PHIRI
Population Health Information
Research Infrastructure

The compact guide to public health foresight

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Foreword

This 'compact guide to public health foresight' was developed within the PHIRI (Population Health Information Research Infrastructure) project.

The guide provides an introduction to all aspects of public health foresight studies and fills a gap that has become more apparent since the SARS-CoV-2 pandemic. Public health foresight studies may provide valuable information for decision makers to develop strategies and implement present day actions aiming at healthier futures. It may be more important than ever to deploy foresight methodology to systematically explore the future in order to bend it in a favourable direction.

Using a structured approach, this guide is the basis for researchers who are new to the field of foresight and interested in developing their own public health foresight study. This guide may also assist policy makers in understanding the foresight process and the need to include foresight in the policy cycle, to support evidence-informed policy making.

With this guide, the reader has a compact explanation of each of the components of a foresight study easily at hand. In addition, the guide provides examples and references that lead readers to additional detailed information. Readers can also make use of the explanatory videos available via the PHIRI website and developed as part of the PHIRI 'Foresight Capacity Building Course'.

Public health foresight

Public health foresight is a systematic, participatory, and vision-building process that explores the future to anticipate trends and support present-day actions in the area of public health.

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Table of content

The compact guide to public health foresight 3
I. Contextual information 3
A. Resources 3
B. Governance 3
II. Objective 4
III. Main target groups 6
IV. Conceptual model 6
V. Indicators 8
VI. Driving Forces 9
VII. Time horizon 10
VIII. Spatial unit 11
IX. Identifying (most important) uncertainties 12
X. Scenario logics 13
XI. Scenario type 15
A. Quantitative 15
B. Qualitative 15
XII. Stakeholders 16
A. Importance of Stakeholders 16
B. Identification of Stakeholders 16
C. Selection of Stakeholders 17
XIII. Data 18
A. National Data 18
B. European data 18
XIV. Tools and instruments 19
XV. Projection methods 20
XVI. Communication strategy 21
XVII. Communication Products 22
XVIII. Uptake of results and evaluation 24
References and Reading Materials 26
About this work 28
Disclaimer 28

The compact guide to public health foresight

This guide considers 18 aspects of developing and conducting a public health foresight study. These are part of an iterative process.

I. Contextual information

A. Resources

To do a Public Health Foresight Study (PFHS) you will need resources. The number and type of resources needed depends on the scope of your study. For instance, addressing a single topic requires far less resources than addressing a public health issue in a more integrated way, accounting for a wide range of determinants and health outcomes. A single topic study could focus on, for example, lung cancer in relation to smoking. A study with an integrated approach about, for example, population health status addressing physical and mental health and their underlying determinants, will obviously require more resources.

Resources that are necessary in a foresight study include, but are not limited to:

- A project team: the team should include professionals with (basic) knowledge on epidemiology, demography, and public health as a minimum requirement. Additionally, the involvement of a communication or knowledge translation expert from the beginning onwards, to start thinking about products and messages already in an early stage, is recommendable.
- (External) experts: to cover expertise on different topics such as statistics, analyses, diseases, that is not provided by the project team members.
- Access to data: preferably access to national data sources and support to assess quality of the data.
- Time: the lead time of a foresight study can vary from 3-6 months till multiple years.
- Financial resources: a budget is needed which size corresponds with how much of the resources described above are needed.

Examples

The Dutch PHFS is being funded by the Dutch Ministry of Health (MoH) and (usually) covers four-year cycles. The number of people that contribute to this foresight study is about 40-50, with a diversity in background (such as epidemiology, mathematics, demography, communication, medical doctors, public health) [1]. Their contribution varies greatly in intensity, generally speaking about 5-8 fte are involved per year.

Fresher was multiyear project was funded by the EU Horizon 2020 project. It had a budget of 2.6 million euro and involved many partners [2].

B. Governance

Next to a project team, additional governance structures might be required to properly manage the daily activities of a foresight study. These can be internal, i.e. within your organization, or external.

A formal external governance structure can be very valuable for your foresight study as it can contribute to the validation of the method and results, support the conclusions, and increase policy relevance and use. Options for these are a formal scientific committee and a policy-oriented committee. To enhance societal relevance of your study there is a possibility to create a societal community which overarches the scientific and policy structures and includes a large diversity of societal organizations representing different groups (e.g. patients, elderly, migrants, health professionals, private sector). Internal structures may have the advantage of having relatively direct and to-the-point discussions, with people familiar to you.

The specific needs of your study and the availability of resources will contribute to the choice of engaging with an external governance structure or opt for more ad-hoc consultations of different experts, policy makers or societal organizations, which require less resources.

If your foresight study has a specific mandate, it will be easier to gain support for your governance structures and eventually also to get your results into the policy cycle.

Examples
In the Dutch PHFS, several Advisory Boards are involved. These are: Advisory Board National Institute for Public Health and the Environment (RIVM) (internal advisory board); PHFS Community (external stakeholders); Scientific Community (subgroup of PHFS Community, scientists/experts) and Policy Advisory Board (Ministry of Health, Welfare and Sport as well as other Ministries) [1].

The National Institute for Public Health and the Environment of the Netherlands has in its law (article 3) a specific mandate to periodically report to the Ministry of Health on the status and future development of public health and the environment [3].

II. Objective

Defining the objectives for conducting a foresight study is one of the first steps to take. The future can be very broad, and it is advisable that you narrow down the focus of the study. It is therefore important to frame the issue that the study will address. This step also clarifies “why” the foresight study is being done.

Defining the objective is one of the key steps to a successful study and requires sufficient time and effort. A clear definition of the objective enables a clearer course for the entire study. Ideally, this step should be articulated in collaboration with stakeholders (see more details in chapter XII). It is also useful to be as specific as possible about the objectives of the foresight study. Therefore, defining the objectives along the lines of topic, main issue and sub-issue(s), going from a higher to lower levels of abstraction, helps to make the objectives more concrete (Figure 1). The distinction between these aspects cannot always be made in a clear manner and following this approach should be regarded as a heuristic to support the specification of your objectives.

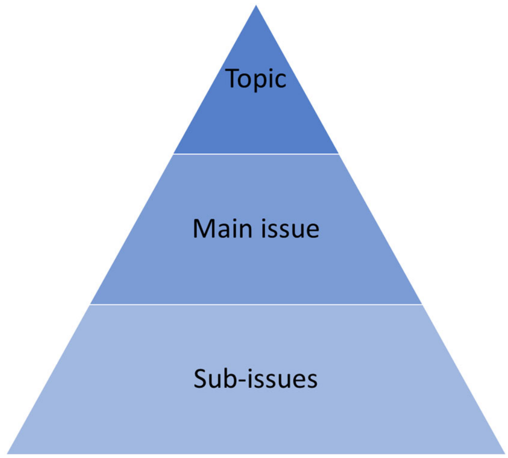

Figure 1. Defining the objective for the foresight study going from higher to lower levels of abstraction
Source: the Authors

- **Topic**: The topic indicates the area or field of study. This should be comprehensive and allow you to subsequently define the main problem areas and possible trends and uncertainties. In Public Health studies, these topics can come from a variety of research fields, such as environmental, healthcare, behaviour, and specific diseases.

- **Main issue**: The main issue specifies what the main focal point or main question to be addressed in the foresight study. It can be for example: "what is the future environmental burden of disease of pollution?", or "how will population health develop after the COVID-19 pandemic?" or "what are possible future personnel shortages in the health care sector?".

