

Behrens, Yvonne et al.

**Research Report**

## Competences in health network management: A textbook for training regional health network managers

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*Band  
27*

David Matusiewicz / Manfred Cassens (Hrsg.)

*Competences in Health Network Management –  
A Textbook for Training Regional Health Network  
Managers*

ifgs Schriftenreihe



**Institut für Gesundheit & Soziales**  
der FOM Hochschule  
für Oekonomie & Management

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Catalina Morales Hernández, José Palacios Ramírez, Roberto Ferrándiz Gomis,  
María José López Arroyo, Nikola Ranchev, Frank M. Amort, Ines Kösters**

*Competences in Health Network Management – A Textbook for Training Regional Health  
Network Managers*

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***Competences in  
Health Network Management –  
A Textbook for Training  
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Yvonne Behrens, Sandra Macher, Zsófia Kollányi, Isabel Morales Moreno,  
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## **Preface**

When the network of “Com.HeNet”, consisting of six European partner countries, met for the first time in Vienna in November 2019, it was still a meeting in “old Europe”. First cases of the SARS-CoV-2 virus had been reported from the Chinese province of Wuhan – everything seemed (still) so far away for the citizens of Europe who were used to security... Who could think at that time that only a few months later the national borders within Europe would regain a significance that for many years had been considered overcome for the “House of Europe”? Supply bottlenecks – whether with regard to masks or even vaccines – strengthened the supporters of Europe in perceiving state egoisms that reinforced the overall picture. It took an even worse event, the war in Ukraine, to forge Europe’s states closer together again; an unthinkable momentum. The European Community, “mother” of the Erasmus+ projects, will have to redefine itself in many areas in the future. This will not only concern the common foreign and security policy, but besides the ecological turnaround, it will be the common health policy as a third pillar, which will have to be managed more proactively in the future.

Paralyzing a continent with several lockdowns, should no longer be necessary in view and times of artificial intelligence. The sad reality, however, was not only that members of a large industrialized nation in the center of Europe held printed test results out the car window during the reinstated border controls while driving through snow in the spring of 2021, while their neighbors did this comfortably by means of the digital certificate. While everyone might still smile here, they were seized by cold horror when the clinics in Bologna and Milan were full of COVID patients and it took a long time, for many too long, before the Europe-wide care management set in. Com.HeNet was developed against this background and in the context of this pandemic story, which continued and was written on in the years that followed, and which could be experienced in concrete terms by everyone. From the outset, the project partners made use of virtual tools, regarding them as a chance rather than a necessity, in order to connect researchers all over Europe and to enable them to work together without the inhibitions of distance or borders. Thus, over the course of two and a half years, committed Europeans developed, almost exclusively with the use of virtual tools, a concept for the management of health regions – unfortunately still “only” for regions in Europe, and not yet for Europe’s regions.

Until the outbreak of the pandemic, infectious epidemics were considered (very) unlikely, or at least manageable. Instead, national health systems – and with them the European Union – focused on combating the so-called epidemiological transition. This refers to the shift in the spectrum of disease from infectious to lifestyle-related. With COVID-19, there was an abrupt break, a classic 180-degree turn-around within days and weeks. The health-promoting regional structures that had been built up over two decades came to an almost complete standstill, and personnel deployed here were assigned to the Public Health Services. This is currently proving to be a serious mistake because lifestyle-related diseases of civilization by no means came to a standstill during the first two years of the pandemic. In many European countries, there was a massive increase in physical inactivity, malnutrition, and a lack of stress resilience. The epidemiological long-term consequences will already reach the European community in the short term; rapidly rising treatment costs around F-diagnoses (mental illnesses and behavioral disorders) may serve as indicators for this.

Isolated solutions, as we had often experienced in every respect on a national level during the first two COVID years, also had to be worked out at Com.HeNet. This is because, despite all the content-related links between the project participants, Europe's healthcare systems were and still are too nationally structured, or even still federally structured in some cases. The best examples of this are Spain and Germany – both countries have highly regionalized health structures. In this respect, the Com.HeNet project represents a minimum consensus in terms of content; beyond that, however, symbolically at the same time a first step on the way to a more common and, in matters of health, hopefully also more homogeneous perspective path. I would like to thank the authors of this editorial book as much for their valuable contributions to this publication and to the blended learning event as for the development of the course on regional health managers. May the strong content presented here inspire regional political decision makers to look favorably on the implementation of such structures precisely because of the recent experience in dealing with long-term COVID consequences!

Prof. Dr. habil. Manfred Cassens

Research Director of the Institute of Health & Social Affairs (ifgs) at FOM University

Project leadership: Competences in Health Network Management (Com.HeNet)

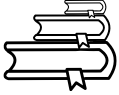
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*Design by Nathalie Krüger, FOM University*



Bibliography



Control Questions



Database Systems, Data Protection and Security



Health and Society – Theoretical Background



Health Regions



Health Needs Assessment



Learning Objectives



Project Management



Promoting the Network



Strategic Management and Planning

## 1 Introduction

*Yvonne Behrens*



### **Yvonne Behrens, M.A.**

Yvonne Behrens is the research coordinator of the Competences in Health Network Management project as well as a research associate in other international projects at the Institute for Health and Social Affairs at the FOM University of Applied Sciences. Her research interests are dementia and migration as well as the promotion of health and social participation of vulnerable groups.

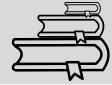
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Health regions are clusters that unite regional competences around the topic of health (Behrens, Movia 2020). In order to manage health regions successfully, interdisciplinary competences are needed. These competences were identified in the Competences in Health Network Management (Com.HeNet) project and transferred into teaching modules. The teaching modules cover the areas of health science, project management and information technology.

The target group of this textbook is people who are training for the management of health regions. Teaching staff in this as well as in related fields can successfully use the book as a whole or its individual teaching chapters. This book can be used internationally as it is a European module. If necessary, national specifics have to be adapted individually. Determining these is also the content of this book.

This book was developed in an international consortium and is based on international scientific cooperation. We would like to thank all the supporters of the project.

The Textbook Competences first embeds the work in the Com.HeNet project. It then provides an insight into the structure and management of health regions. Finally, theoretical contents from the following six teaching units are dealt with in detail: Health and society – theoretical background, Health Needs Assessment, Promoting the Network, Project Management, Strategic Management and Planning, Database Systems, Data Protection and Security. Learning objectives are defined for each chapter. The learning success of the individual chapters can be checked by means of the control questions. Finally, a conclusion is given. This book was positively evaluated by international students.



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## 2 Competences in Health Network Management: Project Description Com.HeNet

*Yvonne Behrens, Ines Kösters*



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**List of Abbreviations**

Com.HeNet	Competences in Health Network Management
ECCPHP	European Core Competences for Public Health professionals
ECTS	European Credit Transfer and Accumulation System
EQF	European Qualification Framework
n	number

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## **2.1 Project Description: Competences in Health Network Management**

If the past few years have shown anything, it is that health is a valuable commodity that must be protected. Accordingly, prevention and health promotion are also an important issue. This is where the concept of so-called health regions or health networks comes into focus. These are associations of relevant actors and stakeholders in the health sector that pool their resources to improve and increase the health of, mostly regional, populations.

The necessity of possessing competences for managing networks, in this case regional health networks, is beyond question, based on the experience gained in the Com.HeNet project. Competences for a professional management of health regions are already interdisciplinary and diverse at the national level. If this professional field is described on an international level, the degree of interdisciplinarity increases. With regard to national peculiarities, such as legal or economic regulations or guidelines, national adaptations are necessary, but overall it is evident that the same competences for the management of health regions are predominantly required in the European area.

This is where the Erasmus+-funded European project Com.HeNet comes in. As a follow-up project of a German national research initiation project on health regions in the Danube region (Kösters 2019), Com.HeNet deals with the basic requirements for the establishment and management of health networks on a regional level. The Competences in Health Network Management project runs from September 2019 to August 2022 and the consortium consists of six European institutions:



**Figure 2.1:** Project Team of Com.HeNet

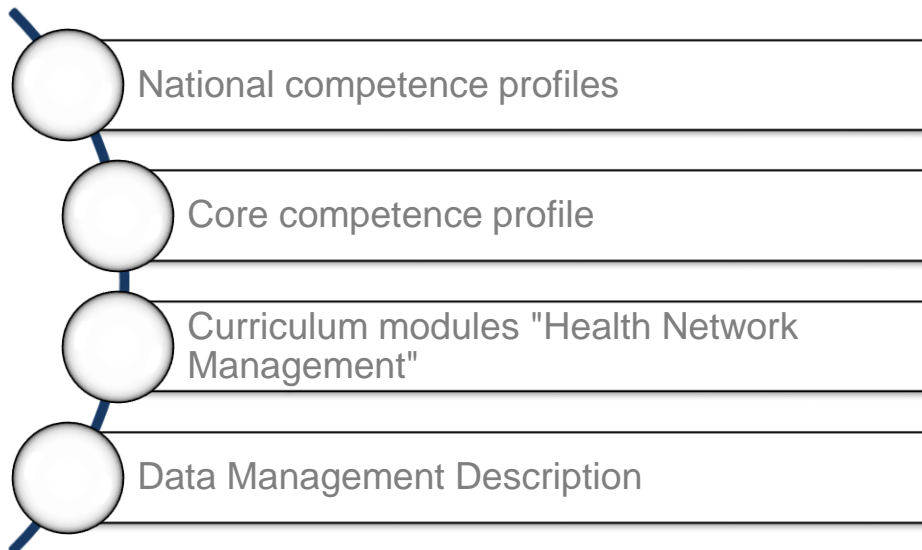
<b>Project team:</b>	<b>FOM University of Applied Sciences (Germany)</b>
	<b>Catholic University of Murcia (Spain)</b>
	<b>Eötvös Loránd University Budapest (Hungary)</b>
	<b>Faculty of German Engineering and Economics Education Sciences, Technical University Sofia (Bulgaria)</b>
	<b>FH Joanneum University of Applied Sciences (Austria)</b>
	<b>Medical University of Silesia (Poland)</b>

In addition, two other institutions are participating as associated partners. These are the Bavarian State Office for Health and Food Safety and the Bulgarian Red Cross. The FOM University is responsible for the overall management of the Erasmus+ project Com.HeNet. Project leadership lies in the hands of Prof. Dr. habil. Manfred Cassens; Yvonne Behrens is responsible for the overall scientific coordination.

