (observed, diagnosed and treated) about which the health service delivery sub-system – that is, medicine – in the broad sense we adopted, deploys its basic binary distinction *healthy/sick* and all range of unfolding codes applied to the individual considered sick (the connective side of the distinction).

Recalling what was previously said; we call medicine "health service delivery", seeing medicine as the broader category of healthcare for individuals, even when there are concerns encompassing other individuals or communities regarding the disease factor faced by the individuals. In this sense, we can say that vaccination of a child is a medical concern when the general health status of the individual child is assessed and the condition for receiving the vaccine or not is evaluated together with possible risks of reactions and side effects. However, as a programme, vaccination is clearly a public health intervention aiming at reducing the risks of specific disease in a given population.

We acknowledge that we are taking a certain degree of liberty in using the term medicine with such connotations. It does carry some potential for controversies and perhaps immediate rejection of the arguments before careful reflection. But it can be accepted that any profession now involved in taking care of individual patients (nursing, physiotherapy, psychotherapy, dentistry, and so on), despite the fact that in most cases doctors would not perform the specific tasks carried out by the respective professionals, exists within the macro frame of medical endorsement and acknowledgement of the technical value and appropriateness of the delivered treatments. In this sense, they all inhabit the semantic space created by the healthy/sick binary code, which historically developed and became the prerogative of medicine. Those distinct professional fields are clearly identified with their participation in the all-inclusive realm of healthcare deliverers of therapeutic value in the health system's sub-system providing healthcare to individual patients.

In consequence of that, the two sub-systems of a health system are distinguished based on the dichotomy *individual/collective*, where the

*healthy/sick* distinction applies to the *individual* side of the distinction (sub-system of medicine), while the distinction *at risk/not at risk* applies to the *collective* side (sub-system of public health). With this conceptual framework it is possible to classify most actions and communications taking place within a health system as public health or healthcare service delivery (medicine, in the broader sense we defined here).

In this conceptualization, while the service delivery sub-system is intensely and continuously involved in addressing the health *problems* of individual patients, the public health system is tackling *problems* and figuring out what the system as a whole is doing and whether it is achieving or not the intended reduction of health risks faced by the population or collectivities it is responsible for.

We can say that both sub-systems deal with *problems*, identified and tackled differently by each sub-system, independently from the interfaces and connections they have with each other. Accepting that *problems* are at the heart of the concerns of these two sub-systems, their respective undertaking can be seen in a new light. Medicine (service delivery subsystem) facing *problems* of evaluating, diagnosing and treating patients, and public health addressing the *problems* of population health, assessing the distribution of risks and healthcare services to the collectivities.

We can ask a general question in relation to public health in the following terms: "why and how does a health system elect some issues/topics and problematize them, giving them a form of problem to be tackled, rather than others?" A first tentative approach to answering this question says that *problems* are formulated with attention to a variety of issues including:

- Preserving what has already been achieved – a continuous source of problems – formulated as how to guarantee the provision of the same sets of services, with the same quality, with the same technology, with the same coverage, and so on.
- Answering concerns and interests continuously voiced by external stakeholders (communities, media, politicians, donors, international organizations, religious groups and suchlike), requiring services and improvements in the health of the society.

- Addressing evaluations of needs and conditions for service delivery, raised internally in the system or by external stakeholders.
- Answering unexpected global, regional or local health threats or emergencies.
- Aiming at the expansion of services with the incorporation of new technologies and procedures not yet implemented.

In the process of answering questions from these areas of concern, the system creates internal divisions specialized in finding and formulating the *problems*[2] and indicating the solutions. These divisions are staffed with qualified professionals.

The public health sub-system has a number of advantages in operating with what we call the *form* of *problems*, specifying what needs to be solved and how. The "form of problem" is a linguistic "device" that allows far-reaching standardized communications of what has been identified as undesirable and/or as something that needs to be addressed and improved.[3] It can then be possible to communicate: the object of concerns and why; how it can be identified and tackled; and which interventions and actions are expected to bring about favourable changes and how they can be implemented. An identified problem therefore already points at, or at least suggests, how it can be solved. The advantages of working with the *form* of *problems* are thus:

- It strategically reduces the complexities of the full range of issues and options the system would otherwise have to consider, therefore focusing the attention on priorities and specific targets and courses of actions.

2 We may say that "choosing a problem" is rarely problematized, except in small technical groups making decisions about which problem to tackle. For the system's narratives to internal and external audiences, the hesitations about the problem to be addressed are kept as an internal matter of the small group of experts.

3 "How Is Social Order Possible", Chapter 2 of Luhmann's (2023) book *The Making of Meaning*, has a valuable explanation on the form of problems in the context of social science.

- It allows the formulation of solutions drawing from already known strategies, narrowing down the concerns.
- It facilitates justifications and connectivity of resources and operations.
- It facilitates the visualization of the mission and aims of the system, and therefore contributes to the system's self-reference and identity.
- It facilitates the flow of communications, establishing validated semantics and relevant channels.
- It offers justification to exclude, leave unaddressed or ignore concerns that cannot be related to the identified problems.
- It stimulates considerations and communications within the premises and limits created with the specified problem.
- It removes attention from the question "what is the problem?" to an already chosen problem; by doing that, instead of facing the indeterminacy of unlimited problematic issues, the attention is directed to focal points.
- It suggests a politically convenient impression that a problem's causes have been identified and are already consigned to the past as the system moves towards solving the problem in the near future using the adopted strategies.

In the public health sub-system the formulation of problems requires the use of indicators, as indicators translate the elements considered into specific and standardized formats. Indicators can also be associated with potential interventions, and consequently the assessment of the results of the interventions. This chapter specifically pays attention to the public health sub-system's problems and the role of indicators in the construction of those problems, by which the segments of the population considered to be *at risk* are identified and targeted.

## Meanings and complexities: what the theory tells us

Before getting into discussion of the indicators themselves, we need to highlight a theoretical point already briefly mentioned in Chapter 2, but

still in need of complementary explanations. For the formulation and use of indicators, a social system based on communications, like the health system, needs to select meanings by which it can build indicators. Indicators consist of paradigmatic synthetic meanings, expressing standard relations between selected elements, which can then be applied to any context, allowing comparisons across contexts and time. Indicators are developed using methodological prescriptions to be strictly followed in order to guarantee reliability, acceptability and comparability. Most, but not all indicators are numerical and require calculations.

The Social Systems Theory tells us that "meanings are complexities". To be clear, as has already been explained in other chapters of this book, any meaning is the result of a process of selection among many possible alternative meanings, of which only one is adopted and the others are therefore discarded (Luhmann, 2022). There is no meaning without the "shadow" background of countless possibilities, which eventually have to retreat to the background to allow the visibility of the chosen meaning at the forefront. Meaning is the form distinguishable from the backdrop of noise of other possibilities. The complexity we refer to is therefore the set of possibilities around the selected one.

Emerging from the contextual complexity, the formulation and communication of a meaning requires the often-difficult tasks of addressing countless connotations, misrepresentation and nuances that the used meanings bring about or can be connected with. Such "cleaning" operations have to be carried out communicatively as both sides of the communication link need to be certain what they are talking about.

However, the "cleaning" cannot be exhaustive or call for full awareness of what has been excluded, because the complexity involved is vast and may never be apprehended in its entirety. In the meaning-construction process, the selected out meanings have to remain unacknowledged (latent) to make the communication possible, even if not perfect. Such difficulties are unavoidable and are inherent to any communication-based system operating with meanings.

Furthermore, any communication-based system observing its environment needs to reduce the complexities of the variables involved by focusing on elements and relations it can work with and their respective

meanings. The system creates simplified models of what it observes in its environment in order to be able to meaningfully approach it. Meanings are the "raw material" of models.

So, we have the complexities inherent to meaning construction, as explained above, and the complexities of the environment, with its surplus of possible meaningful elements and relations. To be meaningful, something needs to be separated and distinguished from the complexity it is immersed in. The complexities from where the meaning has to distinctly emerge are thus reduced. The complexities of elements and relations, which are abundant in the environment, are also reduced with the focus brought about by the selected meaning.

These theoretical references should help us in the discussions to be held next.

## Indicators: anatomical features of public health

In this section we present the most common public health indicators in the literature and official documents of international institutions such as the WHO, development banks, aid donors and countries' Ministries of Health or other authorities.

We briefly present the *technical structures* of each indicator as explained in textbooks and the literature on the topic (for instance WHO, 2010b). We also discuss how each of them is predominantly orientated to inform health systems' *internal* or *external* narratives. We discuss their *inherent complexities* and how the systems usually deal with them. We also discuss the form of problems and solutions the indicators help to elaborate and suggest.