- **Sub issues**: With the general issue defined, the next step is to further specify the focus of the foresight study. These sub-issues guide the study further for the next step to be taken (e.g. regarding the scope, driving forces). For the examples listed under the main issue it could be: "how does air pollution impact burden of disease, and what will be the effect of possible clean energy initiatives?", "what will be the impacts of a changed lifestyle and will mental health be affected structurally?" and "what are the training efforts necessary to tackle shortages?" or "what are possible health impacts of future shortages?".

Examples

To illustrate the above, we present two studies with the objectives (topic, general and specific issue) identified.

"Healthcare in Europe 2040: Scenarios and implications for digestive and liver diseases" by United European Gastroenterology Research in 2014 [4]

- **Topic**: Healthcare
- **General Issue**: Future delivery of health care related to digestive and liver diseases
- **Sub Issues**: Implications for patients and doctors regarding gastrointestinal diseases.

"Looking beyond COVID-19, about the future of our health" by RIVM in 2020 [5, 6]

- **Topic**: Population Health
- **General Issue**: Direct and indirect impacts of COVID-19 on population health
- **Sub Issues**: Mental health, lifestyles, health care, local living environments

III. Main target groups

The specification of the main target group is closely linked to the aim of the foresight study. Often, a foresight study is commissioned, for example by the Ministry of Health, which defines the primary target group. There may also be other potential target groups than the commissioning client. The target group specification is a specification of who our intended users of the (results of the) study are. These target groups or potential users can be, next to the commissioning client, the general public, fellow researchers and/or societal organizations. The target group in a foresight study can be either fairly general such as elderly, teenagers, mothers, children; or more specific, for example: consumers of specific brands, decision-makers, groups of health professionals, etc.

The target groups are not to be confused with the stakeholders (see section XII). Whereas target groups are usually also included as stakeholders in a foresight study, the group of stakeholders is usually much broader. Stakeholders have some kind of 'stake' to protect and promote, a target group is the one whom we expect to act upon the studies' results.

Examples

In the study: A scenario-planning approach to human resources for health: the case of community pharmacists in Portugal, three main target groups were identified for each of the three future scenarios for the Portuguese community pharmacists, who were researchers, pharmacists and general practitioners [7].

The main target group for the Dutch PHFS is formed by policy makers, at the national and subnational level. However, the information is also used by various organizations, for example Diabetes research fund, as an information source for future developments in relation to diabetes. Also, results are often used in education, though this is not formally defined as a target group [1].

IV. Conceptual model

When doing a foresight study, it is advisable to use a conceptual model. This can be an existing one or you can develop one. According to *Elangovan & Rajendran* (2015), a conceptual model is a "*framework that is initially used in research to outline the possible courses of action or to present an idea or thought*" [8].

The conceptual model in a foresight study is a tool to analyse the interaction of the chosen topic/issue with other aspects that may influence it. Therefore, the process of building a conceptual model allows you to understand the scientific framework of the topic and subsequently facilitate the definition of the objective and the identification of driving forces. With the conceptual model, the identified areas also allow you to predict the type/logic of scenarios that will be used (i.e. certain fields are more suited to qualitative and/or qualitative scenarios).

Conceptual models are built by exploring the environment and context in which the study is conducted. This can be achieved through stakeholder collaboration or through literature reviews, or even, studies dedicated to context exploration.

Examples

One example is a study conducted by *Gregório et al* (2014) in Portugal, where the conceptual model identified that community pharmacies are also influenced by several facets such as hospitals, the pharmaceutical industry, wholesale distributors, private providers, patients, and primary healthcare [7]. In this study, the conceptual model was developed through stakeholder input. During a workshop, the group discussed which areas influence the role of community pharmacists and their impact on health services. After the analysis of the findings and a literature review the research team developed a conceptual framework (Figure 2) where the driving forces for this study could be identified.

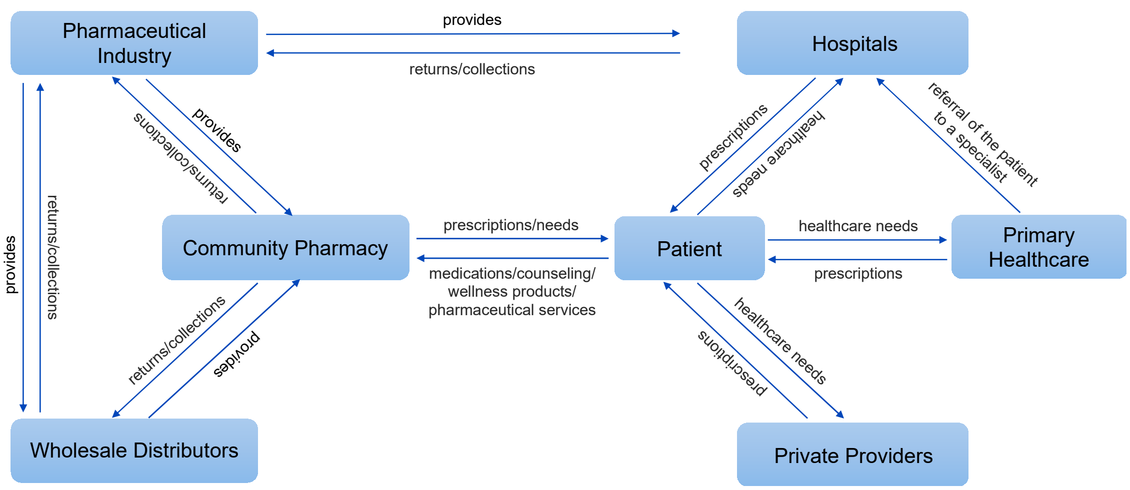

Figure 2. Example of a conceptual model about the community pharmacy context in Portugal.
Source: Gregório, J., Cavaco, A., & Velez Lapão, L. (2014). [7]

Another example is the conceptual model/framework that is used in the Dutch public health foresight study, see Figure 3. This model has its origin in the Lalonde report that was published in 1974 and has been refined since the first PHFS in 1993. In the latest version, COVID-19 was included [9].