## 2.2 Project Structure and Work Packages

The Com.HeNet project has four major missions, which at the same time also represent the work packages.

**Figure 2.2:** Work Packages: Intellectual Outputs of Com.HeNet



The structure and scope of the Erasmus+-funded project was developed in cooperation with all project partners. Several transnational project meetings were used to develop a functional and constructive partnership in order to achieve the overall goal of the project:

***to improve the health of the European population.***

### 2.2.1 National Competence Profiles

First, the concept of a health region as a regional network of health actors was presented in the consortium and discussed with all participating project partners. Since such a concept was not available or known in every participating European country, a major step in the project was to create a common level of knowledge. Furthermore, the competences in the project countries were surveyed in the first project phase (Intellectual Output 1), which regional health network managers need on a national level. For this purpose, a total of 33 interviews with experts in health care and health management were conducted in the six project-related

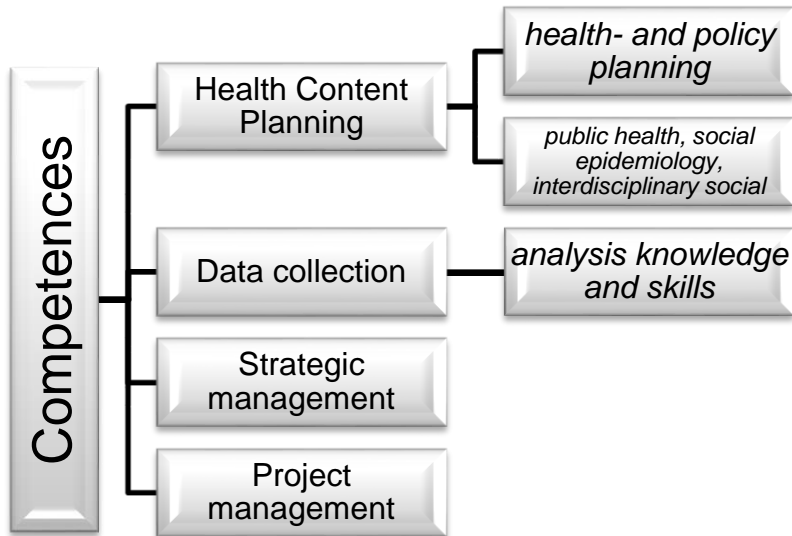
European countries. In addition, a comprehensive literature review was conducted (Movia & Amort 2021, p. 293). In this step, special attention was also paid to national conditions and structural circumstances, which represented a necessity for regional network cooperation in the health sector. The output of this work package was the development of six national competence profiles for the work with regional networks in the health sector which pay attention to national or, if necessary, regional specialties.

### **2.2.2 Core Competence Profile**

Subsequently, in a further step, the national results were compared with each other and transferred into a common European competence profile for regional health network managers (Intellectual Output 2). This allows more comparability (if necessary) and needed competences for working and networking in the health sector in European countries and beyond national borders.

The core competence profile was aligned with relevant European competence frameworks, like the EQF (European Qualification Framework) or the ECCPHP (European Core Competences for Public Health professionals). For further feedback and better fit in the European health sector, the core competence profile as well as the respective national competence profiles were reviewed and checked by relevant stakeholders and experts in the project countries via so-called multiplier events. The collected feedback was used for revision processes to finalize the first two project outcomes. The following necessary competence areas emerged:

**Figure 2.3:** Competence Areas for Regional Health Networking (own representation based on Kollányi & Horváth 2021, p. 294).



### 2.2.3 Curriculum Modules “Health Network Management”

Based on the identified competences and created competence profiles in the first project phases, the Com.HeNet consortium developed European teaching modules for the education and training of regional health network managers (Intellectual Output 3).

These are intended to promote the professional management of health regions (Behrens & Cassens 2021, p. 293). The teaching modules are taught online via a Moodle course as well as in person. The following table shows the developed modules with their related content:

**Table 2.1:** Teaching Units in Com.HeNet

Teaching Unit	Content
Health and society – theoretical background	Public Health Epidemiology Interdisciplinary social sciences and humanities
Health Needs Assessment	Sources of information Quantitative and qualitative methods Health and the surrounding complex system
Promoting the network	Stakeholder analysis Building a Network Managing a Network
Project Management	Introduction Project Management Knowledge Management Integration Capacity
Strategic Management and Planning	Planning activities and resources Network Management Supervision of Networks
Information Technology	Fundamentals of Database systems and applications Data protection and security

The Moodle course provides a theoretical introduction to the individual modules and their content with a workload of 98 hours in total. The face-to-face teaching deepens the theoretical knowledge and expands it through the application of case studies and problems and has a workload of 27 hours with a crediting of 5 ECTS for the whole course.

### **2.2.4 Data Management Description**

The results of the first Intellectual Output already confirmed that digitalization in particular is also an important aspect in the professional field of regional health network managers. This field is observed by the description of a supporting data management system for the management of health regions as content of the fourth work package (Intellectual Output 4). The conscious handling and work with health-related data is extraordinarily important to connect and structure the work of a regional network of stakeholders in the health sector. Because of the importance and sheer scope of this subject area, the field of data management and related usable systems will only be covered by a description of a possible approach in this project.

### **2.3 Evaluation**

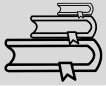
The teaching modules developed in the project were conducted together with international students and project staff from March 14, 2022 to May 28, 2022. A total of 25 people participated in the pilot training and provided comprehensive and helpful feedback to the consortium. Evaluation of the theoretical content in the Moodle course indicates that the teaching scope is appropriate (n=15/25). The compatibility of the individual teaching modules is also evaluated positively (n=21/25). The chapters of the present textbook were also evaluated in the Moodle course. Comprehensibility was also evaluated positively (24/25).

The following table shows a selection of the received results.

**Table 2.2:** Selected Results of the Evaluation

<b>Teaching Unit</b>	<b>Evaluation</b>	<b>Special Value for Everyday Professional Life</b>
<b>Health and Society – Theoretical Background</b>	(very) useful (n=19/19)	<ul style="list-style-type: none"> <li>- Data collection</li> <li>- Understanding health and social problems</li> </ul>
<b>Health Needs Assessment</b>	(very) useful (n=20/20)	<ul style="list-style-type: none"> <li>- Finding topics through brainstorming/mapping</li> <li>- Finding interdependencies between actions</li> </ul>
<b>Promoting the Network</b>	(very) useful (n=12/15)	<ul style="list-style-type: none"> <li>- Communication skills</li> </ul>
<b>Project Management</b>	(very) useful (n=19/20)	<ul style="list-style-type: none"> <li>- Problem solving</li> <li>- Project Management in general</li> <li>- Interviews</li> </ul>
<b>Strategic Management and Planning</b>	(very) useful (n=18/20)	<ul style="list-style-type: none"> <li>- Development of new resources</li> <li>- Project planning</li> </ul>
<b>Information Technology</b>	(very) useful (n=18/21)	<ul style="list-style-type: none"> <li>- Data collection</li> <li>- Communication with IT teams</li> </ul>

The overview of the feedback clearly shows that the individual teaching elements are predominantly evaluated as useful and very useful. This is also reflected in the information on the usefulness of the acquired contents for their own professional life, whereby it is particularly important to emphasize that the participants have different professional backgrounds. The participants describe that they learned something in each teaching module that they can use in their everyday working lives. This is a particularly appreciative response for the work done by the project team, but also for the project as a three-year overall construct.



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### 3 Health Regions

*Yvonne Behrens*



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### 3.1 Learning Objectives

- Understand what a health region is
- Know the steps to build and manage health regions
- Understand what a regional health network manager does

### 3.2 What is a Health Region?

There is no fixed definition of a health region, neither nationally nor internationally. This chapter explains this topic using the German example of a health region. In the federal state of Lower Saxony, this is understood to be the association of regional actors at the level of a district or an independent city. The aim is to combine competences to improve regional health care and health promotion. Managers of health regions offer the regional actors a kind of communication platform for this purpose, in order to jointly use the potential from the region for the region (Landesvereinigung für Gesundheit und Akademie für Sozialmedizin Niedersachsen e.V. 2018, p. 7). Actors in health regions develop joint projects in interdisciplinary exchange to improve the regional health care system. It is about both health care and health prevention. Due to the diversity of the participating actors, the work of health regions is characterized by a great variety of topics (Niedersächsisches Ministerium für Soziales, Gesundheit und Gleichstellung<sup>1</sup>).

Essentially, a health region network has the following characteristics:

- Presence of at least three actors
- Mediation between members
- Network identity present
- Exploitation and creation of resources
- Competitive relationship of members, if applicable  
(Buck et al. 2019, p. 5)

Despite possible competition between members, it is important to create a common identity within the network and to act accordingly within the network's cooperation. This can be a challenge but at the same time an opportunity to develop new ways of acting and ideas.