Not all definitions presented here are exempted from controversies; however, it is not the purpose of this chapter to address those polemics or propose final solutions for classification or applications of indicators. Despite possible disputes about accuracy, for the purpose of discussing the functional systemic meaning of indicators, uncontroversial definitions are not paramount; we are negotiating a conceptual territory with many contingencies. We believe this becomes clear in the chapter. Rather

than precise textbook definitions and classifications of indicators, for our objective of illustrating the use of indicators as building blocks of self-references the presentations we make here are sufficient.

The fact that public health indicators are orientated according to the fundamental key binary distinction of public health – *at risk*/*not at risk* – is important for grasping our message. The usefulness of the indicators consists basically in allowing the identification of populations that can be considered *at risk* and therefore targeted to benefit from risk reduction interventions. Those segments become the targets and the justifications for any intervention based on the respective indicators. We make brief comments related to the issues of *risk* in each indicator in the next section.

However we can anticipate that each indicator has peculiarities in the way it approaches risks; they are not the same in the sense that each indicator deals with different forms of observing risks. For instance, briefly, an indicator concerned with reduction of risks of specific diseases is useful for moving people from the at-risk category to the not-at-risk one; meanwhile, aggregated measurements of the burden of diseases, without detailed specifications, comprehend the whole society as being at risk (more on this later). We hope this will also become clear in the subsequent sections. To facilitate the follow-up of the risk topic, we separate the corresponding paragraph within the discussion of each respective indicator.

Finally, for presentation purpose, we group the indicators in three categories: (A) indicators directly linked to population's health needs and risks factors as the health system's object of concern; (B) indicators linked to means for achieving the necessary conditions for healthcare provision; (C) indicators predominantly of the interests of observers outside the health system (only circumstantially linked to system's internal decisions).

## (A) Indicators directly concerned with population's health needs and risks

Efficacy: This expresses the causal link between specific action and the attainment of the intended specific objective. It can be used, for instance, to indicate the rate of success of a specific drug, technique, method, strategy or intervention (including protocols, clinical guidelines, standard procedures) for achieving specific outcomes. In general terms, the more specific is the action and the intended effect, the stronger the indicator. With that, this indicator can support managerial decisions for procurement, resource allocation, and so on. This indicator can also be relevant at the micro level of treatment decisions, including establishment of protocols and training programmes. An example of the kind of problem formulated with this indicator is: "Which antibiotics have better efficacy for this type of infection?" The indicator tries to reduce the complexities related to uncertainty regarding treatment results, and the contingencies of the circumstances surrounding the treatment. Some complexities may be ignored but not eliminated; Organisms' diverse reactions and uncertain effects of possible interactions with undetermined or overlooked factors (except in rigorous controlled trials) may remain latent. However, such shortcomings do not prevent the use of the indicator for clinical decision-making and establishment of standards of service delivery. Fundamentally, this indicator is of great interest for internal operations of the system but less so for external audiences.

Risk: In relation to populations *at risk*, typically this indicator can be instrumental for identifying populations to receive benefits from the strategies according to their verified efficacy. Efficacy is therefore a valid argument demonstrating the number of potential beneficiaries among those currently *at risk*. Beneficiaries might then move from the *at-risk* to the *not-at-risk* category for the specific disease for which the efficacy of the treatment/intervention has been determined.

Performance: In simple terms, performance is about actions and achievements of predefined goals measured along scales of quantitative and/or qualitative values, observed in a broader (for the whole system) or narrow (for sub-systems or system components) sense. Performance can also be analysed considering relations between means and goals both often broadly defined. Performance indicators tell us about how far the system got towards the targets, outcomes and aims it set for itself, and help to formulate problems about the technical composition and missing elements. Performance also may indicate the system's responsiveness to identified challenges, combined with measurements of outcomes achieved; in this regard, it is also used with the intention to report and justify to external audiences what the system does. Other key terms for complementary assessment of performance are adherence and compliance with standards, and suitable combinations of means and goals. It can have very broad and comprehensive inclusions of other indicators, as the WHO's (2022) recently published HSPA shows, using for example epidemiological indicators as measurement of outcomes in relation to the actions implemented.

Risk: Public health validation of performance indicators requires estimations of benefits obtained, possibly expressed in terms of reduction of health risks by: (a) reducing the chances of those at risk of getting sick; (b) increasing the chances of moving from the at-risk to the not-at-risk category; or (c) achieving assurances that those not at risk will not in the future lapse into the at-risk category. Although difficult to precisely translate performance measurements into those categories, given the number of variables involved, the judgement of performance may involve comparisons with interventions and outcomes from elsewhere, showing increases and improvements in performances (measured as number of activities and/or quality), usually acceptable as a *proxy* indication that health risks seem to have been addressed and reduced.

Efficiency: This is measurement of productivity, comparing outputs (such as services provided) with the inputs used (sometimes expressed as costs) to obtain them. The causality relation between inputs and

outputs does not need to be strict or exclusive but does need to be plausible. It is standard for comparisons across different undertakings with similar objectives. Usually, the assessments are conducted with internally generated data, even when carried out by external agencies, and aim at making the system more productive with the same inputs (more efficient). This indicator has inherent uncertainties related to the estimation of inputs (and their cost expressions) and the decisions on what to include or leave out of the estimations. Besides that, there are uncertainties about the relations between the factors and the probabilities of obtaining the desired results; the causality links may not have more than suggestive plausibility. For instance, the comparison between facilities of similar structure, delivering the same standardized package of healthcare: "which one of those facilities, having the same human resources, presents the lowest ratio of services delivered by cost?" While narrowing down the observed variables may make the assessment easier, complexities are only left out but not eliminated or neutralized. The problems this indicator tries to solve, particularly those in relation to how macro decisions should be taken, are often occurring in policy contexts where conflicting agendas may force the inclusion or exclusion of variables and measurement details (for instance, services produced regardless of quality). Almost always, results can be questioned due to the contingencies of the choices made while formulating the indicator, as the complexities involved can hardly be fully apprehended. Efficiency is measured in accordance with the model employed to summarize the variables involved; but model construction requires reduction of complexities by eliminating or ignoring some variables. Nevertheless, this indicator is useful when optimization is high on the agenda of a system's concerns.

Risk: In itself, the efficiency indicator has economic rationale. To say that, for instance, a system is operating more efficiently because it delivers the "same quantity of services" while spending less doesn't carry public health meanings. It is necessary to clarify whether the "same quantity of services" corresponds to actual needs and, even better, the actual services represent reduction of "risks". Similarly to the

performance indicator, it is hard to gather evidence of such reductions; therefore the indicator may work as a "surrogate", suggesting that risks may have gone down. Being more efficient implies saving resources that can then be used to tackle health risks not addressed previously.

Effectiveness: This indicator tells us whether specific deployed strategies reach expected standardized comparable results in real contexts, without ruling out interference of known and unknown as well as controlled and uncontrolled variables. The results of the strategies may be the same outputs/outcomes, or may be different, but they should be measured in comparable units such as saved lives, averted deaths, prevented cases, speed of recovery, disability adjusted life years (DALYs) averted, quality-adjusted life years (QUALYs) gained. The comparison between strategies can be expressed in terms of their respective costs to obtain a unit of the desired comparable result. Usually the construction of such indicators requires trials in real settings and research projects conducted by external agents (such as academic institutions, drug manufacturers). An example is: "What is the cost-effectiveness of a fifth COVID-19 vaccination dose?" In other words, these indicators are concerned with specific results achieved, possibly considering the resources consumed in the process. A particular case of these indicators is cost–benefit, in which monetary values are on both sides of the equation – that is, the cost of the strategies and the benefits obtained where benefits, however they may be defined, are expressed in monetary terms. In these indicators, the complexities left out include the indeterminate factors that may affect trials and causal links, even after cautious randomizations of variables, and all that concerns the plausibility of assumed causalities, and the comparison with estimations made in different settings. They are often relevant for internal decision-making related to selecting alternative courses of action to obtain a well-defined result. External audiences may also have economic, political and other interests in these indicators.

Risk: Effectiveness is perhaps the indicator par excellence for selection between strategies aiming at risk reduction. It draws clarity and precision from the controlled-trial nature of the procedures to estimate effec-

tiveness. It offers a valuable indication of what risk reduction can be expected by adopting the admittedly most cost-effective of the compared strategies. We may say, though, despite being the public health golden standard for estimation of risk reduction (Jamison et al., 2006), effectiveness has a demanding format, where validity depends on fulfilling the strict requirements of the measurements. The indicator indeed measures risk reduction in one of those previously mentioned possible formats: (a) reduction of chances to move from at risk to sickness; (b) increase in chances of moving from at risk to not at risk; or (c) reduction of chances of moving from not at risk to at risk. However, effectiveness refers only to the considered strategies; therefore, the use of this indicator as "proxy" or "surrogate" for broader multiple health targets and multiple operations for risk reduction, as the previously mentioned indicators (performance and efficiency) address, is not acceptable. Gains in specificity unfortunately correspond to losses in generality; this indicator wins when specificity (targeted intervention) is more relevant than generality (multiple objectives).