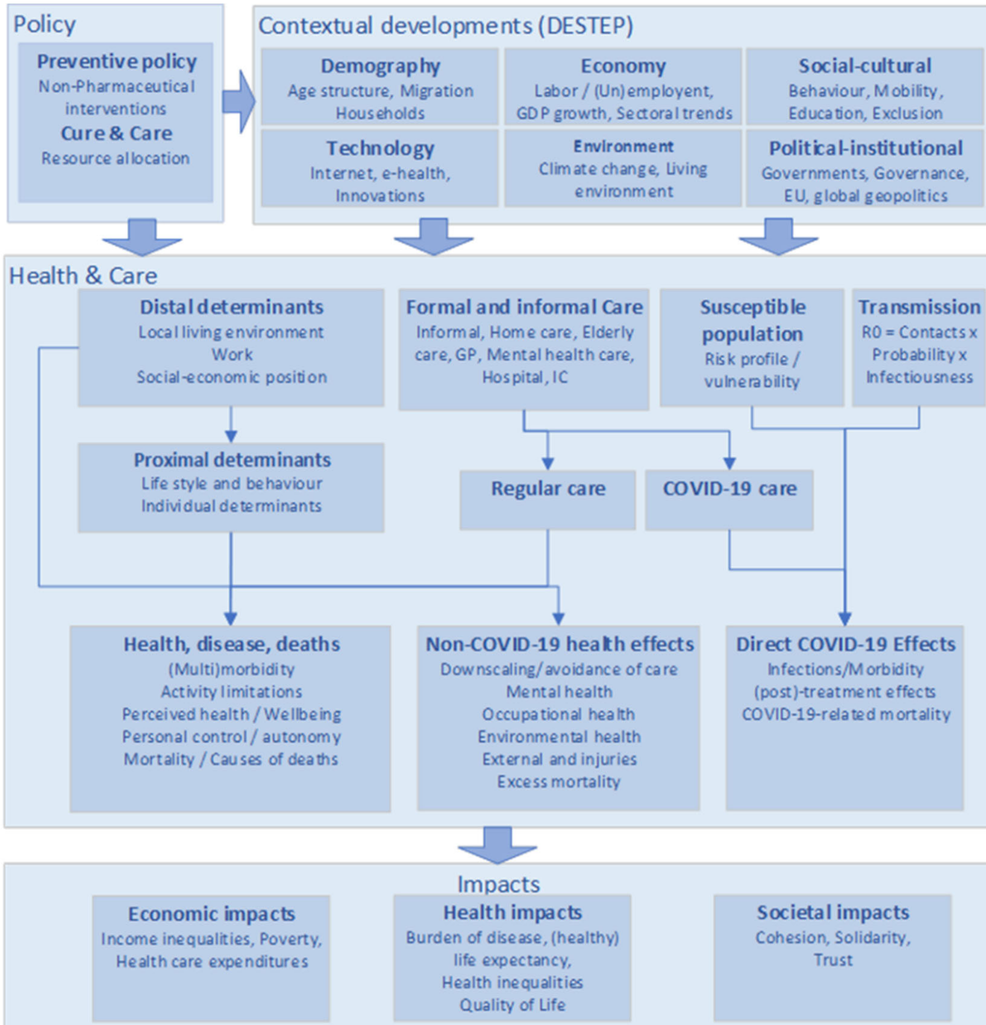

Figure 3: Conceptual model used to understand the wider impacts of the COVID-19 pandemic
Source: the Authors

V. Indicators

Whereas the conceptual model explores or helps to understand how the different themes in your study are related to each other, indicators make the model more concrete. In other words: an indicator provides a operationalization and quantification of a conceptual model. It is good to note that not all facets included in a conceptual model might have a fully corresponding indicator. This requires that you might have to choose for other available indicators which are then a proxy for the intended one. For example, the COVID-19 pandemic has resulted in downscaling of non-COVID-19 health care; this can be made visible e.g. via measuring waiting times, patient-reported experience measures (PREMS) or mortality from diseases other than COVID-19. The pandemic has also affected personal behavior, which may be quantified e.g. via measuring alcohol consumption or physical activity.

It is important to accompany indicators by clear and structured metadata, i.e. an overview of information that helps interpret the indicator, such as its calculation method, data source, unit of time, reference population, validity, policy relevance. For example, when measuring non-COVID-19 mortality, the ICD-codes need to be defined; when measuring alcohol consumption one needs to know if data comes from administrative sources measuring general consumption (liter of pure alcohol a day) or from surveys measuring hazardous consumption with a certain cut-off point and unit of time (e.g. ≥60 g of pure alcohol on ≥ 1 occasion weekly or in the past 30 days). Examples of indicator metadata are the ECHI documentation sheet [10] and the WHO Indicator Metadata Registry [11].

For purposes of international monitoring and comparisons, international indicator sets have been developed. Next to strictly national sources, these can be consulted to find the right indicators for your study. Examples are the Sustainable Development Goals (SDG), the dashboard of EU youth indicators, European Core Health Indicators (ECHI), OECD Health Statistics, and the WHO European Program of Work Measurement Framework (EPW-MF).

Indicators usually measure single concepts but may also measure multidimensional concepts; they are then said to be 'composite indicators'. Examples are healthy life years (HLY) and disability adjusted life years (DALY). A DALY combines the years that people live in ill health and the years they lose due to premature mortality, and thereby quantifies health loss (the 'burden' caused by disease).

There are different ways of organizing indicators. One useful option for public health is by distinguishing the following 4 categories:

- Inputs and processes (e.g. governance, health workforce, investments)
- Outputs (e.g. prevention programmes, quality, safety, access)
- Outcomes (e.g. risk factors, behaviors)
- Impacts (health status, responsiveness).

Examples
Most foresight studies have extensive sets of indicators. Instead of giving these examples it is more helpful to have a good understanding of how indicators are being selected and used. The following two sources provide valuable information on this [12, 13]:

- Structuring Health Information: Frameworks, Models and Indicators.
- Strengthening population health surveillance: a tool for selecting indicators to signal and monitor the wider effects of the COVID-19 pandemic.

VI. Driving Forces

An important part of doing a foresight study is to identify the main driving forces: factors or determinants that influence the processes and the topic that the study is focused on. Subsequently, the trends that influence the driving forces can be identified. The driving forces should be - if possible - cross-ranked in terms of importance and uncertainty. One common method to identify trends and cross-rank them is the DESTEP method, as described below.

A common method for **trend identification** is the application of the DESTEP method (Demographic, Economic, Social-cultural, Technological, Ecological, Political-judicial) method [14]. This method covers trends in demography, economy, society-culture, technology, ecology, and political/-institutions. The DESTEP analysis aims to identify a broad range of future trends in order to select the main driving forces that influence the topic at hand in your foresight study. There are also other variants such as PESTLE, STEEPLED where the categories Legal and Ethics are used. For public health foresight studies, the DESTEP method has proven to be very useful, though if ethical or legal issues play a role, you can use another variant. Keep in mind that the main purpose of applying the DESTEP method is to have a wide and diverse inventory of relevant future trends.

An inventory of the DESTEP Trends is usually done by performing a desk study (via a scoping literature review or reviewing reports on trends) that can result in a long list of possible relevant trends. After the desk study, it is recommended to involve others (e.g. relevant stakeholders) to validate if you have listed all relevant trends and as a second step, to select the most important ones based on input from stakeholders. This can be done based on impact and uncertainty as described below.

Impact

After having obtained the long list of relevant driving forces, you could choose to select the most important ones to be included in your foresight study by ranking the driving forces by relevance, i.e. how much impact they may have on the outcomes. Preferably, this is done in a participative manner, with the involvement of stakeholders, for example, via workshops. The relevance can, of course, differ according to your personal assessment regarding future trends and outcomes.

Uncertainty

Driving forces can also be ranked according to their (perceived) uncertainty or likelihood. It is good to realize that ranking these trends by uncertainty, which is preferably done in collaboration with stakeholders, represents different facets. It can comprise the likelihood of occurring (e.g. a technological breakthrough), or the assumed impacts it might have on the outcomes of your study (e.g. deviating perceptions on how future income inequalities may affect health outcomes), or even deviating ideas about what is an important outcome. People might think and value diverse outcomes differently (e.g. health, health inequalities or health care expenditures), and accordingly, also rank uncertainties in driving forces differently.
It is therefore useful to make an explicit distinction between cognitive uncertainties - those related to limited knowledge - and normative uncertainties - those related to norms and values (see also Section IX).

Examples

The Dutch PHFS uses a DESTEP approach as inventory for the most important driving forces [15].