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<sup>1</sup> [https://www.ms.niedersachsen.de/startseite/gesundheitsregionen\\_niedersachsen/gesundheitsregionen-niedersachsen-119925.html](https://www.ms.niedersachsen.de/startseite/gesundheitsregionen_niedersachsen/gesundheitsregionen-niedersachsen-119925.html) (requested on 21.07.2022)

### 3.2 How Is a Health Region Structured?

A health region consists of different actors from the region who are connected to the topic of health in the narrower and broader sense. As an example, the Federal State of Lower Saxony is presented in this chapter with regard to health regions. In the case of the federal state of Lower Saxony, the management lies with the municipal or district administration. This federal state recommends five elements for a health region.

1. Local government leadership
2. Regional steering group
3. Coordinating force
4. Working groups
5. Health conference

The local administrative leadership is in charge of the regional network. This offers the advantage of easier access to actors from the region. The regional health network manager is based here and coordinates the health region (coordinator). Together with the regional steering group, central goals and fields of action are identified. Ideas are developed, projects initiated and proposed for possible funding at the state level. The working groups are formed according to the projects developed by the regional steering group. They work on the projects according to their expertise. Members are regional actors with the required expertise for the respective projects. In this step, the integration of existing structures and committees is recommended. This can promote the sustainability of the projects. The health conference is a meeting of experts where regional actors and citizens discuss health care in the region, health promotion and impulses for further cooperation.

There are five phases in the development of a health region:

1. Preparation
2. Structure building and information gathering
3. Analysis and planning
4. Implementation
5. Evaluation and stabilization

In the first phase of preparation, initial concepts are planned. Relevant stakeholders are already involved in this phase and give their consent to participate. In addition, applications are submitted in this phase. In the second phase – structure building and information gathering –, the position for the regional health network

manager is advertised. In addition, regional data, especially health data, is researched. In the analysis and planning phase, the results from the second work phase are evaluated and existing committees are compared. Goals are formulated for the district or the city. The first health conference is organized. In the implementation phase, project applications are developed, which the steering group then reviews. In the evaluation and stabilization phase, the developments of the first four phases are evaluated. With sustainability in mind, selected projects are chosen for continuation. This is to be decided individually. In all these phases it is important to inform all stakeholders comprehensively and to proceed systematically. In addition, sufficient financial resources are necessary.

In order to make the results of the work of the health region accessible to the interested public, large-scale public relations work should be carried out. This includes Internet presences as well as cooperation with the (supra-)regional press (Landesvereinigung für Gesundheit und Akademie für Sozialmedizin Niedersachsen e.V. 2018, pp. 8-24).

### **3.3 What Does a Regional Health Network Manager Do?**

A regional health network manager coordinates a health region. The manager mediates between the participating actors. Together with the members, they exploit and create new resources in the region. There are four main fields of activity:

1. Resource management
2. Network governance
3. Network facilitation
4. Network promotion

The resources to be managed are financial, human and physical. Their management needs to be sustainable and in accordance with the goals of the health region. Financial resources must be applied for in a targeted manner. This includes e.g. grants and capital contribution. This step requires a systematical approach in order to be able to act in the long term. The activity of resource management also includes regular reporting to responsible bodies of the network. Finances should always be documented professionally for this purpose. With regard to human resources, care should be taken to ensure that regular personal contact takes place. This can be supported, for example, by a jour fixe. In addition, demand-oriented information tools, such as common virtual platforms, are recommended.

Network governance includes dealing with the appropriate legal form as well as contractual regulations. At the beginning, the appropriate legal form should be chosen. This is an individual and country-specific matter. In the network itself, rules of conduct, tasks and common goals should be regulated in a contract (Buck et al. 2019, pp. 10-12). It is advisable to seek legal advice for this. Other issues in network governance are the creation of decision-making mechanisms and management bodies. This also requires an individual approach according to the needs of the network. Network goals and strategies are identified in this area of activity. Work on these should be ensured and regularly monitored.

The field of work of network facilitation starts with the regional health network managers understanding their facilitation role in terms of the network. They know the tasks as well as the different responsibilities of the network. Network facilitation includes the central counselling of the participating actors as well as the creation of a code of conduct. The latter should be drawn up together with the network. Here, clear communication channels for the network's cooperation are established. The network moderation pays attention to balance in discussions as well as to a network culture that is as non-competitive as possible. Regular evaluation of the processes is also recommended in network moderation.

Network promotion means public relations work. A common strategy for this should be defined in the network. It can be helpful to draw up a marketing strategy. This includes defining concrete measures to increase the visibility of the network's work. It can also be useful to network with external stakeholders (Buck et al. 2019, pp. 12-17).

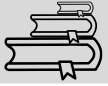
### **3.4 Conclusion**

Health regions are associations of regional actors with the aim of improving health care and prevention. They are characterized by interdisciplinary topics and cooperation (Niedersächsisches Ministerium für Soziales, Gesundheit und Gleichstellung). Regional health network managers coordinate health regions. Central tasks are resource management, network facilitation, network governance and network promotion (Buck et al. 2019, pp. 12-17).



### **3.5 Control Questions**

1. How is a health region structured?
2. What are the tasks of a regional health network manager?



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#### 4 Health and Society – Theoretical Background

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## 4.1 Public Health

The following chapter gives a brief overview of basic concepts of health, definitions and core areas of public health, the determinants of health, health literacy and the health impact assessment.



### 4.1.1 Learning Objectives

- Achieve an understanding of the scientific basis of Public Health
- Be able to critically think about health & society
- Gain the ability to contribute to public health research, policies and practice

### 4.1.2 Basic Concepts of Health

Health is classically defined as *“a state of complete physical, social and mental health, and not merely the absence of disease or infirmity”* (WHO 1948).

As such, health is as much a social construct as a biological characteristic. It is the product of a complex interaction of different factors: this is true at both individual and population levels.

### 4.1.3 Basic Definitions of Public Health

*“The science and art of preventing disease, prolonging life and promoting health, through the organised efforts of society”* (Acheson 1998).

*“The combination of sciences, skills, and beliefs that is directed to the maintenance and improvement of the health of all the people through collective or social actions”* (Porta 2014).

With regard to disciplinary development, a distinction is made between **Old Public Health** (also: Public Health I) and **New Public Health** (also: Public Health II). Old Public Health focuses on the prevention and care of problem groups. The scientific basis is constituted by medicine with theoretical medicine, clinical-practical medicine, hygiene, social medicine and epidemiology as well as the social sciences with health sociology and health psychology. Since about 1980, **New**

**Public Health** has focused on health policy as a whole. Old Public Health is complemented by health systems research and health services research, in which prevention, health promotion, cure/therapy, rehabilitation and care are systematically interlinked (Egger et al. 2018).

**Table 4.1:** Difference between Public Health and Medicine

<b>Public Health</b>	<b>Medicine</b>
<ul style="list-style-type: none"> <li>• Primary focus on populations</li> </ul>	<ul style="list-style-type: none"> <li>• Primary focus on individual</li> </ul>
<ul style="list-style-type: none"> <li>• Emphasis on disease prevention and health promotion for the whole community</li> </ul>	<ul style="list-style-type: none"> <li>• Emphasis on disease diagnosis, treatment, and care for the individual patient</li> </ul>
<ul style="list-style-type: none"> <li>• Employs a spectrum of interventions aimed at the environment, human behavior, lifestyles, and medical care</li> </ul>	<ul style="list-style-type: none"> <li>• Places predominant emphasis on medical care</li> </ul>

Source: Paudyal & Priya 2014, Public Health: Principles, Definitions and Perspectives. Brighton and Sussex Medical School.

#### 4.1.4 Core Areas of Public Health

Public Health Action consists of three core areas (see figure 4.1)

**Figure 4.1:** Core Areas of Public Health



1

Source: own graphic according to Centers for Disease Control and Prevention, 2017.

**Protection** means protecting the health of a population, specifically in these areas:

- Control of infectious diseases
- Managing health emergencies
- Environmental hazards
- Healthy workplaces

**Promotion** means improving the health of a population, specifically in these areas:

- Individual
- Promoting healthy behaviour
- Improving the social determinants of health

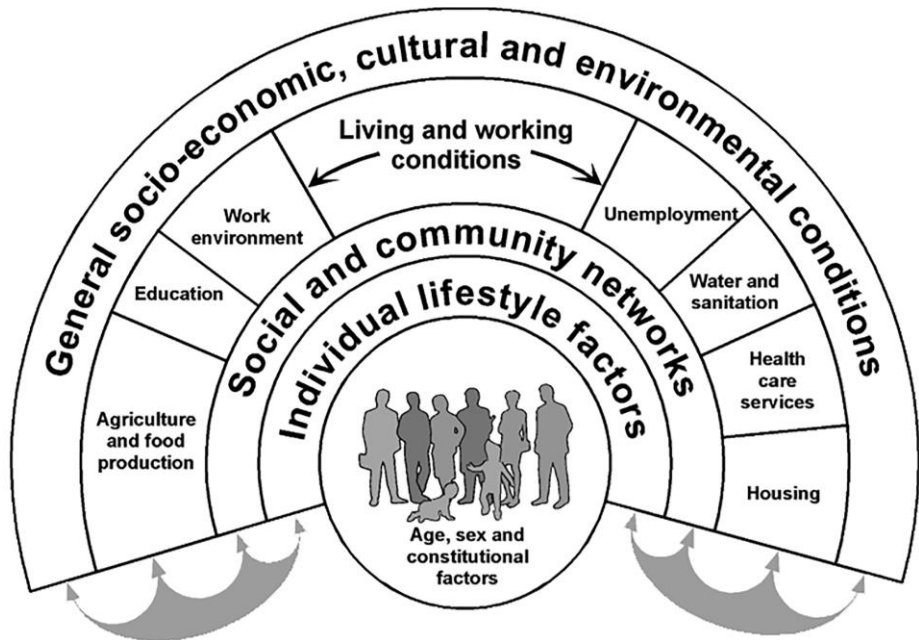
**Prevention** means preventing health issues before they occur. Specifically, there are three areas of prevention:

- Primary prevention: Prevention of the occurrence of health damage, new cases of disease and deaths in the population, or at least reduction of the probability of occurrence
- Secondary prevention: Detecting clinically still inconspicuous early forms of diseases and treat them in time, so that the disease does not progress or can even be cured
- Tertiary prevention: Preventing the worsening of an already manifest disease or slowing down the process

#### 4.1.5 Determinants of Health

Different determinants have a differential influence on different groups of people, which can contribute to health inequalities. Systems theory states that a system is composed of interdependent and interrelated parts, with change in one part producing changes in others (von Bertalanffy 1968). In order to explore the impacts of and the potential to influence different determinants it is thus necessary to appreciate their interrelationships. A number of conceptual models assist this. The most frequently cited is the Dahlgren and Whitehead 'rainbow' – Figure 4.2 (Dahlgren & Whitehead 1991).