Equity: This indicator compares the distribution of availability or results of healthcare services and goods with the distribution of needs and other characteristics of population groups. More specifically, it assesses the distribution of opportunities to access and reap benefits from services across populations divided into defined categories. Population categories can be constructed according to many variables: for example, ethnicity, income, education level, gender, age group, residence, occupation. The indicator can also assess the existence of barriers preventing some population categories from having access to and benefiting from certain services. They can be estimated with multiple different aims in mind, such as equity of distribution of: life expectancies; access to specific or general care; delays to access healthcare; access to quality care; outcomes of treatments; survival rates after treatments. They are often estimated by external agencies with specific political purpose. Different estimations may reveal different types of equity/inequity, even considering the same population groups – equitable distribution of basic services together with inequitable outcomes, for example. To com-

plicate matters, scarcity of resources often means that access for some is at the cost of access for others. Complexities arise from the multiplicity of perspectives and from the inclusion of time variations. Setting aside unaddressed complexities, equity indicators may be amenable to formulations shedding a favourable or unfavourable light according to the intention of the studies. But still, these indicators are of interest both for those praising the system's achievements and for those criticizing them in arguing about fairness and distributive justice.

Risk: The validity of an equity indicator derives from the clues it can reasonably give. Ideally, equity would be estimations of fairness in the distribution of risks and risk reduction interventions across populations seen to be *at risk*. However, these estimations of fairness for diseases, treatments, prevention measures and so on are hampered by enormous difficulties. If, for example, access to healthcare, quality of treatments, quality of outcomes, are unevenly distributed across populations, following clearly demarked differences according to income, ethnicity, education, the indicator provides enough suggestive evidence that some populations are disadvantaged in comparison to others, and therefore some are likely to be more *at risk* than others. The corrective measures should consequently be justifiable. In assessing equity, considering risk and risk reduction effects, these possible formats are also relevant: (a) reducing chances to move from at risk to sickness; (b) increasing chances of moving from at risk to not at risk; or (c) reducing the chances of moving from not at risk to at risk. For that matter, the more specific the interventions and respective measurements, and the distinctiveness of the populations being considered, the greater the validity of the equity judgement.

Coverage: This indicator is intended to point to how key inputs and service provision capacities (such as human resources, healthcare facilities, laboratories, complex healthcare services) are distributed throughout the country and located according to population or population needs (often in association with demographic and actual services production). This indicator can take into account a number of features of the struc-

tures of healthcare provision, such as the existence of organized referral networks, the integration and continuity of services from the lowest to the highest complexity levels and the ease/difficulty of accessing the facilities/services. This indicator may complement but may also clash with the equity ones, when certain uneven distribution of services may be justified based on concentration of cases and scarcity of resources, leaving parts of the population with disproportionally lower coverage (of healthcare services, for instance). These indicators are often of internal as well as external interest. They can be used internally for planning and investment decisions, and also provides inputs for equity estimations. They carry uncertainties related to the assumed equivalence of the officially recorded or directly observed distribution of inputs, assuming also uniformity across inputs (presuming same efficacy, same effectiveness, same efficiency, and so on). Besides that, they may be estimated in ways that make possibly large variations in quality of care invisible. Of many possible descriptions of coverage, the intended narratives have to select those suitable for the concerned audiences. Consequently, the complexities inherent in having different possible descriptions are left out of consideration. Although of high political relevance, these indicators carry vulnerabilities, open to contestations given the difficulties of solving trade-offs between high/low coverage of expensive/cheap services in contrast with presumed or measured high/low need or utilization.

Risk: Furthermore, the translation of this indicator in terms of *risk* reduction – that is, aiming at or assessing whether coverage reduces risks, is highly complex and difficult. Coverage means the services are available and reachable at the point of need (or when prevention is necessary). However, given the unpredictability of needs, blindly pursuing coverage availability would imply maintaining services regardless of actual needs, in order to ensure the service will be there if it is needed. This obviously is not feasible in a context of scarce resources, which implies that sometimes some services may not be available at all. The differences between coverage aims and actual availability at the point of need create insurmountable practical problems. Coverage, in its broader general sense, does not strictly discriminate between those *at risk* and those *not at risk*

in the population, given the unpredictability of determining and distinguishing one from the other at all times. Therefore, coverage (particularly universal coverage) often becomes coverage for those not at risk as well, because it is uncertain when someone will cross the line of the not-at-risk/at-risk distinction. In this sense, coverage becomes conceptually resistant to approaches trying to distinguish between the necessary risk-reducing coverage from the wasteful coverage with no risk reduction effect. More than resistant, coverage may create an unsolvable problem; it will always fail, either for not being enough or for being wasteful. Anyway, the logic of scarcity of resources eventually leads to a practical solution for resource allocation, which can't be precisely optimized in terms of risk reduction, but certainly and justifiably reduces risks. And coverage may be still valid when the respective services are clearly specified, like coverage – of vaccination, of infectious disease control programmes, of antenatal care, and so on – when *at risk* can be precisely specified as *at risk* of, respectively, not getting the vaccines, the disease not being detected, not accessing antenatal care. In addressing general needs, coverage loses strength as a guiding indicator.

Quality: It is clearly understood that healthcare services can be delivered in accordance with additional attributes that are not included in the technical combination of inputs deployed. The same services can be judged according to quality standards of provision that not only consider the valuation of the outcomes of the treatments from the point of view of curing the disease, but also considering the level of satisfaction and comfort of the patients during and after treatment, measured for instance by quality of life years after treatment. As part of health system ethos, attention is given to assuring that services are made available and operate according to established standards and requirements, including perceptions of users. Professionals are often mobilized with the objective of establishing the standards of care for their respective professional categories, which often consider patients' perceptions. There are motivating factors pushing the election and compliance with standards originating internally in the system as well as externally (insurance companies, government, and so on). Quality of care can become

a contentious issue, as the perspectives of the players are not always aligned. Professionals may be motivated to create protection against the consequences of potential mistakes, unfortunate results, and to avoid subjective criticisms. The scene therefore involves a wide range of complex aspects selectively elected with exclusion of some possibilities that could otherwise create controversies about the indicators. Nevertheless, they are useful for decision-making on specific matters, where they are considered as valid arguments either in favour or against certain solutions, like treatment procedures that are less painful or uncomfortable for the patient even if they have lower efficacy.

Risk: From the point of view of risk reduction, the indicator has mixed outlooks, as the issues of risk reduction and quality of care do not neatly map out one another, and may project different orientations towards the outcome of the services provided. Low quality may still be risk reducing and high quality not necessarily so, particularly when quality emphasizes perception, presence of amenities and elements that do not affect the reduction of risks. In many circumstances when quality of care refers to the skilful and correct deployment of healthcare procedures, risk reducing acquires the connotation of, for instance, avoiding: sequels, unnecessary or excessive use of drugs, side effects and errors. So, while discussing and deciding on how to approach quality, risk reduction effects can be quite relevant. Surely decreasing medical errors is something public health pays attention to as inherent to both quality of healthcare and risk reduction.

Health profile: This is not a distinct indicator per se, but rather a collection of measurements, predominantly of epidemiological nature (such as prevalence, incidence, morbidity, mortality, fatality) portraying the health status of a given population, with particular emphasis on measurements such as: infant mortality, maternal mortality, under five mortality, morbidity due to infectious diseases or non-communicable diseases, and so on. Indicators such as life expectancy at birth, general mortality rate among others reveal the overall health status of a society, reflecting all possible causes, where health services may be only one among

many other determinant or contributing factors. These indicators are usually processed from data collected by civil registration institutions in charge of producing vital statistics, often independently from the health system. The health system cannot alone take on the task of improving general societal indicators such as life expectancy. However, these are often used to indicate progress, and the existence of problems on which the health system may need to focus. Specific components of the health profile can constitute clear targets closely related to access to health services (preventive and curative alike), such as reduction of infant mortality and maternal mortality.

Risk: We may say that the elaboration of health profiles is definitely an important process for risk reduction estimations. Profiling is in fact part of the approaches and methods for verifying risk reduction and therefore setting targets for additional reductions. A specific indicator in health profiles is the burden of diseases. Given its relevance, we dedicate a few lines to it here. Together with effectiveness, burden of disease is a particularly valuable public health indicator. Let's take the DALY (Global Burden of Disease (GBD) estimations by Institute for Health Metrics and Evaluation), representing the loss of healthy life years due to illness (calculated for sets of diseases or as an overall figure for a given country or groups of countries) – avoided DALYs over time can be interpreted as indicating risk reduction. If DALYs is used in a cost-effectiveness study (for comparing estimations of outcomes of two strategies for tackling neonatal and maternal diseases for example), it should allow reliable conclusions regarding the strategy to be adopted. It offers the reduction of the burden expected from the winning strategy, which can also be read as aggregated reduction of risks made possible by that strategy. In this sense, reduction of the burden of disease and reduction of risks tells the same story, offering strong arguments for adopting the winning strategy as the one that is expected to yield lower risks in the future, following implementation. The same is not the case when the burden of diseases is compressively estimated as an aggregation for a country as a whole for large sets of diseases, including diverse types of interventions; in such case, links between strategies and risk reduction cannot be established.