Another example is the EURO-HEALTHY project which applied the PESTLE approach. They have distinguished the Legal category among the driving forces, representing EU Environmental policies and regulations [16].

VII. Time horizon

The time horizon specifies the period that you consider in your foresight study. A foresight study usually covers each year of the future projection period (i.e. the period between the base year and the time horizon). This gives insight not only in the future state in a particular year in the future, but also the path of the whole projection period towards that state. The choice for a time horizon depends on the topic that you want to address. In general, the further the time horizon, the greater the uncertainty one has to acknowledge.

For example, in public health foresight, ageing often plays a dominant role. Addressing the process of ageing and the impacts on, for example, non-communicable diseases (NCD's) of which prevalence increases with age, can be related to the "baby boom" generations in European countries. Therefore, an appropriate time horizon could be 20-25 years from now, when the baby boom generation is reaching old age. However, if you want to analyze the health impacts of a smoke-free generation, an even further time horizon is required since the positive effects of no smoking might mostly be seen after at least 50 years. Also topics like climate change or urban planning require a further time horizon (e.g. 2050 or 2100) is required. Other topics, such as technology or the impact of COVID-19, should probably be considered in a shorter time horizon, such as 5 years from now. Combining different time horizons is also an option, though this can also cause some confusion if this results in different policy messages. This implies that for different time horizons different policy targets may apply, possibly resulting in different intervention strategies.

Examples
There are some examples of a time horizon of 20-25 years such as the Dutch PHFS (published in 2018, updated in 2020) [5] and the Liver and digestive disease study with a time horizon of 2040 [4]. The Fresher project used a time horizon of 2050 [2].

VIII. Spatial unit

Spatial unit refers to the geographical unit of analyses and outreach of your study. As shown in Figure 4, your foresight study could cover public health at a local, regional, national, or international/global level. The choice for the spatial unit of your foresight study partly depends on who is commissioning the study (e.g. national government, local authorities, etc.) and the topics you want to address in your study. Data availability might also play a role, though it will not be the primary concern in this phase (see data in section XIII).

For example, addressing (national) healthcare expenditures requires a different geographical level compared to the local living environment of a city or a village. However, these levels are often (inter)connected. For examples, climate change has a strong global character; however, impacts might be particularly felt on a local scale in areas that are prone to climate change.

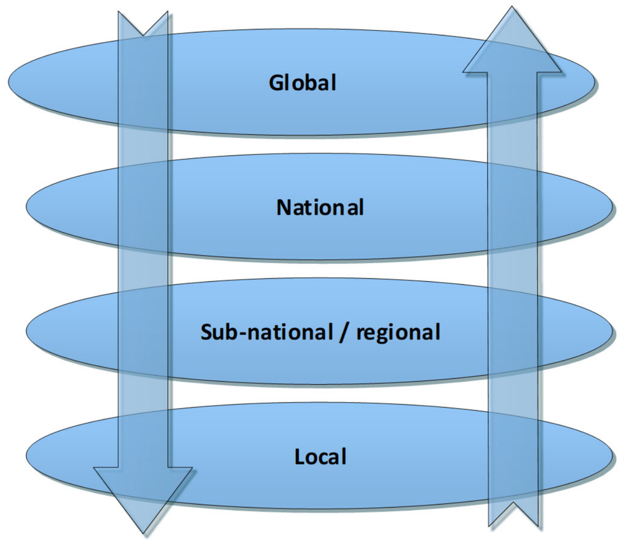

Figure 4. Interconnection of different geographical levels
Source: Adapted from Hilderink et al. (2018) [17]

IX. Identifying (most important) uncertainties

Often, foresight studies make use of a large variety of data sources, information and knowledge, each of them having its own uncertainties. Under the DESTEP methodology (see Section VI), two important aspects of uncertainty are listed related to driving forces, namely: limited knowledge (strength of evidence, dose-response relationships, economic growth, technology) and normative uncertainties (different norms and values, desires and ideas within society and politics). A third aspect of uncertainty, the statistical uncertainty (for example: in registrations, underlying data, sample size of studies) can also be of relevance. You can handle statistical uncertainty by including distributions instead of point estimates. Also, sensitivity analyses can be performed to explore which uncertainties have most impact, and in what direction potential changes in parameter values affect to overall outcome. It is important not to vary all different aspects of uncertainty at the same time.

As mentioned previously, in the DESTEP method, emphasis has been put on the cognitive uncertainties, i.e. limited knowledge about possible future trends and their impacts. It is good to realise that normative uncertainties, such as what people value most, is already playing an implicit role since the relevance of the trends depends on what people value as important outcome measures. It is important to make these normative uncertainties also explicit. Especially in the field of public health, where people might think differently about what they value most and on what they consider “good health”, normative uncertainties can be very relevant, for example for the choice of policy strategies to improve health.

Examples
There are still only a few examples of Foresight studies that explicitly distinguish normative uncertainties. One example is the Dutch PHFS-2014. The methodology applied in this study stems from a study done by Netherlands Scientific Council for Government Policy that elaborately describes these normative uncertainties [18, 19].

“Healthcare in Europe 2040: Scenarios and implications for digestive and liver diseases” – Using the contextual and environmental framework, the factors most likely to influence healthcare in 2040 were identified. Through a participative process through debate and discussion, the key uncertainties were identified envisioning how these might evolve in the future [4].

X. Scenario logics

Based on the main trends and driving forces identified through the DESTEP methodology, you can make the choice for certain scenario logics. The level and type of uncertainties that are relevant for the selected driving forces are important in informing this choice. You also have a choice in how many scenarios you are going to define in your foresight study. The more uncertainties that are identified as relevant, the more combinations are possible, possibly resulting in 4 or more scenarios. Here, we describe the most common scenario logics.

When there is one dominant uncertainty, the choice can be made for a *high-low* or *best-case/worst case* scenarios - thus resulting in 2 scenarios. It can easily be expanded by defining another scenario in between, resulting in a more varied way of describing different futures. The disadvantage of choosing 3 scenarios is that a user often tends to focus on the middle scenario and pays less attention to the more extreme ones which might be as or even more relevant for the user.

One particular methodology applied in previous decades, with the Intergovernmental Panel on Climate Change (IPCC) as one of the first and most prominent one, is to select two main uncertainties and combine them as *two axes* resulting in 4 quadrants [20], see Figure 5. This can only be done when two uncertainties can be clearly distinguished as the most important ones. Also, combining these uncertainties assumes a high level of independency between these two uncertainties.

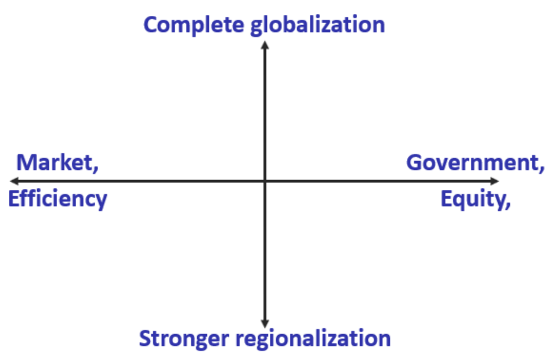

Figure 5. Example of a two-axis approach.
Source: Intergovernmental Panel on Climate Change (IPCC) [20]

Selecting two main uncertainties has become less popular as a method in the last decade. Especially with foresight studies addressing broader topics, and the acknowledgment of the complexity of these topics with interconnections with many other research and policy domains, the two axes approach is less useful. When distinguishing more than two uncertainties, with many combinations possible and stronger interconnections between them, a *morphological* approach is more appropriate, see Figure 6. A set of, for example, 3 to 8 uncertainties is then mixed to obtain a consistent setting for the related driving forces. For example, when economic growth, technological progress, and educational attainment are identified as main uncertainties, the morphological approach acknowledges that they are connected, and the high economic growth is related to high technological progress and high educational levels.