**Figure 4.2:** Dahlgren and Whitehead's Determinants of Health Model (1991)

Source: adapted from Dahlgren and Whitehead, 1991

Source: Based on Dahlgren & Whitehead 2021 and Dahlgren & Whitehead 1991.

The extent to which different determinants can be influenced varies; certainly, no individual is likely to exert direct control over most of them. Furthermore, these determinants can have a differential impact at different stages of an individual's life as well as between different social groups and between different countries (Solar & Irwin 2007). Clearly, context is crucial. Since the health determinant model graphically represents the areas that can influence the health and also the needs of a population, it will be described in more detail in the next chapter "Health Needs Assessment," in Section 5.1.

#### 4.1.6 Health Literacy

Health literacy is the degree to which individuals have the capacity to obtain, process, and understand basic health information needed to make appropriate health decisions (Health Resources & Services Administration 2019).

Low health literacy is more prevalent amongst:

- Older adults
- Minority populations
- Those who have low socioeconomic status
- Medically underserved people

#### **4.1.7 Health in All Policies: Health Impact Assessment**

Health Impact Assessment is a methodology for prospectively assessing the potential impact of policy proposals in order to improve their positive impact on the health of a population and to minimize inequalities in health. The HIA is a combination of procedures, methods and tools by which a policy, programme, or project may be judged as to its potential effects on the health of a population, and the distribution of those effects within the population (Drummond et al. 1997, cited by Guest et al. 2013).



#### **4.1.8 Control Questions**

1. Why is it important for health network managers to be aware of concepts of health?
2. Why is health literacy important?
3. Please explain the three core areas of Public Health.

## 4.2 Epidemiology

Epidemiology is the method used to find the causes of health outcomes and diseases in populations. In epidemiology, the patient is the community and individuals are viewed collectively. By definition, epidemiology is the study (scientific, systematic, and data-driven) of the distribution (frequency, pattern) and determinants (causes, risk factors) of health-related states and events (not just diseases) in specified populations (neighborhood, school, city, state, country, the global community).

Issues that epidemiology deals with include: Environmental exposures, injuries, natural disasters, terrorism, non-infectious diseases, infectious diseases.



### 4.2.1 Learning Objectives

- Achieve an understanding of the basic terminology used in epidemiology;
- Be able to search for information about widespread diseases, their prevalence in the population, and their risk factors;
- Have a clear understanding of the complex nature of health and surrounding factors.

### 4.2.2 What is Epidemiology?

Epidemiology is the method used to find the causes of health outcomes and diseases in populations. In epidemiology, the patient is the community and individuals are viewed collectively. By definition, epidemiology is the study (scientific, systematic, and data-driven) of the distribution (frequency, pattern) and determinants (causes, risk factors) of health-related states and events (not just diseases) in specified populations (neighborhood, school, city, state, country, global).

Epidemiology deals with the following issues: Environmental exposures, injuries, natural disasters, terrorism, non-infectious diseases, infectious diseases.

### 4.2.3 Basic terms

The simple way to access any new science is to learn about the basic terminology used in it. It is also necessary to catch the most common definitions for a full understanding of what we will face. At the beginning of our acquaintance with

epidemiology we must familiarize ourselves with the basic population. In the original sense of the word, population means all people living in a given area: the globe, country or region. This definition is not always fully adequate to epidemiology and should be associated with other units instead (e.g. documents, situations, institutions). In that case “population” is a set of units, appropriately defined for a given study, from which we take a sample for testing and the intended results are related. Another word that needs some explanation is “sample” as a subset of the population on which measurements are made and statistical analysis is performed. Choosing elements (people) to be sampled is called selection. If the selection meets the representativeness condition, the results obtained in the sample study can be applied to the general population. The word “random” in statistical meaning is also important and refers to the sequence of observations, activities, assignments, etc. which are the result of a random process in which the probability of each sequence of events is known or can be determined. Randomization is a process of assigning patients (individual cases) to research groups using the random process described above. This does not mean every random assignment but requires the skillful use of arrays of random numbers or appropriate computer generators. The toss of a coin or a dice does not fully meet the randomization requirements. In epidemiology, a large area is devoted to bias which is the lack of validity, and a study is considered biased if a systematic error is present in the study design, data collection, or data analysis. But since these are important issues, firmly related to epidemiological research, they will be further described (National Institute of Public Health 2013).

#### 4.2.4 Basic Health Measures

Health can be described in many different ways because each of us experiences it in our own individual way. In order to achieve a reliable and scientific approach in describing relations between the “health” of different groups, the measures needed for comparisons began to be specified. The most popular ones are those relating to diseases, their effects and the total number of deaths. Their definitions are presented below.

The most commonly used measurement in epidemiology is a **measure of disease frequency** that falls into two broad categories: prevalence and incidence. **Morbidity** is a measure of proportion of people in a population having a given disease, or other analyzed trait, at a defined point in time and provides an estimate of the probability (risk) that a person will be sick at that moment, or for a short period of time. Measures of morbidity frequency characterize the number of

persons in a population who become ill (incidence) or are ill at a given time (prevalence). A frequently used indicator is **Incidence**, which is the number of new disease cases (but can also be used as an indicator of other events) that have occurred in a tested sample (population) within a specified time interval. There are two different measures of incidence: the cumulative (aggregate) incidence and the incidence density.

Measures related to deaths are **Mortality and Death rate**. The first one means the number of deaths that occur over a given period, usually a calendar year. There are general mortality (number of all deaths) and cause-specific mortality (number of deaths due to a specific disease). The measure of mortality is the death rate. In demographics it is the number of deaths in relation to the number of inhabitants. To be more specific the structure of deaths can be present in division of analyzed disease cases and its cold **Death-to-case ratio**. The number of deaths attributed to a particular disease during a specified time period divided by the number of new cases of that disease identified during the same time period.

The latest approach suggests that not only cases of death or morbidity should be analyzed in order to properly assess the state of health. The measures used earlier usually describe the end result of the problems a given person is dealing with. The preventive and promotional approach to health suggests not only to focus on the disease and its negative effects. The actual state of health, or rather full physical, mental (etc.) well-being, should be described by measures aimed to assess the quality of life, not only its length. As a result, measures that better characterize the new trends began to emerge. The first of these is a different approach to mortality. It is more accurate to analyze **premature mortality** – mortality, which – in a given age group – can be prevented by effective actions representing health promotion, disease prevention, as well as appropriate diagnostic, therapeutic and rehabilitation procedures. Premature mortality is a comprehensive measure of the effectiveness of the health care system in relation to the control of morbidity and mortality in selected groups of diseases, in the population dimension. Premature mortality, measured in terms of **potential years of life lost (PYLL)** before the age of 70 years, focuses on deaths among younger age groups of the population. PYLL values are heavily influenced by infant mortality and deaths from diseases and injuries affecting children and younger adults (OECD). In other word the potential years of life lost (PYLL) is a summary measure of premature mortality providing an explicit way of weighting deaths occurring at younger ages. The calculation for PYLL involves adding age-specific deaths occurring at each age and weighing them by the number of remaining years to live up to a selected age limit, defined here as age 70. For example, a death occurring at five years of age

is counted as 65 years of PYLL. The indicator is expressed per 100.000 females and males.

There are also other measures worth mentioning like **HALE**, **QALY** and **DALY**. The first one is an average number of years that a person can expect to live in “full health” by taking into account years lived in less than full health due to disease and/or injury. The second one is quality-adjusted life year or quality-adjusted life-year (QALY) which is a generic measure of disease burden, including both the quality and the quantity of life lived. The last one represents the loss of the equivalent of one year of full health. DALYs for a disease or health condition are the sum of the years of life lost due to premature mortality (YLLs) and the years lived with a disability (YLDs) due to prevalent cases of the disease or health condition in a population (EUPATI 2022, U.S. Department of Health and Human Services 2012).

#### 4.2.5 Epidemiological Studies

Not every study can be called a good epidemiological study. To acquire a correct one, it is important to have in mind that the main goal of this research is to estimate valid measure of association (e.g. an odds ratio) or other population parameter that will be precise upon statistical evaluation. An estimate of a parameter is considered valid if the expected value (over infinite replications) is the true value. If we want the conducted research to reflect the truth, it must be created in a thoughtful way. The most important thing in the planning stage is the exclusion of bias.

**Bias** is the lack of validity and a study considered biased if a systematic error is present in the study design, data collection, or data analysis.

A systematic error is a persistent error having a nonzero mean that cannot be attributed to imprecision in the system of measurement. A random error is due to imprecision in a measuring instrument or protocol used to collect data. Random errors in the absence of systematic errors will not typically cause bias, and their effect can be reduced by increasing the sample size (Coggon et al. n.d.).

The three general categories of systematic errors:

- Selection bias – study population does not represent the target population in respect to important characteristics.
- Information bias – information does not represent the true state of nature.