In this sense, we can say that in estimations of general burden of diseases, the whole society can be alleged to be at risk, and the burden of diseases cannot be used for estimation (or proxy) of risk or risk reduction. This is because of the three possibilities of risk reduction – (a) reducing the chances to move from at risk to sickness; (b) increasing the chances of moving from at risk to not at risk; or (c) reducing the chances of moving from not at risk to at risk – estimations of the burden of disease only mention the possibility (a) (moving from at-risk to sickness) because the risk in this case is expressed as registered diseases, while (b) and (c) do not include the appearance of actual diseases. In short, public health is not only concerned with diseases and population *at risk*; it is also pays attention to populations *not at risk*.

### (B) Indicators linked to means for achieving the necessary conditions for healthcare provision

Financing: These indicators obviously deal with money matters. They may have diverse focus and concerns: for instance, on sources and amounts of funds being brought into the health organization; allocation of funds across services, regions and populations (checking optimization in terms of benefits for example); on the distribution of the funding burden in alignment with needs and utilization; on financial protection and guarantees to the disadvantaged; on cost compatibility with financing profile and justifiable comparison standards; on payment and incentives for healthcare services providers and their efficiency. These indicators may gather information from several sources, depending on how broad the interests are, as addressed for example in the National Health Accounts methodology (Maina and Mwai, 2019). The indicators can be developed internally or externally depending on the objectives and concerned players. Uncertainties may arise where information is not made available by the interested parties or may not be properly accounted for (as it is often the case with informal payments and unrecorded out-of-pocket expenditures). They are often employed with political and business intentions, leaving out the complexities

inherent to the variables and estimations considered unworkable or inappropriate for the purposes in mind.

Risk: Financing can only tentatively suggest risk reduction, when financial resources increase and expectations of healthcare services improvements can be reasonably expected. The assumption that positive changes in financing lead to risk reduction, as comparisons across different financing arrangements suggest, can only be tentative until empirical confirmation is possible. The sets of variables are indeed huge. Financing as a means for acquiring and paying for inputs does not involve direct relationships with the effectiveness, performance or efficiency of those inputs. Productivity can vary immensely for countless factors. While financing, as a macro indicator remains relevant (even vital) for public health self-assessments and narratives about the health system, they may have a "loose relationship" with the reduction of risks. The case of low- and middle-income countries such as Cuba, Costa Rica, Kerala state in India and others showing better health indicators than high-income countries is an example (Balabanova et al., 2013). On the other hand, we can consider that the three possibilities of (a) reducing the chances to move from at risk to sickness; (b) increasing the chances of moving from at risk to not at risk; or (c) reducing the chances of moving from not at risk to at risk, can be influenced by financing at a micro level. Financing can operate as a risk-protection "device", when certain financial arrangements such as health insurance make a patient's access to healthcare possible. In such cases, they may enable the patient to move from sickness to an at-risk or optimally not-at-risk position, becoming countable in the sphere of public health concerns and interventions. Indeed, financial protection may also open doors to preventive care, allowing people to access services, and moving from the at-risk to the not-at-risk position, which could not perhaps be possible without the financial protection. Nevertheless, precise estimations of reduction of risks in relation to changes in financing require sizable work.

Sustainability: These indicators aim to tell us whether the resources generation are sufficient to keep services going and structures in place. Assuredly, depleted hardware should be replaced and manpower preserved and reproduced with self-generated resources. As such indicators rely on predictions for the future, they carry with them all the corresponding time-related uncertainties. The conditions are fluid and the relations between production factors and results have the inherent unpredictability of development of technologies, availability of funds, availability of human resources, timely decision-making, favourable political context, and so on. The level of uncertainty can be so high that any serious requirement for evidence of sustainability as a condition for proceeding with an endeavour might be equivalent to giving up the initiative altogether. Only circumstantially might such indicators become of interest, particularly when funding agencies want assurances about political commitment to the continuity of the investment. In this sense, rather than balancing a business-like equation of revenue-raising potential against cost potential, it becomes a balance between preservation of interests in keeping the initiatives going and the feasibility of covering costs. As we can see, there are a lot of "potentials", and therefore uncertainties. Competing agendas are not in short supply and the emergence of unforeseen threats may make all forecasts rapidly outdated. Sustainability became a must-be-included word in international health narratives, but the carefully circumvented or disguised uncertainties are more like "we do not need to talk about the elephant in the room". In this fashion, complexities have to be left unaddressed and the projects might go ahead based on good faith and hope. As mentioned, sustainability indicators have to deal with questions inherent to the dimension of time. Lives are supposed to be saved or improved today, not later when the initiative will prove to be sustainable. All initiatives can only claim to be sustainable in the future; until then, sustainability is anyone's guess and hope, informed or otherwise. However, the need to improve and save lives should not be deferred. Decisions are therefore taken today regardless of the reliability of predictions of future results. Assurances of provision of inputs such as human resources, equipment, maintenance and finance can never rule out unpredictability, and the streams

of benefits accrued from future services can only be good guesses at best. Unpredictability and complexities cannot be ruled out.

Risk: Sustainability is a criterion in its own terms; sustainability maintains what has been achieved, even without implying risk reduction. The criterion is thus satisfied; in that sense this indicator has a weak public health meaning, however relevant it is in business decisions. Furthermore, the sustainability of a health project and the sustainability of the risk reduction effects of the project are two different questions. A successful project, generating valuable health impacts, which nevertheless is extremely dependent on the funds provided by external donors, obviously does not have a good prospect in terms of future benefits (expected risk reduction) once the flow of funds stops. In this case, the merits of the project should not be judged according to its sustainability rather than the benefits it actually generates. Conversely, a sustainable project (funded by the state, for instance) may not operate at optimum levels in terms of risk reduction. Nevertheless, risk reduction must be the priority criterion, while sustainability thus may remain a less relevant one. It is often the case, however difficult to admit, that a project's merit is judged in terms of the risk reduction it brings about instead of whether it is sustainable or not.

Organization: These sets of indicators reflect characteristics of the organization of the system, considering aspects such as management structures, centralization/decentralization, hierarchies, authority, partnerships (including public–private partnerships – PPP), autonomy, strategic decision-making, integration of services, facilities network, planning, logistics, monitoring and evaluation. These indicators may describe organizational structures and how management is exercised at different operational levels in the system. Portraying the organizations, these indicators also point to how they may or may not change, with the respective links between institutions and agencies (including multisector collaborations). Of relevance for macro planning and large investments, they also concern operations and functionalities of programmes, projects and initiatives articulated at different levels in the system. The

narratives about organizations explain, for internal guidance of the system, how it is organized, but also provide topics for external communication. The presentation of the diversity of organizational features needs to be as precise and specific as possible, therefore complexities should be addressed; organization structures and functionalities need be portrayed as consistent and coherent or otherwise adjustable. Emphasis may be placed on critical matters related to, for instance, how far decentralization is real; how far informal networks inside the organizations are controlling it; how provisional relations of trust, partnerships and leadership are effective; how membership in the organizations is recognized as a source of influence; how far autonomy is respected. These organizational and managerial matters are often described in narratives explaining the structure and functioning of the organizations operating in the system. These indicators are mostly descriptive and often employ social science paradigms and frameworks explaining organizational aspects in terms of networks, power stakeholders, leadership, feedback loops, game theory, and so on. As many organizational structures and functions are of a contingent nature, these indicators address complexities in cross-sectional snapshots of time, which may not reveal the complexities of the dynamics driving the system towards changes. Such changes might be unpredictable, however comprehensive the provisional descriptions of the system may be. In a context of the presence of many different organizations of different types, and diverse public and private providers and funders, the portrayal of the system tends to be limited and incomplete.