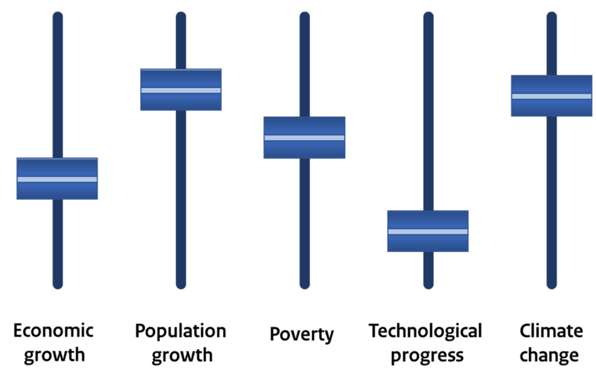

Figure 6. Example of a morphological mixing panel
Source: the Authors

Another, rather different approach is to put the normative uncertainties at the central point of the scenario logics. This can be done when the most important uncertainties are normative and not cognitive of nature. This can result in, for example, 4 different scenarios on health. These normative scenarios could be combined with different cognitive scenarios, though one might end up in too many combinations (with four normative and two cognitive scenarios you already have 8 possible combinations). One way of dealing with this is the use of a *trend* or *business-as-usual* scenario and combine this with the normative scenarios.

The last option included here, is the trend scenario (also referred to as baseline or business-as-usual scenario). In a trend scenario, current trends are expected to continue without a change in policies. Such an approach is often applied to identify most important future challenges and to evaluate different policies. The trend scenario or baseline is then used as a reference scenario for example to compare additional policy scenarios (Figure 7).

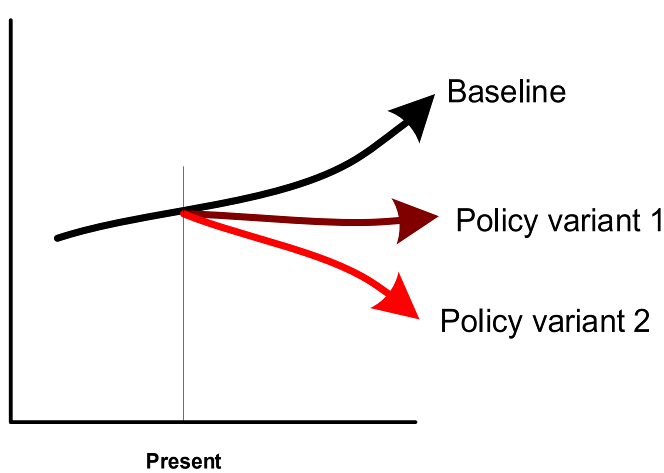

Figure 7: Example of a baseline with (policy) variants
Source: the Authors

Examples

EURO-HEALTHY – population health inequalities across Europe. This project embedded the 'Extreme-World Method' into a three-stage scenario building. After validating drivers, a two contrasting scenarios structures following the Extreme-World Methods were created. Thus, two scenario structures were built: one 'worst-case' scenario where inequalities would continue to increase (labelled Failing Europe), and the 'best-case' scenario where inequalities would decrease (labelled Sustainable Prosperity) [16].

XI. Scenario type

After choosing the scenario logics, you can further develop the scenarios. These scenarios can be quantitative or qualitative. Most foresight studies have both qualitative and quantitative aspects (see also Figure 8), as described below.

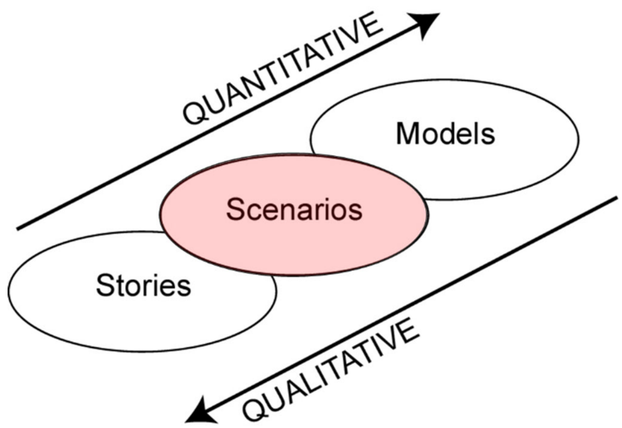

Figure 8. Quantitative and qualitative dimension of scenarios
Source: Nakicenovic et al. (2000) [20]

A. Quantitative

Quantitative scenarios focus on the analysis of quantitative data to be able to develop the scenarios that better contribute to decision-making. The purpose of these is the description of future scenarios based on quantitative figures, like health status, health care demand or human resources requirements. Including specific quantitative results about the critical future trends might increase higher awareness of the decision-makers.

B. Qualitative

Qualitative scenarios work with data of a qualitative nature as the focus of analysis. These scenarios aim to use data such as quality or stakeholder perceptions of the driving forces under study, which can contribute to define working groups to better address riskier topics or to establish a set of indicators to better evaluate riskier trends.

Examples

The study "The Sustainability of Health Care Spending in Canada 2017" relied on quantitative scenarios to project Canadian Health Care spending between 2017 and 2031. The two scenarios differ by the time span in which the data are analysed (i.e., long-term data of the past 15 years, and short-term data of the past 5 years) [21].

The study "Health Scenario Stories" developed qualitative scenarios with a morphological scenario approach. Here the stakeholders' perspectives and opinions about the uncertainties were analysed, not data and statistics. These were then quantified [2].

XII. Stakeholders

A "*stakeholder*" is someone (company, institution, organization, or set of people) who has an interest in the topic and issue under analysis in the foresight study, and, therefore, is also interested in contributing to the research study or is affected by its outcomes. It is important to note that stakeholder are critical to the project. Below we describe the importance of stakeholders, how to identify them and how to select them.

A. Importance of Stakeholders

Stakeholder involvement is essential because their input can be highly useful. Involvement of stakeholders can have different purposes:

- Quality enhancement: including knowledge, different perspectives, values that are not present in the project team.
- Instrumental: To stimulate use, recognition and support of the outcomes of the study (including access to tools and data, etc.).
- Democratic aims: everyone can participate and / or represent certain groups in society
- Emancipation of population groups: groups can be empowered that might not be heard otherwise

B. Identification of Stakeholders

One of the most important contributions from stakeholders results from the interaction with them during the study. For this, one must know what kind of stakeholders you want to involve and what you expect them to contribute with.

There are several ways to identify which stakeholders are most appropriate for your study. To do so, one can consider including a 2-axis graph or table, where the most important stakeholder characteristics for the study can be identified:

- Power-Interest – the power to influence, affect, or be involved in the project is one way to identify stakeholders. The "*power-interest matrix*" is a graph where on one axis is the level of power/influence on the project and on the other is the interest in the project [22].