- Confounding bias – measured association does not represent the true association because of the effect of another factor.

As we already know, each study may have some errors. This fact does not mean that such studies should be deleted. Sometimes even in the good ones there are defects that could not be avoided. However, being aware of their existence, allowed us to formulate conclusions correctly. For these reasons it is important to know what type of research we are currently analyzing or want to conduct ourselves. Initially, a basic division on **observational or experimental studies** should be distinguished. The first one concerns studies in which the investigator does not assign a treatment or exposure to the study participants for the expressed purpose of the research. Observational studies can be divided into two categories: **descriptive or analytic**. The most frequently encountered observational epidemiological studies employed to investigate issues of equine health are **cohort, case-control, cross-sectional and case series**. The table below lists their explanation and description. Investigators performing **experimental** studies, or randomized controlled trials (RCTs), randomly assign treatments or exposures to study participants for the expressed purpose of the study. Experimental studies must be analytical and are typically clinical trials of patients designed to investigate therapeutic or preventive interventions. Experimental studies are frequently expensive and difficult to design well but, on average, provide the highest quality of evidence for identifying true causal associations (Fosgate & Cohent 2008).

**Table 4.2:** Types of Observational Studies

<b>Types of observational studies</b>	<b>Description</b>	<b>Specific features</b>
<b>COHORT</b>	Study in which the researcher follows (observes) a group, termed the cohort, over time to measure the incidence of a particular outcome. Co-	Data is collected at the individual level
		Exposure groups for comparison are defined by factors independent of the research

	<p>hort studies can be descriptive or analytical, and can be defined as prospective, retrospective or a combination of both.</p>	<p>Cases are sampled based on membership in a cohort that is defined by a characteristic of the past or present</p> <p>Data concerning outcome status must be available for a minimum of 2 time-points (beginning and end of follow-up).</p>
<p><b>CASE-CONTROL</b></p>	<p>Investigation in which the researcher selects a group of affected individuals (cases) and a comparison group (controls) to investigate factors associated with being a case. Controls are selected to represent the exposure distribution of the source population from which the cases developed.</p>	<p>The data is collected at the individual level</p> <p>The exposure groups for comparison are defined by observed characteristics, not derived from random assignment</p> <p>Cases are sampled for study based on prior knowledge of outcome status</p> <p>Data could be collected for a single or multiple time-points.</p>
<p><b>CROSS-SECTIONAL</b></p>	<p>Study in which the researcher selects a group of individuals that is often defined by membership in a target population at a particular point in time. These studies are typically descriptive in nature</p>	<p>Data is collected at the individual level</p> <p>Exposure groups for comparison are defined by observed characteristics, not derived from random assignment</p>



	but they could also be designed to test specific hypotheses and, therefore, be analytical.	Cases are typically sampled for study based on membership in a certain population (not required)
		Data concerning outcome and exposure is either collected according to the same time-point or data is collected by investigators at the same time
<b>CASE SERIES</b>	Descriptive observational studies used to generate hypotheses concerning predictors of disease or recovery that can be performed retrospectively or prospectively.	Data is collected at the individual level
		Cases can be grouped for post hoc statistical comparisons based on exposures but assignment to groups is not performed by the investigators
		Cases are sampled to represent the disease or therapeutic procedure of interest
		Information can be collected prospectively or from retrospective sources related either to a single or multiple time-points

#### 4.2.6 Non-infectious Diseases vs. Infectious Diseases

A few years ago, we would not have devoted our time to such comparisons. Pre-occupied with fighting problems such as heart attacks, diabetes or cancer, we have completely forgotten what the world looked like before. We have put out of our head, for a few years now, the problem related to bacteria, viruses and other microorganisms. The world of science has boldly thrown infectious diseases into the basket labeled “obsolete”. The COVID pandemic has strongly verified the approach of scientists. The first issue – the prioritization of activities – has changed. The whole world stopped because of one virus, therefore everyone was anxious to find a cure as soon as possible and others solutions related to e.g.: social or

economic problems. The dilemma that we are currently struggling with should be a lesson for all of us, not only due to a poor preparation for such situations, but also because of a huge drop in reliance on science. If the SARS-CoV-2 virus was more virulent, the health and social effects could be much more deplorable, especially if one takes into account the current lack of adherence to the recommendations and restrictions. Currently, our actions should be more focused on an undesirable events analysis. Referring to experts' suggestions, we should:

- Take action to create a modern public health structure;
- Prepare a legal, organizational and institutional framework enabling preparation of a strategy to combat a possible epidemic threat;
- Initiate efforts to empower public health as a scientific and professional discipline;
- Increase investment in research on threats to population health;
- Undertake activities to effectively implement all types of modern health education in schools;
- Modernize the health care system in the work settings;
- Prepare a new law on public health;
- Stay ethical at work.

(Golinowska et al. 2020)



#### 4.2.7 Control Questions

1. Why is it important for everyone involved in epidemiology to follow ethical principles?
2. Is the scientific world also at fault for not being prepared for the coronavirus pandemic?
3. Could you explain the difference between basic health measures and the more precise health measures like DALE or PYLL?

### 4.3 Humanities and Social Sciences on Public Health: Notes for an Integrative Proposal



#### 4.3.1 Learning Objectives

- have a general understanding of humanities and social sciences on Public Health
- get to know Public Health from a theoretical, sociological, and critical point of view
- be able to conduct valuable research on this topic

#### 4.3.2 Introduction: a Previous Context

Social and humanistic knowledge have been increasingly present in Public Health for a long time due to their strategic nature for the future and the clear necessity for inter- and transdisciplinary approaches entailed by this knowledge field (Ilangoan et al. 2022). The strategic contribution of the integration of this knowledge can be summarized in a main principle (Chen et al. 2022):

The contemporary ways of expert intervention need to articulate technical skills and civic values, integrating the management of the different types of existing social diversity (difference/inequality).

The social recognition of population segments (gender, ethnicity, stigmatization or exclusion) and the imperative to address different forms of inequality or marginalization in realities such as HIV, disabilities, homelessness, mental health, gender violence or addictions, have created an integration necessity for socio-humanistic knowledge that goes beyond the educational/training field (Singh et al. 2022) to become present in the intervention field, now strongly reoriented towards participation. This context explains the growing presence of intervention experiences that deepen in a cooperative understanding of the professional/patient-user relationship, and which can be materialized in a heterogeneous set of new techniques such as storytelling, theater, visual art, poetry or body mapping.

All this background is part of a complex process that undoubtedly has positive elements, although it also presents a series of challenges.

It seems undeniable that our health systems need to work more adaptively with specific groups (Hamilton 2021), as well as turn conventional health care into roles of facilitation, accompaniment and promotion of health cultures. This implies

starting socially-oriented strategies, in order to configure models that will be articulated around the experiences of patients-users-collectives, and configure multilevel care networks that combine formal and informal resources in a flexible way. This process entails the problem of including skills such as the translation of knowledge, the comprehensive criticism of social contexts, or the generation of communication strategies (Bracken et al. 2021).

### **4.3.3 An Integrative and Critical Proposal**

The different dilemmas and gaps that are expected to be solved with the integration of socio-humanistic knowledge, as well as many of the challenges that our public health systems will face in the near future, are related to diversity, or in other words, to different dimensions of what is called healthcare pluralism (Jutte 2013; Wong et al. 2021).

Among the challenges that also can be framed by the practical inclusion of socio-humanistic knowledge, we can highlight:

- Increase epistemic pluralism;
- Generate a more holistic and methodologically interdisciplinary perspective.

In short, the recognition of the potential of social and humanistic knowledge can allow for the understanding of intervention frameworks in Public Health as social technologies with socio-cultural and ethical-political implications and inherent effects unnoticed or partially perceived from a solely “technical” approach. This expanded conception of Public Health systems introduces the possibility of imagining more creative strategies in order to define the problems or articulate forms of collaboration with individual and collective actors.

#### **4.3.3.1 Realistic Interdisciplinarity with a Transdisciplinary Projection**

The first step to thinking about the integration of socio-humanistic strategies and knowledge should focus on clarifying the cooperation framework in which it will be developed. As it is well known, there are several models to explain the possible forms of cooperation between scientific disciplines (Stokols, Vogel & Hall, 2013, p. 24):

- **Interdisciplinary:** Integrating two or more academic disciplines or fields of study in research or practice.
- **Multidisciplinary:** Combining several academic disciplines or fields of study in research or practice.
- **Transdisciplinary:** Involving an integrative and creative process whereby scholars and practitioners from both academic disciplines and nonacademic fields work jointly to develop and use novel conceptual and methodological approaches that synthesize and extend discipline-specific perspectives, theories, methods, and translational strategies to yield innovative solutions to particular scientific and societal problems.

These three options include an attempt to integrate different types of knowledge, in general in front of complex fields or objects. Nevertheless, while in the case of multidisciplinary the different disciplines keep their own boundaries and logic, in the case of interdisciplinary, about the goal is to generate integrative links between the knowledge of the different disciplines that serve to create a different and coordinated knowledge (Choi et al. 2006).

In our case, we are going to work from an interdisciplinary conception, which serves to generate different and coordinated knowledge. We understand this decision as a realistic first step, since the idea of a total and creative integration of knowledge and methodologies seems more like a horizon towards which we should be heading than an actual possibility now.

#### **4.3.3.2 A Collaborative Research**

The concept of research in an area such as Public Health implies the issue of collaboration between researchers from different areas of health like clinical, management or policy design, collaboration also with professionals from the social and human sciences such as epidemiologists, but also anthropologists, psychologists and even historians (as examples, see Bourgois 2002; Elliot & Thomas 2017).