Risk: Optimization of organizations is in pursuit of a diversity of aims and objectives. Individually, each organization, such as providers of hospital care, tries to minimize risks for patients in all that concerns the hospital environment and treatments deployed. In terms of our discussions in this chapter, patients are those who crossed the line from at risk to sickness – that is, they crossed the *healthy/sick* distinction and entered the realm of the medical sub-system. As individuals they are not of specific interest for the public health sub-system, although, we should highlight, the collective of patients may again be treated as

a *collective at risk*, because of what can happen to them – for instance, hospital infections, where they are at-risk as far as those infections are concerned, independent of their original ailments. Public health orientation will try to devise strategies to bring them from the *at-risk* position to the *not-at-risk* position while they are in the hospital – a difficult task in some cases. In this sense, public health orientation is not exclusive to Departments of Public Health. The orientation spreads throughout the organizations and structures of the system, wherever approaching *collective risks* is appropriate and in fact necessary. In that, the indicators of organizations may narrate links of organizational attributes/initiatives and risk reduction. However, Departments of Public Health (or similar) have the responsibility to deal with risk reduction in society at large, wherever people *at risk* may be, including those collectives under organizations' initiatives but also all those risks and risk factors present in society that are not within the remit of any specific organization. As mentioned in Chapter 2, the Social Systems Theory sees organizations as one of the three types of social system based on communications. Perhaps the reader can refresh their understanding of organizations by checking the glossary at the end of the book. Organizations, including any involved with healthcare services provision, are primarily orientated to their survival and the reproduction of their distinct communications among their recognized members. Tackling risks may become part of the survival strategy of the organizations, but in these cases the focus is narrowed down to the scope of actions of the organization (it does not go beyond its boundaries). Health organizations aim at reducing risks for those receiving the services the organizations provide; the operations of the organizations are exclusively concerned with the service they provide and those directly receiving them. Nevertheless, while being organizations themselves, the assignment and mission (self-reference and identity) of the Departments of Public Health include identifying and tackling all sorts of health risks in the society and reducing them. These departments perhaps are the only organizations for which reproduction and survival are dependent on effectively reducing society's risks; no other organization in the system has such broad scope. The self-reference narratives of the health systems should therefore include

accounts of how, when and whether their Public Health Departments are fulfilling their risk assessment and risk reduction mission. This mission surely includes accessing whether the organizations operating inside the health system are adopting organizational structures that optimize their risk reduction possibilities.

Health workforce: We have already mentioned human resources in relation to indicators of coverage, denoting the availability of health professionals according to population size and needs. The workforce theme is given prominence in the literature and international organization as evidently expressed in WHO frameworks, where the workforce is a fundamental pillar of health systems. Besides coverage, we understand that workforce can also represent the aggregate composition of the human resources operating the health system and how they are distributed throughout the structures comprising it, including public and private organizations and institutions. Health workforce assessments also indicate possible gaps and possible excesses and the capacity of the system to generate and absorb more human resources wherever they may originate. It may highlight serious limitations and bottlenecks of the system, and this means that the complexities that can possibly be addressed while scrutinizing workforce structure, composition and dynamics are vast and need to be narrowed down. For that matter, the portrayal of workforce problems should be in line with anticipated solutions. Complaining about insufficient neurosurgeons in a country that cannot cover the needs of general practitioners in primary healthcare facilities would seem unacceptable.

Risk: Risk reduction has close links with workforce; the workforce makes risk reduction possible. Therefore, the understanding of workforce should be part of public health assessment of risks and risk factors reduction. Health professionals involved in prevention and preventive care, in curative service delivery and public health programmes, should understand the scope and amplitude of risk reduction objectives, incorporating it into the professional ethos. The public health narratives can therefore explicitly link workforce composition and distribution

with risk reduction aims, without resorting to specifically and precisely quantifying the magnitude of the reduction achieved or expected.

### (C) Indicators mainly of interest to observers outside the health system

Governance: These indicators bring to the fore whether the provision of care and the functioning of the health system correspond to normative principles of legally established rules and rights, as well as to judgements of standards of public services operations, including ethics. The indicators carry strong political interests as they closely relate to political objectives and may be used as a demonstration and justification of politically motivated actions. In its elusiveness, governance resembles more a medium than a form. In the medium of governance – a semantic medium, we can say – in the last decades, a plethora of forms have taken shape, appearing in the academic literature and reports of international institutions such as the WHO. Very much a characteristic of a medium, the term governance is always presented with the addition of the form-shaping adjectives and specifications giving visibility to it. As an example of forms used to explain governance, we can list rule of law, accountability, strategic policy formulation and vision, effective oversight, coalition-building, correspondence with legislation and regulation, effective implementation of regulation and legislation, hierarchies, networks, stakeholders' voice, protection of the vulnerable, information and intelligence, institutional design and efficiency, patient centredness, political economy, transparency, multi-sector collaboration, social participation, awareness raising, responsiveness, institutional memory. The list is indeed very long and still growing. These forms often overlap but still each brings specific nuances. Obviously, selections are made according to the preferences of the context as the full range of meanings related to governance become impossible to address in empirical terms. Such a collection of terminologies and meanings, from our point of view, corroborates the understanding of governance as a medium with many potential forms, instead of a specific tangible, singularly recognizable object. The term and its forms are often of external interest for substan-

tiating political judgements, political platforms of actions or critical monitoring of the system. Besides that, these indicators may reflect the overall structuring and functioning of the government across the public sector, closely reflecting the type of political regime in place, by which all sectors are also affected. The concepts are rarely of the exclusive internal interests of the system. The terms are mostly of particular interest for those who want to portray a certain view of the health system in focus. Given the diversity of views the concepts introduce, the complexities are conveniently left outside the debates, remaining unsolved. It is always possible to pick up the forms with connotations to fit the purposes, while the meanings left out might be activated later on, if there is the intention. The assumption of clarity and enforceability of governance indicators in practice is overburdened by the complexities that have been added to it in the last decade. It is possible to say that the more medium-like an indicator is, the more prone it is to attract proposals of new candidate forms.

Risk: The links of the governance indicator with risk reduction are complex and difficult to trace. Indicators situated at the convergence of management, political and legal science have rationales that do not require precise links with reduction of risks and risk factors. The justifications for such indicators are raised for advantages seen from the point of view of the science where they originate. Their relevance in terms of risk reduction are thus inferred and assumed without precise verification or validation. Public health literature shows an "invasion" of such frameworks (of which system science is in a peculiar way also a part) without revealing whether or not risks are effectively being reduced. While agreeing to distance itself from its core business by becoming involved in such debates, public health may weaken the references to what it is really about: risk reduction. Social Systems Theory, however, by bringing public health self-reflection and self-descriptions to the fore, also brings the signalling roles by which public health should recognize its differences from public management in general. The *at-risk*/*not-at-risk* binary code must be kept as the core identification of the public health sub-system and its fundamental reference for self-reflection.

Voice and accountability: Usually also under the wide umbrella of indicators of good governance, these indicators more specifically try to observe whether policy-making, policy implementation and management allow for participation and voice, particularly of the disadvantaged supposed to benefit from the system's activities. These indicators are often external and used for formulating the degree of attention the system gives to those who are served or supposed to be served by it, and how integrated they are in evaluations and decision-making. They are of political interest and require independent assessments, which often can be criticized in terms of bias and distortions, perceived therefore as of limited scope and intended for specific audiences. Where they are of general attribution (reporting whether or not the system as a whole is accountable in its institutional mechanisms), they may be imprecise and used for expressing overall criticism with little practical implications, given the high complexity of health systems operations and the closure of technical communications. As is usually the case for many indicators, complexities are left out but not eliminated. The indicators have to deal with the indeterminacy of motivators and the attribution of links between factors/effects and responsibilities. The term accountability, however, can also refer to the internal processes of communications where the system and its components are internally accountable in daily operations not objects of external attention or scrutiny.

Risk: Where voice and accountability are criteria for judging a system's performance in terms of expected risk reduction, communications between the operators of the system and those receiving or entitled to receive healthcare services is complex. Expectations on the receiving end may not be fully in line with the plausibility and order of priorities as seen from the provision side. Risk, risk reduction, risk factors and the causalities involved are often expressed in technical terms which recipients of services may find difficult to grasp. The evolution of the health systems, as discussed throughout this book, required communications fencing the semantic space and therefore setting rigorous limits for participation. Medical language, for instance, became too highly complex for anybody other than doctors to use and understand. Therefore, ac-

countability may end up happening in accordance with the meanings the system itself develops and adopts for that particular purpose. As said in this book, public health has the ability to explain the system both internally and externally, to the other systems and organizations. The narratives thus generated need to address issues of risk reduction, though how far the incorporation of service users' and potential users' voices and the accountability procedures involved have any effect on risk reduction is an empirical question to be further determined. Having to be accountable and explain its actions to society make the public health sub-system more engaged in producing such narratives, participating in external communications, but such purposes and efforts are not directly linked to risk reduction effects. Public health engages in risk reduction activities not because it needs to explain what it does; essentially, risk reduction is the self-identity, the reason for existing and reproducing, and thus an essential self-reference of public health.