- Power-Proximity-Urgency – better known as the "*Stakeholder's Circle*", this flexible model enables the selection of those who have power over the project, can be involved in the project, and those who have urgency for results (have actions to take or values at stake) through 5 steps (identifying, prioritizing, visualizing, engaging and monitoring stakeholder aspects) select those who have power over the project, can be involved in the project, and those who have urgency for results (have actions to take or values at stake) [23].

• Proximity-Interest - can be selected depending on the proximity to the project (the stakeholders that can be most influenced or affected by the results) or those who are most interested (experts, government, private sector, interested groups) [24].

C. Selection of Stakeholders

The selection of stakeholders should be carried out depending on the purpose of the selection and the target group. The following framework might be useful to help the selection of stakeholders (Table 1).

Table 1. Methods for stakeholder selection
(Source: PBL [24])

Selection method	Purpose of selection	Target group
Mapping, Analysis of arguments	Mapping out different perspectives	As diverse as possible: e.g. doctors, town-dwellers, human rights activists, business people, religious groups etc.
Snowball sampling	Involving stakeholders in the process	Stakeholders in general or principal stakeholders
Knowledge Mapping	Gathering knowledge	Experts and 'hands-on experts'
Selection from the registers	Mapping out social preferences	Various groups: over-65s, school children, business people, people with limited education etc.
Random sampling	Legitimacy through representativeness	The general public

Examples
In these examples we illustrate the two important aspects to highlight regarding stakeholders: the importance of representativeness and the selection process.

Selection Process – The study "Health Scenario Stories" selected its stakeholders taking into account their perspectives on the focus of the study. The selection approach was based on proximity to the topic and the results. Each workshop organized was aimed at collecting different perspectives: a more urban perspective, one concerning the Eastern and Western European culture, and another more Southern [2].

Representativeness – In studies dealing with several uncertainties and driving forces simultaneously, it is necessary for the research team to be able to include as many perspectives as possible. As can be seen from study "A scenario-planning approach to human resources for health: The case of community pharmacists in Portugal" in Portugal, the representativeness of the study is ensured by the diversity of the stakeholders: Public Health, Pharmacist Communication, Systems Engineering and Health Informatics, Managers, among others [7].

XIII. Data

Depending on the aim and complexity of the study, specific types of data will be required. In foresight studies, data needs can include vital (demographic) statistics, basic epidemiology, risks factors, health care data, survey data, environmental data, and socio-economic data. To build projections (see section XV) historical data ideally are available.

A. National Data

Nationally, the main sources of health statistics are surveys, administrative and medical records, claims data, vital records, surveillance, and disease registries. These are the different elements that constitute a national health information system, typically generated in a routine way. The strengths of national health information system will depend on the availability, quality, and coverage of each of the mentioned sources as well as the potential to link the different sources. Additionally, information can be queried from scientific peer-reviewed papers or grey literature.

The moment the right health information sources have been identified, it is essential to be able to access the data. A tool that can be used for this purpose is the newly launched European Health Information Portal which offers catalogues of health information sources for almost all European countries as well as information on how to access such data.

B. European data

Internationally, there are also multiple data collection systems in place. In Europe, the leaders in this sector are the European office of the World Health Organization (WHO), Eurostat and the Organisation for Economic Co-operation and Development (OECD). These organizations are closely collaborating with each other to combine their data requests and reduce the workload on national health information systems. Also, EU-wide health interview and health examination surveys exist.

Eurostat

Eurostat is the statistical office of the European Union and it aims to provide high quality statistics and data on Europe. Eurostat collects data on health and determinates through two main European health surveys: the European health interview survey (EHIS) and the European survey on income and living conditions (EU-SILC). Members States are also asked to send information the cause of deaths, occupational diseases, other work-related health problems and illnesses and health care (expenditure and non-expenditure) data. Through their website, access to data can be requested.

Eurostat database: https://ec.europa.eu/eurostat/web/health/data/database

OECD

The OECD is an intergovernmental economic organisation that aims to stimulate economic progress and world trade. One of their main activities in the health field is the Joint Data Collection on non-monetary health care statistics in collaboration with Eurostat and WHO Europe.

Their website also allows visitors to query data on several health indicators. In addition, OECD prepares reports where data is interpreted and conclusions on the results are drawn. At the European level, the OECD produces the Health at the Glance and every two years, a state of health in the EU for each Member State.

OECD database: https://stats.oecd.org/Index.aspx?ThemeTreeId=9

WHO Europe
The WHO Regional Office for Europe (WHO/Europe) is one of WHO's six regional offices around the world. One of their main health information tools is the Health for all database with more than 1500 indicators. With this information, national health reports are prepared and conclusions are drawn on the status of the different European health information systems.

WHO Gateway: https://gateway.euro.who.int/en/hfa-explorer/

Global Burden of Disease Study
Differently from the previously mentioned international organizations, the Global Burden of Disease study queries all available health data from different countries across the world. Such data is then fitted into sophisticated statistical machinery that transforms available, disparate epidemiological input parameters into internally consistent burden estimates.

Additional information: https://www.thelancet.com/gbd

XIV. Tools and instruments

To substantiate the quantitative and qualitative facets of the scenarios, a broad range of tools and instruments can be employed. Which one to choose depends on the purpose, availability, and applicability of the tool.

Qualitive tools include, for example: opinion surveys, experts interviews, focus groups / expert panels, Delphi method, essays, relevance trees, morphological analysis, catastrophe theory, historical analogy, and visioning. Of these, expert panels are a commonly applied method in foresight studies.

Quantitative tools are, for example: extrapolation of time series, probabilistic forecasting, stochastic processes analysis, regression analysis, econometric models, simulation modelling, system dynamics, impact analysis, cost-benefit analysis, input – output analysis, and game theory.

To be able to apply these quantitative methods, you need to realize this brings a data demand.

Examples
In the Dutch PHFS, different quantitative and qualitative methods are used. It uses expert panels and focus groups to identify and describe public health topics and uses quantitative method such as simulation models, regression analysis and systems dynamics to make quantitative projections into the future. The fresher project also has a combination of qualitative and quantitative methods [15].

XV. Projection methods

One purpose of applying quantitative models is to do projections into the future for various population health indicators. Some of the most essential population health indicators comprise those regarding mortality (e.g. overall mortality, causes of death), morbidity (e.g. incidence, prevalence, disability), and health determinants (e.g. life style, behavior).

There are various ways to do these projections, varying from simple demographic projections to advanced simulation models. In a **demographic projection**, only future changes in size and age are taken into account by combining the population by sex and age with constant rates by sex and age (e.g. prevalence of a disease). This method can be used to show the impact of the aging of the population, for example, on the prevalence of diseases that have a strong progression with age, such as dementia. Since population projections are often available, this method can easily be applied.

Accounting also for epidemiological changes requires assumptions on how rates in the future might change. This can be done by doing analysis on historical data. These combined **demographic-epidemiological projections** (Figure 9) can be done for separate determinants and morbidity and mortality variables. However, there is a dependency between these variables and, ideally, these are projected in a way that assures consistency in the projections (which is not assured by doing them separately). This requires a much more advanced mathematical modelling. These models have the advantage to simulate various indicators in a consistent way, for example, by analyzing possible health impacts of interventions. These approaches have limitations regarding their scope since they cover a limited number of risk factors and diseases.