It is not only about the difficulty of establishing cooperative ways of negotiating concepts, strategies to collect different types of data that must contrast or complement each other despite the different conceptions of scientific practice. In recent years, the incorporation of the most critical social sciences has added the challenge of establishing collaboration circuits, return of knowledge and participation. Thus, what was understood as a design that, starting from a series of closed theoretical precepts, collected data from a population defined as a subject

of study that, after the process, generally never knew anything about the conclusions, has become a process in which theoretical conceptions about conflicts or needs are based on previous deliberations with communities and associative sectors. In these processes, methodological design includes moments of exchange of points of view between researchers and participants on the orientation of the conclusions.

#### 4.3.3.3 Other Quality Criteria for Research

The inclusion of these approaches has generated debates about quality standards in research, even more so in an area such as health, in which experimental forms of knowledge objectification take on a very special role.

From the qualitative social research point of view, since the end of the 20<sup>th</sup> century, this debate has taken place in terms of searching for a broader framework of epistemic pluralism. In general, as alternative quality criteria we could cite (Gehrig & Palacios Ramírez 2014; Flick 2007):

- **Reflexivity:** With this term we refer to the researcher's self-critical awareness about the development of their research process at various levels, especially about their theoretical and methodological decisions and the ethical implications of their work.
- **Transparency:** It is related to "showing the kitchen" of the investigation as much as possible: why one technique and not another, why some types of collaborators and not others; likewise, in terms of the data analysis strategy.
- **Authenticity:** The aspiration to obtain unique, true and indisputable conclusions is not realistic; in any case, it is a matter of achieving the most plausible representation possible of the reality of the study, offering visibility to the greatest possible number of possible perceptions and experiences.
- **Holistic perspective:** In order to define a research problem, we need to take into account the entire context in which it is developed.
- **Methodological systematicity:** The chosen techniques, the types of participant, and even their temporal succession, must start from a pre-designed, explicit and productive order. If said design undergoes changes due to circumstantial factors, it is necessary to draw conclusions about it.
- **Social impact or return of knowledge (participatory principle):** Aside from current scientific criteria, the idea of establishing mechanisms to

share and return to the participating individual/collective actors the systematization of the collected information and the possible conclusions and actions emerged from it.

#### **4.3.3.4 Methodological Resources from the Social and Human Sciences**

Narratives/Storytelling is usually associated with Cultural Anthropology and Social Psychology, especially in the work with illness narratives. Very interesting tool to capture models of stigmatization or exclusion in a psychosocial sense, which can lead to very interesting specific issues such as forms of embodiment or somatization. It can be useful as well in order to collect narratives from groups such as professionals in care areas or associative actors in an institutional meaning. At the level of techniques, we could talk about conventional uses linked with the conduction of semi-structured, biographical interviews or focus groups, and also of discursive analysis of other forms of production and discourse such as analysis of social networks, artistic forms of expression that can pre-exist or emerge in the framework of research as reflexive experiences. As a tool, it has been successfully used in many experiences related to Public Health (Elhami et al. 2021; McCall et al. 2019) such as the effects of climate change, vaccination, cancer screening, resistance to antibiotics, smoking or obesity.

Health inequalities/social determinants are usually more associated with epidemiological approaches. The issue of unequal distribution (age, gender, class, ethnicity, rural-urban) of health, disease and access to care is a key feature. To access evidence on these issues, it is usual to start from quantitative works produced by official surveys of different state agencies or by our own surveys. We can also cross data with surveys and data carried out by associations and groups of the third sector that carry out research and social advocacy for the rights of specific groups. Social medicine and the social determinants of health movement have been promoting a more critical approach to quantitative data, which does not naturalize in terms of biology or cultural essentialism the effects of determinants and forms of social and environmental exclusion. The work based on narratives is a magnificent complement to this resource, allowing us to access individual cases or segments singularly harmed by structural violence, in a way that allows us to experientially present and visualize the expression of structural and measurable factors through particular examples as illness cultures or self-destructive response behaviors for individuals or communities.

Historical-social perspective is a resource from historiography with an emphasis on the social, on oral history or on the so-called mentalities, has enormous potential in Public Health issues, as educational experiences have shown (Adams et al. 2021), carried out to gain a better understanding of the impact of social factors on decision-making during the management of the COVID-19 pandemic. Here there are several possible paths depending on the creativity of the researcher, the available data and the geographical delimitation established. Possible ways would be: trying to link certain characteristics of the care systems to socio-historical factors and more or less local processes, the elaboration of the histories of certain types of administrations or forms of management (preventive, educational campaigns) that can also be studied in antecedent moments, or address the evolution of certain types of speeches in the press about certain groups or practices.

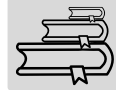
Philosophical perspective, perhaps a humanistic knowledge, less taken into account has been regaining importance in business schools, leadership courses and media debates. Philosophical knowledge would be an interesting resource at two different levels: first, as a theoretical foundation (generally phenomenological) for practical developments linked to questions of empathy; second in terms of the most contemporary models of work on concepts and social categories of language that connect with many of the current forms of activism and cyber activism (for example regarding terms such as gender, well-being, happiness, care, denialism).



#### 4.3.4 Control Questions

1. Why do you believe that socio-humanistic knowledge could be useful in order to approach the future problems in the Public Health systems?
2. Can you explain the differences among interdisciplinary, multidisciplinary and transdisciplinary research approaches, and argue which one you prefer and why?
3. What do you understand as a collaborative research in Public Health and can you propose a short example?





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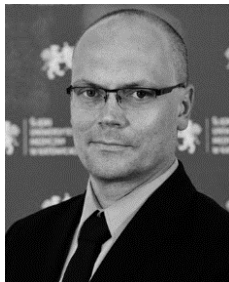
## 5 Health Needs Assessment

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### **List of Abbreviations**

CATI	Computer-Assisted Telephone Interview
CAWI	Computer-Assisted Web Interview
CLD	Causal Loop Diagram
HNA	Health Needs Assessment
LE	Life Expectancy
SD	Standard Deviation
WHO	World Health Organization

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## 5.1 Health Needs Assessment – Sources of Information

Health Needs Assessment (HNA) is the process of revealing health needs of a given population, at the beginning and along the policy cycle. Health needs assessment traditionally builds on quantitative methods, and in this chapter, we introduce the main descriptive statistical methods that can be useful when analyzing health needs of a given population. We also give a short description of the main qualitative data collection techniques, as another frequently used method of needs assessment. Finally, according to the trends in state-of-the-art public health science, we also introduce participatory methods as powerful tools in understanding and mapping complex systems.



### 5.1.1 Learning Objectives

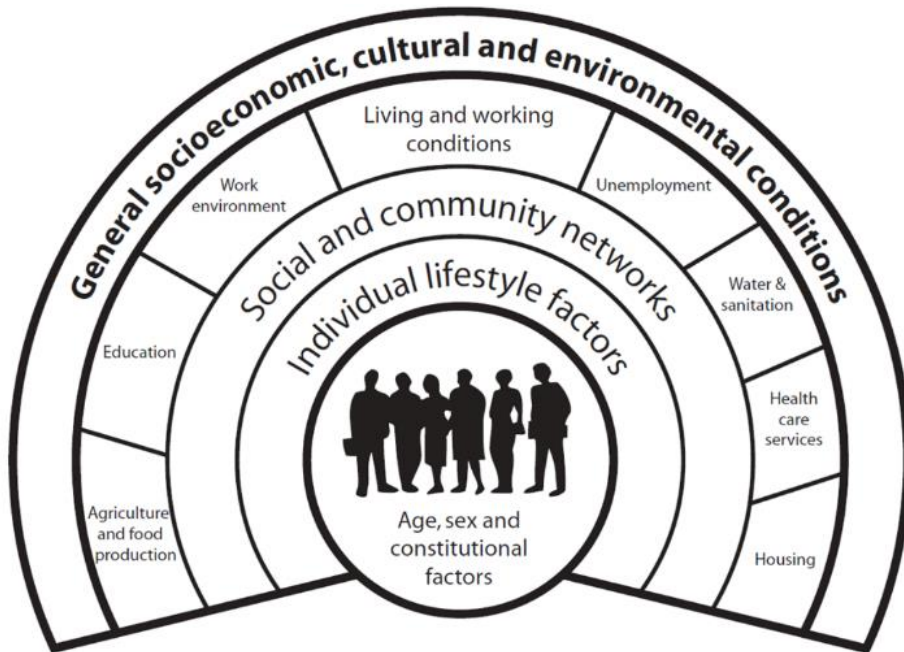
- Understand the determinants of individual and population health and the interrelatedness of different factors;
- Know about different kinds of data to be used in health needs assessment, their advantages and limitations;
- Learn about possible data sources and the nature of data these can provide.

### 5.1.2 Determinants of Health

To perform a reliable and comprehensive health needs assessment using proper sources of information is necessary. These sources are dependent on a number of factors or health determinants, as well as features of the analysis that is about to be performed. What should be defined first is:

1. which population is addressed,
2. what are the exact aims intended to be achieved (e.g. reducing health inequalities by X% by a concrete date),
3. what are the conditions and determinants of factors affecting the needs, and which of them play the crucial role.

The factors mentioned may be presented in different forms, including the graphical models. The example of such a model is the so-called rainbow proposed by Dahlgren and Whitehead and published by the World Health Organization (Fig. 5.1).

**Figure 5.1:** Rainbow of Health Determinants

Source: Dahlgren & Whitehead: European strategies for tackling social inequities in health: Levelling up Part 2. WHO Regional Office for Europe, Copenhagen

This model tries to include numerous health determinants, part of which are individual and are not subject to modification, while the other ones refer to a complex of social and environmental conditions, which may be controlled, at least to some extent.