Environmental impact: These indicators scrutinize whether the interventions and services provided by the system have negative consequences, becoming health risk factors (such as pollution, contamination of the environment with hazardous substances or organic materials, destruction of natural resources), damaging the physical environment where the system operates, or contributing to the occurrence of disease. These are mostly external indicators maintained by environmental agencies in connection with politically established rules with environment protection objectives. Among the complexities omitted but not eliminated that can be mentioned are the imprecision in determining environmental effects and their consequences and the time scales required, with problems of consistency over long-term follow-up or retrospective scrutiny. Where rules are well defined, these indicators consist basically in observing whether the system and its organizations correctly adopt the necessary procedures to comply with rules of environmental protection.

Risk: As an evaluation criterion on its own, environmental impact is concerned with avoidance of new risks. In this sense, it seeks assurances that the populations in the environment of the healthcare operations, who

are considered *not at risk*, will remain as such, instead of moving to the *at-risk* category or, worse, to the *sick* category, due to negative impacts of health facilities in their physical environment.

Gender awareness: These indicators are concerned with assessing whether the system observes and acknowledges needs and services according to gender considerations. External stakeholders with specific agendas on gender issues, and capacity for making surveys and disseminating information, are the ones often investing in them. Internally the system deploys them usually as reaction, directing internal attention when the system observes pressures coming from its social and political environment. Among the complexities which this indicator may try to avoid without eliminating them, it is worth mentioning cultural factors in which the system itself is immersed, influencing gendered perceptions, observations and communications. The formulation and use of these indicators reflect the overall interest and attention of society, and particularly vocal key stakeholders on gender issues.

Risk: These indicators have become relevant, as awareness of gender issues has been demonstrated to have influence over decision-making concerning many aspects of service provision affecting risk reduction aims. As a type of indicator within the typical effectiveness measurement, focusing on specific genders and respective needs, the indicator can provide clear orientation for risk reduction. In more practical terms, awareness of the needs of privacy and due respect for pregnant women during delivery or antenatal care examinations, for example, are relevant not only because of quality of care but also effectiveness, as better-standard services are more likely to achieve patients' adherence and compliance.

## Discussion

Before we start the discussion, it is important the reader realizes that this is not a textbook of indicators or a manual for fieldwork where indi-

cators need to be measured. This is a reflection on health systems' self-reference. Self-reference is self-observation – observation of how the system constitutes and deploys the meanings that are its prerogatives. We also indicate to the reader that in the concluding remarks section in the end of this chapter there is a brief subsection on risk and risk reduction, summarizing the topic.

Broadly speaking, in line with the Social Systems Theory, indicators are standardized narratives made and used by health systems for self-observation and self-description. Self-description includes all sorts of plans, projections, evaluations, reports, statistics, and analysis and so on about the system. The system needs the internally made narratives as decisive tools for its self-reference and reproduction. However, externally elaborated indicators are also relevant and are acknowledged as such, particularly where the system couples with other systems elaborating and making use of those indicators. But, in short, indicators are schemas for communications of condensed representations of a system's features, operations and attributes of interest.

Excellent examples of such narratives can be seen in the publications produced by the European Observatory of Health Systems in Transition. The publications have thorough assessments for each country case, with consistent interpretations of possible system problems to be addressed. The countries' health systems can find rich descriptions about themselves and use them in the construction of their own narratives. As these publications are elaborated with academic rigour, the countries in focus may need to select the themes and matters they can actually address and solve. The complexities portrayed in those publications constitute a potential hindrance for the use of the studies by countries with limited public health skills and resources. Countries do need to construct their own narratives about their respective systems, and those narratives often have to be deployed in political arenas where comprehensiveness needs to be reduced and complexity "tamed" (reduced).

When a system elaborates its own narratives, it is also concerned with communicating how other systems should see it. A health system orientated to exchanges with science systems may construct its own interpretations of data and complexities of the environment where it op-

erates. The system of politics may use indicators for political purposes and the economic system (for example, insurance organizations) may use health indicators for their business decisions. However, the health system decides whether or not and how far the indicators of external interests are relevant for it.

In general, indicators are constructed using combined efforts to reproduce meanings, explaining and justifying what the system is about and the results it achieves. They refer to the internal and external environments of the system, where its actions are expected to attain certain effects. In this fashion, indicators give form to the *problems* the health system tackles or intends to address (more on this later).

Indicators are employed to measure/describe conditions and selected types of activities, outcomes and levels of performances, in reference to those defined aims of the system. The measurements are related to actions and action conditions as well as effects and their factors and consequences. In this sense, indicators have time dimensions, with measurements of the recent past becoming a reference for future measurements, and are also supposed to indicate the "way ahead", clarifying the range of options the system (at different levels inside it) may consider and decide upon.

Essentially, indicators are based on distinctions, which specify, select and limit the fields of observation, and the elements to be taken into account or otherwise ignored. They become meaningful in their articulation, with self-reference constructions made by the system and therefore taken as guidance for possible actions. Outside these connections, indicators become useless and are forgotten by the system, even when some external stakeholders carry on valuing them.

The indicators therefore perform complexity reduction that is vital for the system. This is one of the important messages of this chapter. Indicators are pre-selected forms that are intended to capture the attention of the audience and make links to subsequent observations. Indicators narrow down the fields of observation to meaningful elements to focus on, and by doing so they reduce the complexities the system has to deal with.

In that way, indicators also signal the boundaries of the system, understood as selected meanings the system considers relevant. Beyond that, everything should remain unspecified. Therefore, indicators stabilize the structures and symbolic boundaries of the system.

At the same time, indicators project the image of the system as a unit, upon and about which the indicators bring to light a unifying vision. For the observing eyes (internal or external), the system to a great extent becomes what the indicators tell about it. We can say that indicators create the profile of the system, making it visible.

Once articulated, with targets and objectives the system sets for itself, indicators become guiding tools, creating expectations and acquiring normative force. The system recursively employs its selected indicators to conduct self-observations and make the corresponding narratives, reporting (or omitting) evaluations of successes or failures of plans and programmes designed with the guidance of the indicators.

Regardless, indicators can be interpreted or reinterpreted (or forgotten) by the system according to the identity the system wants to project. As mentioned above, the system also considers whether or not to pay attention and incorporate in its communications indicators produced by other systems (the science system for instance).

Indicators are thus designed, structured, calculated, used and updated in defined time scales. The system creates the time scale of the usefulness of the information contained in the indicators, the reliability of the observations and the validity of possible temporal comparisons.

There are multiple indicators, as we saw above. As may have become clear, it is not possible to reconcile all indicators, using them simultaneously, making all of them point in the same direction. There are trade-offs, as progress in an indicator may be achieved at the expense of progress in others, and there is great diversity of scope, with indicators focusing on specific operations, while on the other extreme, indicators address comprehensive features of the system. In the overall set of indicators, multiple values are at stake without necessarily having complementary or synergic mutual effects in any given situation or context.

Furthermore, and perhaps more importantly for our discussion, all indicators carry degrees of indeterminacy and *paradoxes*. When used for prescribing solutions at system level, the indeterminacy has to be somehow tackled or omitted. Meaningful indicators require selections of elements to be considered while discarding others. In that, at the same time they highlight certain aspects, and omit or hide others, which however may still return to be considered at later stages by other stakeholders.

The appearance of precision of indicators in fact disguises the indeterminacy. Indeterminacy arises in consequence of several factors: lack of data; imprecision in the data; complexity of the causal relations between the variables involved; gross simplification of factors and effects when comparing indicators across different contexts; pressures to make positive (or negative) reports, and so on. Often a lot remains unsaid or dismissed in order to attempt an effective use of indicators for some specific purpose of system representation.

For instance, indicators may be omitted in order to strengthen a certain specific intended message about the system. The inclusion of the selected out indicators would make the picture less clear. The deployment of complex arguments instead of achieving the desired reduction of complexity makes the messages difficult to understand. Such selections are therefore largely unavoidable. Indicators always have intentional purposes in line with the way the system portrays itself and expects to be recognized internally and externally. The system deals with expectations of how and whether the combined meanings of indicators are going to be scrutinized.

In short, the system needs to select which indicators it will pay attention to, as consideration of the full set of indicators would create complexities beyond the capacity of the system to handle. As already mentioned, the system may also pay intermittent attention to some indicators and concentrate only on a few for planning and policy-making purposes. Other indicators may be disregarded or remain outside the focus, although still valued and used by organizations outside the system, participating for instance in the science or the political systems.

Moreover, contingencies are relevant. Indicators remove contingencies from view, suggesting that no contingencies are at stake or even ex-

ist, and the indicators are expressing the reality of objective facts, pertinent therefore for the orientation of the system. But the choice of indicators is contingent (and can be different) and the measurements and methods can also be different, if other factors are included in the calculations or other perspectives are taken into account. However, the system assures itself that it is using the appropriate sets of indicators, adequately observed, measured and calculated.