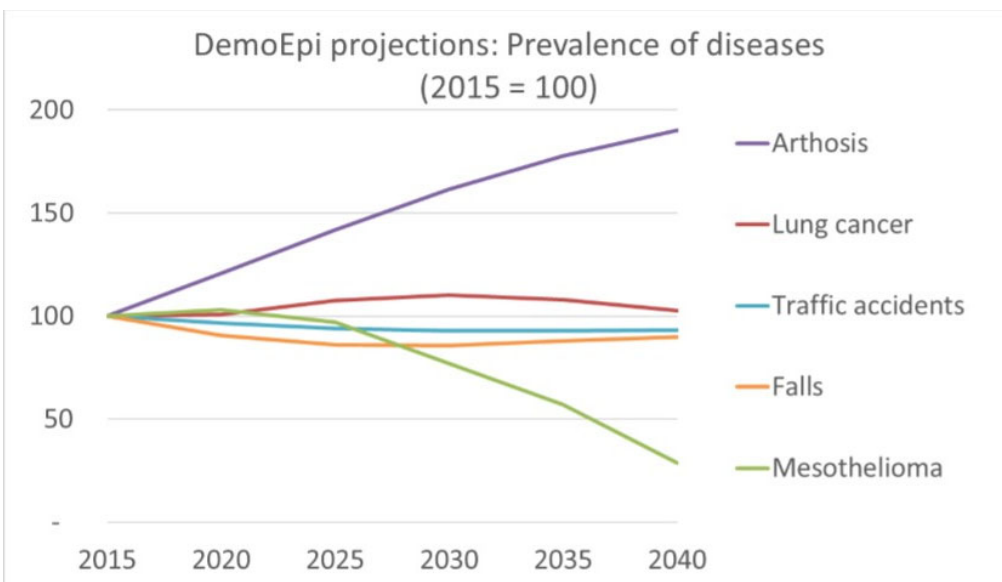

Figure 9: projections combining information about changing demography and epidemiology
Source: the Authors

Here, we elaborate on some modelling options as examples of how you could do projections.

Mortality
Given large changes in mortality rates and causes of death, a combined demographic-epidemiological approach may be the minimum level of doing projections.

Data needed:
- Causes of death data (from 1996-2019), ICD10 classification, rates by sex and age.
- Epidemiological projection based on Poisson regression analyses for different causes [25].
- Envelope method to assure consistency between projections for cause-specific mortality and total mortality.

Morbidity
For many of the morbidity indicators, such as incidence and prevalence, no historical time series are available (or no changes are observed). In these cases, a demographic projection can be used, especially when rates increase with age, which is the case with, for example, prevalence rates of dementia. In a demographic projection, relative measures by sex and age (e.g. prevalence) are kept constant, and only population size and age structure change. Such a projection shows then the effects of an ageing population.

Data needed: Population projections by sex and age (e.g. Eurostat), and recent prevalence data (e.g. IHME). For some diseases, such as cancer, historical data might be available, and they could be used for additional epidemiological projections.

Risk Factors
Risk factors also show, in general, large changes over time (e.g. smoking). A combined demographic-epidemiological approach may be the minimum level of doing projections.
Integrated projections risk factors and impacts
To link risk factors with health impacts, the Population attributable fraction (PAF) is often used. This is a simple, static approach that is easier to apply than an advanced model.

Data needed: Exposure data and Relative risks.

Simulation models
There are various ways of modelling that link risk factors and health outcomes in a more dynamic way. The following clusters of models can be distinguished:
- Multi-state risk factor modelling: e.g. DYNAMO HIA, Chronic diseases model (RIVM)), Health Care models: Chronic Care Model, CCM (Wagner), Improving Chronic Illness Care, ICIC (Wielawski), Innovative Care for the Chronic Conditions, ICCC (WHO), Cost-of-illness (RIVM)
- One issue models: Specific diseases e.g. MICADO diabetes model
- Infectious disease modelling

XVI. Communication strategy
Although described towards the end of this guide, it is important to already start planning your communication strategy at the very start of your study; the appropriate communication strategy very much relates to the aim of your study and your target group, and its success depends on your actions throughout the process.

Dissemination and exploitation of a project's results is key to maximizing the impact in health policy and practice. Having a communication strategy which is tailored to you audience's needs and level of health literacy ensures a common understanding between data providers (i.e. project researchers) and end-users (e.g., health care planners, care providers, patients, the general public).

A strong dissemination strategy 1) raises awareness about the relevance of your foresight study results on population health, 2) clarifies your positioning within the landscape of evidence informed guidelines, existing practices, and potential fake news and 3) facilitates uptake of evidence to inform decision making in policy, practice, and healthy lifestyle choice.

The first step in developing a PHFS communication strategy is to clearly identify the type of impact that you expect from the use of your public health foresight study results [26]

- for changes in knowledge, understanding or attitudes (*Conceptual use*)
- for concrete application of knowledge and describes changes in behaviour or practice (i.e. best practice, adoption of clinical guidelines; *Instrumental use*)
- as a political or persuasive tool (lobbying/advocacy; *Symbolic knowledge use*)
- for changes in health and wellbeing (mortality or quality of life; *Patient Leve use*)
- as a measure of provider satisfaction/practice (*Health Care Provider Level use*)
- as a measure of change in health care systems or costs (*Process Level use*)

Identifying your audience's needs and expectations in the early stages of your research also means you can take full advantage of the windows of opportunity for dissemination (i.e., the timing of the policy cycle and the general context in which the evidence is being disseminated).

XVII. Communication Products

The challenge is to identify amongst all communication products which will be most efficient in reaching key players of the health system, patients and civil society at large.

Communication products include: policy briefs, scientific report/publications, face-to-face workshops with experts, newsletters, printed/digital content, social media, infographics.

In large, this will depend on your audience's level of health literacy and also the products that they usually engage with as part of structural decision making processes, e.g. clinical guidelines in health facilities, policy briefs or white papers at governmental level.

When targeting the general public it is critical to put scientific results in context and showcase the concrete added-value of the evidence [27]. Whereas scientific writing or more technical reports might focus on explaining the methods used to generate data, science communication requires a shift towards highlighting the impact of the evidence and problem solving [28].

Infographics for example, are used to highlight key evidence in an easily accessible format. A clear advantage of infographics is also that they can easily be integrated to other communication products such as a report, a public health brochure or on social media platforms (i.e. see below). They are also drafted in lay-man's terms which ensures a broad reach with the audience.

In PHFS, specific communication challenges apply [29]. For instance, while scenarios are key foresight study products which are used for strategic decision making, scenarios often entail communicating complex systems-level messages (ie. ss multiple determinants will impact at different levels of health) which can be difficult to convey. To address this issue, the outputs of scenarios often include both written descriptions and pictures/concept maps to provide more clear representations of the futures considered.

Resources invested in communication should be carefully matched to the expected impact whether at local, (sub)national, or EU/global level. In particular, given the impact of the non-health determinants of health, foresight study researchers should aim to facilitate the understanding of experts and policy makers across all sectors that can impact on population health and well-being.

Examples
A video explaining the European Commission 2021 strategic foresight report [30].

The use of an infographic (Figure 10) is explained in a paper aiming to transfer the Dutch experience with performing broad public health foresight studies and its uptake in policy-making [31, 32].