### 5.1.3 Data Needs for HNA

Considering the exact data needed, at first one may refer to the population, namely a group of people sharing some common features, like for example:

- geographic location (e.g. living in a deprived neighborhood),
- settings (schools, prisons, workplaces, etc.),
- social experience (asylum seekers, specific age groups, ethnic groups, sexual orientation, homelessness)

A population may also mean people who experience a particular medical condition, i.e. mental illness, diabetes or any other disease. A population being subject

to health needs assessment may be defined by one factor or a combination of factors (i.e. middle-aged workers suffering from alcoholism).

The examples of data referring to population may consist of the following: demographics, knowledge or education level, local history, environment, housing conditions, transport infrastructure, voluntary and community organizations active in the population, and many others. Each of these characteristics may have an impact on concrete health needs and then may provide information about concrete actions that are necessary to improve the health status of the population.

The second crucial set of data will refer to diseases and health conditions. These, when experienced within a population, affect health functioning, and generate certain health needs. Diseases and health conditions may sometimes be caused or influenced by a given determinant, such as poor housing or smoking or other types of behavior. This shows in turn that the data qualified to different subcategories may highly permeate and influence each other.

The collected (or intended to be collected) data will also be determined by issues to be selected for intervention:

- Impact – which health conditions and determinant factors have the strongest impact in terms of size and severity on the health functioning of the population?
- Changeability – can the most significant health conditions and determinant factors be changed effectively?
- Acceptability – what are the most acceptable changes needed to achieve the maximum impact?
- Resource feasibility – are there adequate resources available to make the required changes?

#### **5.1.4 Sources and Types of Data**

The data sources to be used may be identified on different levels, namely: local, national and international. The data to be used may also be primary data or secondary data, whereby primary data refers to those that have not been generated or collected before and for that reason require to be generated by the researcher on his own. Secondary data concerns data that has already been collected by someone else and that is available for use. To collect primary data most probably a survey will be needed. However, before starting the survey it should be verified that the same examination has not been carried out by other bodies, statutory or voluntary agencies, like disease-focused support groups mapping the extent of

the illness and/or care provision. Since using secondary data is generally easier, less time-consuming and less expensive, trying to approach local institutions and organizations (NGOs, social welfare offices, local or regional public health offices, primary care providers) seems a good recommendation. A useful set of secondary data may also be at the disposal of teachers, dentists, pharmacists, social or community workers and religious leaders, and, whenever possible, they should also be approached before conducting a new survey.

At the central level in a given country, there is usually an institution, which collects and publishes the most important demographic or epidemiological data about the population. This may be either a national statistical office or public health department, or ministry of health or welfare, or all of them. It is recommendable to try to recognize if there are any specific national databases with useful data available. Finally, there are international databases with social or epidemiological data that may be useful while performing health needs assessment. Their basic advantages are easiness of access, comprehensiveness and largeness of volume. Nonetheless, they usually present data on the level of the country, which limits their usability for local health needs assessment. Despite that, they provide a lot of information about trends, reference points and global epidemiological data.

Although secondary data may be extensive and easily available, it may happen that they have limited usability, i.e. due to their incompleteness or obsolescence. In any of such cases, conducting one's own survey to generate primary data will be necessary. A survey may aim to collect quantitative or qualitative data.

Quantitative data refers to a type of data that is presented in numbers and allows the researcher to perform any kind of arithmetic operations to analyze it and to draw conclusions. Statistical methods are needed to work with the data: descriptive statistics at the most basic level, or statistical tests to find any kind of correlations, cause and effect relationships and many other features of the social and epidemiological phenomena that are described by the data.

Qualitative data in turn refers to any kind of information that may be derived from written text, speech, movies or pictures. Sometimes it may be necessary to quantify them, namely to transform them into those that may be presented in numbers and amounts. But in many cases this will not be possible or even desired.

Since qualitative data is usually collected at a smaller scale, and also does not require sophisticated statistical methods to be analyzed, it may seem that it is easier to collect this kind of data and then use it to achieve assumed aims. This is not necessarily true. Qualitative data requires strict rigor during the process of coding the information obtained from the survey procedure; it is much more

vulnerable to the bias while interpreting it and may be very time-consuming on the stage of compiling the data and then deriving the desired information.

When conducting a survey some basic rules should be followed to avoid difficulties and to obtain the desired objectives. The process should always start with defining the aims of the survey. This will enable to construct the data collection tool that is as compact as possible and will make it easier to systematize and order the data at further stages. This will also ensure that the data collection process will not be unnecessarily extended in time and will deliver more reliable data (the longer the questionnaire, the more random are the answers, especially in further parts of the questionnaire). The second key rule refers to the way of conducting the survey. Depending on the scale of data to be obtained, on organizational and financial capacity of the assessor, on time available, as well as the accessibility to people intended to fill in the questionnaire, it is possible to choose in-person survey is possible, or CAWI (Computer-Assisted Web Interview), CATI (Computer-Assisted Telephone Interview), or paper-distributed questionnaires. Defining the target population for the survey is another key issue. This should be done at the very beginning as it determines the collecting methodology. The population should be adequate to the general aim of your survey. Once the population is defined, a right way of sampling should be applied. In case the population to be surveyed is too big, it will not be possible to obtain data from all of its members, which, in turn, requires sampling. Only if the sample is randomized and of adequate quantity, it will be representative of the entire population and will allow conclusions with regard to the entire population. Non-randomized sampling methods, like convenient sampling or snowball sampling, may also be useful, as they are usually easier and faster, but limitations with regard to providing population-related conclusions must be taken into consideration. Finally, a pilot study should be organized before the main survey is launched, since this enables to eliminate any possible errors and inconsistencies in the questionnaire and increase general credibility of the survey.



### **5.1.5 Control Questions**

1. What are the main determinants of health?
2. What factors may define a „population“?
3. What kind of data sources are there, what kind of data can these provide, and how (using what methods) is it possible to obtain the data?
4. What kind of data can we obtain at country/central or international level?
5. How can you obtain primary quantitative data?
6. In order to get high quality (reliable and valid) data, what are the basic rules when conducting a survey?



## 5.2 Quantitative Methods

### 5.2.1 Learning Objectives

- Understand the usability of basic quantitative analytic methods according to the kind of data
- Acquire a basic understanding of descriptive statistics
- A basic understanding of indices.

### 5.2.2 Descriptive Statistics (Based on Schobert & Vetter 2019)

Descriptive statistics as an analytic technique serves to summarize a given set of data: in other words, to reduce the amount of data while keeping relevant information. Nominal (when data values are not ordered, e.g. gender) and ordinal data (when there is an order, but there is no zero point and the difference in numbered values does not translate into differences between categories) are best summarized by absolute and relative frequencies. Central measures like median and mode are also usable in this case.

Interval and ratio dataset distribution has two main characteristics of interest here: their central tendency characteristic and their variability.

Central tendency can be measured by

- average: the arithmetic mean;
- median: if we order all the elements according to their respective values, the median is the value of the element exactly in the middle; it divides the dataset into two equal parts;
- mode: is the value with the highest frequency.

Measures of variability are

- standard deviation (SD): measures how far values in the dataset deviate from the average – SD typically accompanies the average value.
- inter-quartile range: shows the distance between the first and third quartile (Q1 and Q3), or, in other words, gives information on how far the bottom 25%'s top from the top 25%'s bottom are apart from each other. Is often used when reporting the median.



### 5.2.3 Indices

Indices are relative measures<sup>3</sup> for comparing two or more units for which the same variables or characteristics are known. Indices can be useful either when comparing some values of different geographical units (e.g. countries or regions) in a given point of time, or the values of one geographical unit across different time points.

There are two main kinds of indices: base index and chain index.

Base index means that all other units are compared to the same one. For example, when calculating how the life expectancy (LE) of different EU countries compares, in %, to the EU average; or when we calculate how much LE in a given country in % changed compared to a given year, we use base indices.

The chain index can be used only with longitudinal data, and not geographical, given the condition of preceding units. When we calculate, for example, how much (in %) LE changed in a country from year to year, we use a chain index.



### 5.2.4 Control Questions

1. What is the difference between nominal, ordinal, and interval or ratio data?
2. What statistical techniques can you use in case of nominal or ordinal data?
3. What statistical techniques can you use in case of interval or ratio data?
4. How can you measure the central tendency of a dataset?
5. For what kind of data can you use average, median and mode in a meaningful way?
6. How can you measure the variability of a dataset?

---

<sup>3</sup> Another meaning of indices is composite measures or indicators, constructed from different, single variables by some weighting method.



## 5.3 Qualitative Methods

### 5.3.1 Learning Objectives

- Understand the advantages of qualitative methods
- Get to know the types of qualitative methods
- Acquire basic knowledge related to interviews and focus groups

### 5.3.2 Why and When to Use Qualitative Methods and What Qualitative Method to Use

Qualitative methods of assessment are produced through exploratory research and result in non-numerical data. These results cannot be easily translated into numbers. They are often used when you need the information behind the numbers – the feelings, small actions, or pieces of community history that affect the current situation.

The basic reason to use qualitative methods is that there are kinds of questions and some dimensions of assessment that can be better addressed than by quantitative methods. Some of the major reasons are that this approach:

- answers questions that quantitative measures can't (e.g. open-ended questions) and also provides other information in the process,
- connects directly with the population and the community,
- can get at the underlying realities of the situation,
- involves the population of interest, or the community at large, in helping to assess the health issues and needs,
- allows for the human factor.

There are a number of qualitative methods that can be used in assessment of health issues or needs. They include:

- **Observation.** Observational research is a method where the target respondent/subject is observed and analyzed in their natural/real-world setting. It is used when other data collection procedures, such as surveys, questionnaires, etc. are not effective or adequate.
- **Community or other large meetings.** These meetings allow a range of people a chance to express their opinions and react to that of others.