A final general point concerns the links between indicators and the decision and actions based on them. Such links are not always straightforward, as is suggested in justifications for policies, plans and programmes. The objectives may need to be consistently pursued over the course of years until results are achieved. Health resources have a great deal of inertia and their allocations cannot be changed easily. Unfulfilled expectations based on indicators may require discrediting the original indicator. Causalities can be reinterpreted in line with new observations and techniques. Indicators therefore may carry the "seeds of doubt" into the future. This gives them a provisional and tentative nature and only temporary validity.

We can say that indicators hide ambiguities, and that is also one of their main roles, because no indicator has a definite answer about what the system is or has to do. Indicators indicate in different directions and it is always possible to find an indicator to recommend another course of action, even the opposite one. The system therefore has to make selections of indicators and keep the other possibilities out of sight. There are contingencies all around; contingencies, a term that often appears in Luhmann's texts, and we have mentioned a number of times in this book, points to the fact that something contingent is neither necessary nor impossible; therefore it can be different.

## Concluding remarks

Let's say an international development donor has XX million dollars to donate and/or lend to country Y's health sector. The money is already scheduled for disbursements. What is missing is the formulation of the

problem and activities to solve it. For that, teams of consultants are mobilized to develop preparatory analysis and documents, and among them narratives spelling out in detail the actual problem to be tackled. Then, indicators play a useful role.

Indicators draw the frames and the sketches by which the problems become visible. There are countless potential candidate problems; we can say that there is always an excess of possible problems. But a selection needs to be made, as resources are limited. The selected problem has to fit with previous decisions and policies, and somehow connect to what has been done previously. The indicators must show the way.

The donor will rely on consultants and the public health sub-system of the recipient country to establish the narratives with indicators, spelling out the operations. They know that throughout implementation, indicators will need to be constantly calculated and perhaps re-evaluated and reformulated.

Newer indicators may appear, as public health incorporates concepts and notions from other fields of knowledge. The implementers may see that the complexity increases, as the translation of plans into actions causes unforeseen factors and variables to emerge. Nevertheless, meaningful use of indicators carries recommendations for preserving the originally adopted guidance. The public health sub-system is well aware of the need to keep indicators narrowed down to those the system can handle and will remain relevant for communications with other organizations, particularly in this case the donor.

The public health sub-system is also well aware of the impossibility of combining all indicators; the excessive complexity would overwhelm the endeavour. Indicators hide ambiguities, as we discussed previously. No single indicator has a definite answer about what the system has to do, and they often indicate different directions. It is always possible to find or explore indicators recommending a different course of action. The system therefore selects the indicators it will work with, keeping the others out of sight. As we can see, finding and formulating problems is a problem in itself, and the indicators are part of the problem as well as the solution.

The academic world does not feel such pressure as it operates within the boundaries of the science system. Researchers do not feel the pressure to narrow down or decrease the formulation of new indicators because the academic world has a different approach to complexity. While it is relevant for academic papers to "embrace complexities" and bring new features and their indicators into the descriptions of the realities, the health system implementing programmes, facing constraints of all sorts, goes in the opposite direction; it wants to keep the narrowed-down range of indicators as they have already been incorporated along with the meanings deemed useful.

Furthermore, for the implementer, indicators should, as much as possible, not leave "empty connections" – that is, areas open to controversy. While controversies are welcome in the academic world, for the wealth of possibilities they bring about, they are not well received in the world of business and politics, especially after decisions have been made.

Indeed indicators are indispensable tools for framing problems, constructing solutions and following up implementation. But we need to understand that to put indicators to good use, the system has to reduce complexity, being careful in the selection it makes and the indicators it can rely on. The public health sub-system has to deal with the unavoidable uncertainties of indicators, the ambiguities of their joint indications and the difficulties with external observers to understand the indicators in light of the use made by the system, and not in accordance with their own agendas.

The use of indicators is supposed to be framing and solving problems, as well as eliminating or reducing chances of controversies about what the indicators themselves are. In the political arena, indicators, deemed reliable and truthful, are used in contested topics to assert positions defended by one side against the other, and may steer controversies in political disputes that are welcomed by one side but not much by the other. By choosing indicators, the managers of the health system select those that have highest chance to portray the system in a good light or make it easier for the system to progress, or blame others for

lack of progress. There is nothing in the indicators themselves that can prevent them from being used in such a manner.

International organization such as the WHO put on the table an overwhelming list of indicators to be considered and possibly adopted in the health systems of developing countries. The HSPA framework is an example of that. Indicators from the academic literature and the WHO are gathered. That hardly reflects the selection challenges the countries' health systems face. In the academic world, the formulation of indicators is very often disconnected from the task of concretely using them to formulate problems and monitor progress on the ground. Those who deal with the task of implementing activities over the years, making real measurements and incorporating them into objective problem-solving narratives, clearly see the differences between the two tasks.

## Risk

With the more empirically referenced discussions on risks related to the indicators in the previous sections we can now reflect on the concept of risk with theoretical intentions.

Public health departments in Ministries of Health as well as in academic, research institutions and international health organizations maintain under the umbrella of public health numerous approaches and concerns that we can say belong to knowledge and semantic fields that are preserve of the public health domain and orientation towards collective health risks.

On the other hand, we have also highlighted in this chapter that public health has no "property" over conceptual constructs and methodological practices belonging to scientific and technical fields on which public health cannot properly reflect, criticize and change, because it does not have comprehensive command of those fields and their particular semantics and conceptual structures. Nevertheless, imported concepts are often used and become part of public health conversation, sometimes to the detriment of its core business of finding, defining, addressing, observing, measuring and acting on health risks and health-risk factors.

We therefore advocate that public health needs to continuously go back to its "soul", which is to say, go back to the business of dealing with collective health risks and health-risk factors. Such self-reflection is needed and has to be kept as part of the self-reference of the public health sub-system.

With these introductory notes, we can now talk about the notion of *risk* and its specificity. First we talk about Luhmann's conceptual works on *risk* and then we conclude with our "take-home messages".

## Luhmann's approach to risk

In his book *Risk: A Sociological Theory* (2008b), Luhmann approaches risk with a different orientation in comparison with our view of risk as chances of negative health events, mostly involuntary, unrelated and independent from any purposeful risk-taking decisions by individuals and communities, eventually finding themselves suffering or under threat of suffering health losses.

From his sociological perspective, Luhmann studied risk as the consequence of and embedded in actors' decisions, where risks are weighted and considered in antecedent decision-making – when for instance enterprises deal with the potential profits or losses of their decisions. On the other hand, we have looked at risk as mainly determined by natural events – that is, the organic development of diseases related to an universe of factors whereby decision plays only indirect, unintended, involuntary or no role at all.

No one gets sick by their own choice, even allowing for self-harm, where subsequent bodily disorders follow their own organic, often unknown causality paths, unsubordinated by and/or indifferent to the original intentions of self-harm. Similarly, some philosophical schools of thought indicate that no one commits suicide knowing what the after death will be like.

Of crucial relevance in his text, Luhmann draws a distinction between *risk* and *danger*, where *risk* implies decisions and the consequences of what actors decided, and in contrast, *danger* comprehends the probabilities of negative events brought about by the environment

(nature especially), over which the systems and individuals have no determination or even awareness.

We could say that Luhmann's concept of danger does not sound appropriate for our concerns with the health thematic. The connotations of the term danger are loaded with the sense of peril and threat linked to meanings of severity of consequences (such as in earthquakes and natural disasters) that are not always the case in healthcare. Danger implies life-threatening conditions. This does make the term unsuitable for deploying in health systems communication to replace the usual employment of the term risk, which tolerates a diversity of degrees and specifications. No one will treat a mild fever in an otherwise healthy teenager as a sign of danger. Health risk terms have already been incorporated for many decades in the public health and epidemiological jargon, and signify anything that may justify getting the attention of a health professional.

In this sense, public health professionals easily accept and understand that being *at risk* is not always a danger nor a matter of choice for the patient or those exposed to risk factors; therefore, it is not at all similar to an entrepreneur who makes "risky" investment decisions with the possibility of negative returns on the invested money.

We can further argue that even a chain smoker, who despite all warnings about the risks of developing lung disease still carries on smoking, thus staying in the *at-risk* position, cannot be compared to a reckless adventurous entrepreneur. The chain smoker can claim to have seen many of his non-smokers friends dying of lung diseases while he is perfectly fine. Although uncertainties exist on the horizons of the entrepreneurs making conscious decisions of risky investments, uncertainties for the smoker are much greater. The smoker faces a lottery with a diverse range of undesirable outcomes, which cannot be selected, predicted or protected against. On the other hand, the entrepreneur faces only a range of possible losses (still with optional protective hedging mechanisms) but also the prospect of the desired gains, within clearer time frames. So the structures of the gambles are very different. They are so different that we can defend our decision not to use the term "risk" with the same meaning as Luhmann does. We believe Luhmann would not be offended as he

acknowledges in his book that the word "*risk*" has many denotations and connotations in different fields of science.