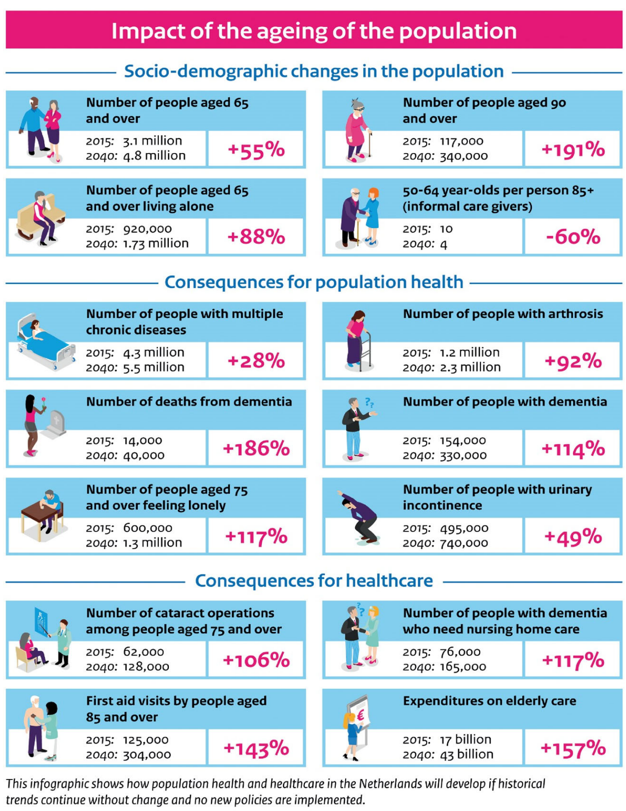

Figure 10: Infographic on the impact of the ageing of the population
Source: Verschuuren, et al. (2019) [32]

Links to further reading material

- What is research impact? [33]
- Foresight results to communicate [34]

XVIII. Uptake of results and evaluation

The appropriate exchange, synthesis, and ethically sound application of knowledge to strengthen the healthcare system and improve health is known as “Knowledge Translation” (KT). KT can be summarized as a dynamic and iterative cycle in which researchers engage with end-users, while feedback from the field guides informs future research/data needs thereby completing the process. This relies on researchers building strong relationships with a range of stakeholders and understanding their needs and expectations in order to drive change. The WHO has identified six principles to ensure effective communication: the evidence should be accessible, actionable, credible and trusted, relevant, timely, and understandable [35].

Nowadays, scientific evidence competes with an excessive amount of misinformation which can quickly backfire. Therefore, it is more than ever necessary to understand better who the users of scientific results are, and to what ends are the data used in the health system. Additionally, when planning for an evaluation, it is important to consider timing, so that evaluation results can feed into design, renewal, and modification.

The European Commission has developed a toolkit for evaluating communication activities, including (conferences, newsletters, websites, PR events, press events, social media activities, smartphone applications and publications) [36]. The following steps can be used for planning this part of the evaluation (Figure 11).

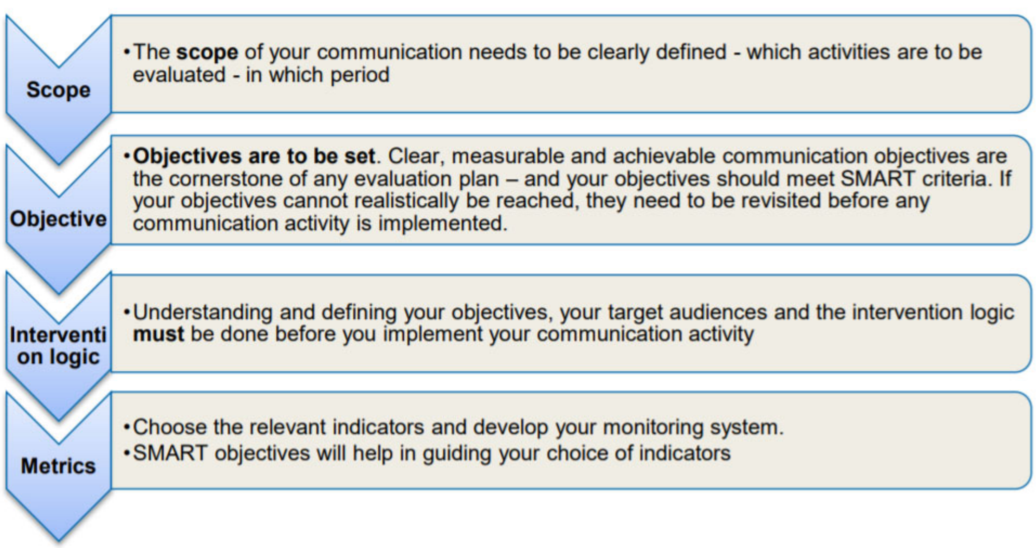

Figure 11. Steps in evaluating communication activities and for developing a monitoring framework
Source: TOOLKIT for the evaluation of the communication activities – European Commission, DG Communication [36]

Traditionally, the focus has been on the production of evidence, and less on evaluating the impact of this evidence in the health system. The uptake of foresight study results can be difficult to gauge as there are different types of evidence use: this could be a change in the understanding or attitudes of stakeholders (i.e. conceptual use), concrete applications and changes in behavior or practice (instrumental use), or for persuasive purposes and lobbying (symbolic knowledge use). There are also three application levels: at patient level, healthcare provider level, or at organizational level/the level of the health system.

Monitoring KT can help identify bottlenecks from the field which go beyond the evaluation of communication activities. Several knowledge translation frameworks have been developed which can guide evaluation. For instance:

- The Re-aim framework covers 5 domains [37]: Reach (R) and Effectiveness (E), operating essentially at individual-level – *how are healthcare providers applying quality assurance procedures or the latest recommendations?* while Adoption (A), Implementation (I) and Maintenance (M) are focused on organizational and community-level change – *how have new procedures been integrated to a clinical facilities' workflow?*
- The Knowledge-to-Action framework [38, 39] consists in: (i) the Knowledge creation funnel in which research data are generated, synthesized and contextualized to become more useful, and (ii) the Action cycle which includes a range of actions targeting changes in stakeholders' level of understanding, behaviors and attitudes.

Finally, the Health Information (HI)-Impact framework [40, 41] was developed specifically for monitoring the communication and implementation of evidence at the level of health system based on 4 components:

- **HI Evidence Quality** assessing whether the data provided to stakeholders is fit-for-use i.e. accurate, representative, and relevant.
- **HI System Responsiveness** assessing whether data are widely available and have been disseminated effectively to stakeholders. This requires careful tailoring communications based on the level of health literacy of end-users and also the problem-at-hand.
- **Stakeholder Engagement:** which relates to the use of evidence for training, decision-making and the implementation of interventions in public health policy and practice.
- **Knowledge Integration**: which pertains to the use of evidence by community partners, and across sectors which could promote better equity in health as well. This last domain captures the implementation of evidence in other sectors that largely influence health and well-being (ref Dahlgren and Whitehead's model of the layers of influence on health).

Examples

In the study of scenarios about the role of community pharmacists in Portugal [7], the foresight team organized a set of workshops with stakeholders and the advisory board of the study, mostly the pharmacist's association, Faculty of Pharmacy of the University of Lisbon and the Ministry of Health. They discussed the role of community pharmacists in delivering health care as well as the role of pharmacy technicians who can provide more support to pharmaceutical care. The digitalization of pharmaceutical care was addressed and the need for improved skills and collaboration with digital health experts was pointed out. Finally, organizational issues were highlighted, especially with primary care physicians and also improving efficiency of care. Furthermore, this process of knowledge transfer has led to a new study to address the challenges of digitalization of pharmaceutical care [42].

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About this work

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