In the health field, as public health works have demonstrated, health risk structures are consequences of many possible factors, hierarchies and temporal sequences of related factors. These include genetic predisposition; temporary vulnerability; circumstantial weakness of the body; lack of prevention; exposure to harmful substances; contact with pathogens (be it from other individuals or vectors); unavailability of diagnosis and treatments; low-quality treatments; lack of response to treatments; comorbidities; mistakes. To these factors, basically involving organic-level causalities, there are several sets of influencing factors with no biological determination but strong influence and conditioning power, making possible and often triggering the organic causalities; this is where social determinants of health appear. The complexities of the risk structures are clearly reflected in the variety of public health indicators we discussed in this chapter, with each indicator aiming at risk and risk reduction possibilities with different horizons and approaches, some addressing organic causalities and others orientated to social determinants.

Luhmann reflects on the position of the observers: the first-order observer as the one who makes the risky decisions, and the second-order observer the one who observes the first one deciding. In relation to health, say the second-order observer picks the distinction *at risk*/*not at risk* for observing, possibly seeing retrospectively how those who developed conditions became at some point *at risk* without acknowledging or choosing it.

From our perspective, also in relation to health, one would prefer to remain *not at risk*, and may have even made efforts with that purpose, but often the negative outcome comes unannounced and by its own causal determinations. Decision-making influences in these processes are often only marginal. The observer, on the other hand, considers whether or not something is a risk, exposure to risk, or risk factor; the observed (at risk or not at risk), on the other hand, frequently does not know whether they have options to pick up from. We will return to this point later.

In spite of these nuances of conceptual divergences, Luhmann's reflections on risk bring highly valuable insights to our discussion. The prominence he gives to the observer and point of observation of risks is highly relevant for us. In his view, the concept of risk does not indicate a fact independent from the observer. Whether the observer is the one making decisions on risky matters (the entrepreneurs), or the ones suffering as victims of unpredictable infections (the patients or collectives), risk requires an observer that defines it as such. In that we are on the same page.

Luhmann calls attention to the attributions that accompany the observation of risk; attributions of presence and strengths of causal factors; and the conditions where decisions are made. Although decision does not play a significant role in our approach to health risks, we can still recognize that the attribution exercise requires decisions by the second-order observer, who tracks the conditions of the identified risks and constructs the explanations and preventive interventions.

In fact, defining risks of undesirable health events is expected to come together with, however imprecise, explanations about the causal factors and possible solutions. To be clear, the second-order observer in our case is the health professional dealing with the risks of those who are sick or *at risk* of becoming sick (or their sickness worsening).

Pointedly, Luhmann also talks about prevention and how prevention is expected to affect risk and risk assessments, and the risk of having preventive actions with desirable effects, or not. These considerations fit well the discussions about health risks and preventive care, where the notion of "avoidance" becomes part of the characterization of risk, or more precisely the constitution of the notion of avoidable or preventable illnesses. This is relevant for the public health conception of risk, where the priority is to search for avoidance strategies as close as possible to the organic causality level (vaccination, prophylaxis, disinfection, elimination of vectors, education about healthy lifestyle, prompt access to healthcare services, and so on).

Furthermore, Luhmann highlights the importance of the time dimension in the construction of ideas of risk and related expectations and prevention. His discussions about time are of fundamental importance

for grasping key features of public health. We can exemplify time as a relevant dimension in the following senses: as the frame wherein risk can be traced from the onset of trends; as the identifier of limits; as the interval between the start of prevention and its expected effects; as the estimated transition to and from *at-risk* and to and from *not-at-risk* positions, and so on. We may say that public health exists because individuals can move from *at-risk* to *not-at-risk* positions, or be prevented from moving in the opposite direction. However tentative the predictions and the estimations of these passages might be, unavoidably such moves require time.

The meaning of risk therefore implies a time dimension where the actual risk is an index pointing at the future where the foreseen risk factors are expected to produce the undesirable negative events. We could say that risk is the present tense of a verb to be conjugated in the future tense (the disease might happen, the treatments might not be effective, the patients might die, and so on). Addressing something as a risk is an attempt to reduce the uncertainties about the future with indications from the past. Interventions aiming at reducing risks of future occurrences are carried out over the current forms of the identified factors, as they were or are observed in the recent past and/or in the present (which is already rapidly joining the past). The approach takes for granted the permanence of the factors, and the permanence of the factors' power and influence.

Perhaps more accurately, we can say: (a) we estimate in the present the risks of the past and assume our estimates are still valid in the present and will remain valid in the future; (b) we estimate the risk of the future based on the projections made with expectations of results of interventions and/or planned or otherwise fortuitous changes in risk factors. We do not know for sure the actual risk in this very present (we only have an echo coming from the past), and even more so the risks of the future.

Still on the time dimension, because risk is the risk of being a "victim" of what has not yet happened, although based on or understood from what has indeed happened earlier, by tackling risk, the public health subsystem is aiming at tackling what hasn't yet happened. Dealing with uncertainties in the time dimension, public health faces difficulties in pre-

cisely knowing whether it succeeds or fails in consequence of its actions or inactions, and its adopted or not conceptions of causality. Threatening paradoxes may carry on hovering above.

For a concrete example, let's consider mathematical simulations forecasting numbers of malaria cases in a given population, considering factors currently known and their respective relations and strengths. The simulated interventions may then be put in practice according to the constructed scenarios. The future will still remain uncertain. Then, when the future becomes present, it will be possible to compare the predictions with the facts. Most likely, there will be surprises. For one thing, among the possible variations, the intervention might largely differ from the planned one. Interventions often do not fully comply with plans, or results with expectations. So, for public health there is always a good deal of "business risk" in believing health risks predictions.

In this sense, dealing with and responding to expectations related to risk puts one in a tricky position. No surprise then that many works considered as public health in fact apply notions from other fields of knowledge where risk remains unaddressed. In this sense, risk is an unforgiving topic. We say again that risk is not observable; it is only suggested, contingent, inferred, because when risk is identified using the available data, it is already in the past, referring to the past, and therefore no longer observable as a current on-going "object". In contrast with an actual disease precisely detected in an actual body (which medicine concretely observes), collective risks are only assumed (within "helpful" confidence intervals).

Luhmann (2008b, p 42) notes: "There is no longer an objective vantage point for correct evaluation", and, we add, for risk. By correct, we understand he meant precise and objective evaluation. A few more useful sentences:

> "With hindsight, we evaluate risk in terms of whether a loss has occurred or not." (p. 42)

> "And from the future another present stares us in the face in which we will in retrospect certainly come to a different appraisal of the risk situation we are experiencing in the present." (p. 42)

> "It has to reckon with too many possible systems states." (p. 43)

In short, decisions have to be made about how to define and construct the risks of what will happen in the future. We have then to wait until then to see whether our predictions were correct or not, nevertheless remaining aware of the fact that the actions we currently take in line with our predictions may (or may not) have significant effects on the chances of the future occurrences.

We cannot do justice here to all the points Luhmann addressed in his book. It would require at least a whole chapter, or even perhaps a book. Before finishing though, we can mention his reflections on the late appearance of the concepts of risk, which from a historical point of view certainly has had an important influence on the emergence of public health, as a discipline and practice essentially based on the notion of observing, tackling and preventing risks within limited time frames. Risk is risk only in a time frame. Currently, the time dimensions of risk are part of the notion of health risks, but risk remains a complex concept, for not being self-evident and for its constructivist nature. Public health will certainly progress by devising forms and approaches to tackle risk and its time dimensions.

## Take-home messages

Finally, we summarize our understanding of indicators as reflected in this chapter. Indicators are schemas of observation operating with distinctions. Those distinctions make forms appear in the medium of society (a semantic medium, we should keep in mind), ultimately constructing forms in terms of risks of becoming ill and dying. Even when the indicators seem apparently not to be talking specifically about risk, as for instance the indicators about organization, voice and accountability, and

others do, they indirectly are still addressing problems of health risk or intending to frame risk reduction possibilities, even if only tentatively.

Those examples (communities with *voice* demanding *accountability*, and *organizations* of services that can offer larger coverage and efficient health services) are to be judged for the benefits they bring for the health of the population; or, in other words, the decrease of risks of getting sick and/or dying. In the end any judgement about any indicator is to be made according to their contribution to understanding better the risks for the population and how they can be reduced. In all senses, the public health self-definition is about being in charge of the understanding and tackling of health risks.

Public health must not lose track of its domains: risk and risk factors. If something is recognized as a health risk, public health needs to say and do something about it. Furthermore, being the interface with the other systems, the political system included, public health will explain how "risky" the risk is and what can be done about it. Still "troubled" with uncertainties, public health will need to present the problems related to risks to relevant concerned individuals, systems and organizations, which may not yet have understood properly the unavoidability of uncertainties.