They can draw on a large pool of opinions and knowledge at one time, and uncover disagreements or differences that can then be discussed.

- Individual interviews. The individual interview is a valuable method of gaining insight into people's perceptions, understandings and experiences of a given phenomenon and can contribute to in-depth data collection.
- Group interviews describes the systematic questioning of several individuals simultaneously in formal or informal settings.
- Focus group. This is a group of people, led by a trained facilitator, assembled to answer specific questions.
- Interpretation of records, transcripts, etc. Might not always be useful in assessing health issues or needs, but can be very effective in convincing policymakers or funders of the importance of those issues and needs.

When do you use qualitative methods?

- when you don't know what to expect, to define the problem or develop an approach to the problem,
- when you want to go deeper into issues of interest and explore nuances related to the problem at hand,
- particularly in an assessment situation – what you are often looking for is descriptive or analytical information,
- when quantitative data are unavailable or unobtainable.

Steps of using qualitative methods:

- decide on a question you want to study,
- evaluate whether qualitative research is the right fit for your research question,
- choose a qualitative research methodology,
- choose the people who will gather the information,
- collect and analyze your data

### **5.3.3 Interviews**

Three main types of interviews are:

- structured interview – questions are planned and created in advance. All respondents are asked the same questions in the same order.

- semi-structured interview – only a few predetermined questions are given while the rest of the questions are not planned in advance.
- unstructured interview – the interviewer asks questions which are not prepared in advance. Instead, questions arise spontaneously in a free-flowing conversation, which means that different respondents are given different questions.

### **5.3.4 Focus Groups**

Focus group discussions are structured discussions with a small, homogeneous group of people identified by preselected criteria.

Focus group discussions generally encourage discussion within the group, fostering an air of constructive debate where information can be cross-checked and issues probed. It is important to ensure the right dynamic between discussion participants and to be careful that the views of some members are not muted by the presence of others.

The size of the focus group discussion plays an important role, as enough people are required to ensure a lively discussion, but it should remain small enough that voices are not lost to the group. Where possible these groups should aim at four to eight individuals (though in some crisis settings it may be difficult to avoid the gathering of larger groups).

Where focus group discussions are run it is useful to have two facilitators in order to ensure one person is able to take notes while another facilitates the discussion. While it may be necessary to identify potential answer options in a questionnaire to facilitate analysis, it is important that the wider discussion is recorded. New and unforeseen responses should always be encouraged.

It is used to learn more about opinions on a designated topic, and then to guide future action.

Steps of a focus group:

#### **Before the meeting:**

- recheck your goals and methods
- decide who should be invited and recruit your members
- decide on the meeting particulars and prepare your questions
- review the arrangements

**During the meeting:**

- review the purpose of the group, and the goals of the meeting. Set the stage.
- Go over the outline of the meeting – how it will proceed and how the members can contribute. Encourage open participation.
- Ask an opening question. This could be a very general question or something more specific.
- Make sure that all opinions on that question are heard. You can for example summarize what you think you have heard and ask if the group agrees or ask a follow-up question.
- When all your questions have been asked, and before the group meeting ends, ask if anyone has any other comments to make. This can be an effective way of gathering other opinions that have not yet been voiced.
- Tell the members about possible next steps.
- Do not forget to thank the group for coming!

**After the meeting:**

- Look at the data. If you have it audio-recorded, make a transcript.
- In some cases, you can devise and use a coding system to "score" the data and count the number of times a particular theme is expressed.
- Share the results with the group.
- Use the results. Now you have the opportunity, and perhaps also the responsibility, to put it to use.

**5.3.5 Control Questions**

1. What are the main reasons to use qualitative methods in HNA?
2. What are the main examples of qualitative methods?
3. What are the steps of using qualitative methods?
4. What are the main types of interviews and how do these differ?
5. What are the steps of focus groups before, during and after the meeting?



## 5.4 Health and the Surrounding Complex System

### 5.4.1 Learning Objectives

- Understand complexity
- Understand the nature and cause of “wicked problems”
- Understand the advantages of participatory methods

### 5.4.2 Health as a Complex System

Health is determined in a complex system.

Complex systems are examined in various different scientific fields, from physics to informatics, biology, etc., to social science areas. The “complexity” of a system does not only mean that the system is utterly complicated. Complex systems have several unique characteristics, even if there is no general agreement on these across different scientific fields. Some of the most commonly acknowledged features of complex systems are:

- A high number of elements which are connected on different levels
- The connections are often characterized by a non-linear nature and seem disordered, the outcomes being hardly predictable. Still:
- The system as a whole operates according to a robust order (and often is highly resistant to change from the outside).

Consequently, it is very challenging to understand how a complex system operates, and especially how can we change it. The human brain is wired for direct causation and linearity: we tend to believe that if two things are causally related and we change one (e.g. pull a string), the other will change accordingly. And proportionally, we usually expect that if we pull harder, the outcome will also enhance. In reality, however, and especially when human beings are involved, this is rarely so. All around the world, a shared experience of policy makers, social scientists, and field workers is that whatever they do, whatever they try, many of the problems they aim at seem to slip out of their hands, and either completely resist to change, or come back in disguise. Public interventions or government programs often create new problems even when mitigating the original – if they do at all.

### 5.4.3 Wicked Problems

However, what if the reason behind this experience lies not in the nature of public interventions and governments (Le Grand 1991), but in the nature of the problems themselves? That is what the term “wicked problem” (Rittel & Webber 1973) refers to.

According to Rittel and Webber (1973), the ten main characteristics of wicked problems are the following:

- There is no definitive formula for a wicked problem.
- Wicked problems have no stopping rule; there is no way to know your solution is final.
- Solutions to wicked problems are not true-or-false; they can only be good-or-bad.
- There is no immediate test of a solution to a wicked problem.
- Every solution to a wicked problem is a "one-shot operation"; because there is no opportunity to learn by trial-and-error, every attempt counts significantly.
- Wicked problems do not have a set number of potential solutions.
- Every wicked problem is essentially unique.
- Every wicked problem can be considered a symptom of another problem.
- There is always more than one explanation for a wicked problem because the explanations vary greatly depending on the individual perspective.
- Planners/designers have no right to be wrong and must be fully responsible for their actions.

Because of these characteristics, wicked problems cannot be expected to react to single-point interventions, or not in the desired way. Also: as the causes of the problem are themselves complex and multilayered, no single person could be able to rightly identify them, and to come up with workable solutions.

For these reasons, the application of participatory methods in problem assessment, intervention planning and even decision making became increasingly prevalent during the past decades.

### 5.4.4 Participatory Methods

If in some form the population is involved in a public policy decision, we can talk about social participation. A wide range of different involvement strategies is possible: from providing transparent information to surveys and other passive forms

of opinion assessment, establishment of public forums, etc. These methods and forms may differ significantly in their depth, depending on whether the communication is one-way or mutual, and at which stage of the decision making process the involvement happens.

One of the main advantages of participatory methods is thus that we gain access to the “wisdom of the crowd” (Landemore & Elster 2012). On the one hand, it means that we can paint a more accurate, realistic picture of the needs and wants of a community. However, the participatory process, in which experts and ‘civilians’ from different fields are all involved in intense interactions with each other, can bring problems and solutions to the surface that individually would have been unavailable to everyone. Another great advantage is that, as opposed to non-participatory decision-making, where decisions are made “about us, but without us” by experts or elected representatives, in this case the fact of being listened to and heard may result in serious attitude change. In addition to these, the participatory method can handle local conflicts of interest, thus increasing social cohesion (Landemore & Elster 2012).

Participatory methods allow us to get to know the reality of other stakeholders. However, in order to plan an intervention, we need a systematic framework in which we can analyze and assess needs and opportunities to intervene.

#### **5.4.5 Causal Loop Diagrams (CLD)**

A useful tool for this could be the so-called Causal Loop Diagram (CLD), which is a visual tool to interpret dynamic systems.

CLDs consist of nodes and links. However, to create a meaningful and usable CLD, there are several rules of thumb we should follow:

##### **Nodes:**

- these are “things” (usually nouns)
- keep them as neutral as possible
- keep them as separate as possible

##### **Links:**

- are “processes” or “effects” (usually verbs)
- are always directed (one node affects the other)
- can be positive (one adds to the other) or negative (one takes from the other)



- include only direct causal relations

When creating the CLD, you always keep yourself to the *ceteris paribus* rule: consider how the change of one node affects the others, given that everything else is unchanged.

This way you will come to a system map, on which you can identify some important phenomena, like:

- external factors (not affected by anything inside of the system)
- long causal chains
- loops: circular forms in which, if following the arrows, you can go around.

The CLD is named after these loops, because basically loops are what keep wicked problems up. There are two types of loops:

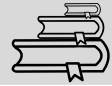
- Balancing loops (with an odd number of negative links)
- Reinforcing loops (with zero or an even number of negative links)

Balancing loops tend to resist change, while reinforcing loops make systems change very rapidly and unexpectedly as a consequence of even a very small impact.



#### 5.4.6 Control Questions

1. What are the main characteristics of a complex system?
2. What are the characteristics of a wicked problem?
3. What are the characteristics of participatory methods?
4. Why can participatory methods offer better solutions for wicked problems?
5. What is a causal loop diagram (CLD)?



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## 6 Promoting the Network

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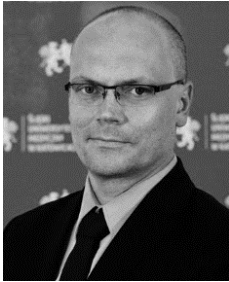
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## 6.1 General Concepts

In this chapter, an insight into health networks and the analysis of networks is given.



### 6.1.1 Learning Objectives

- Understand health networks
- Understand the term *stakeholder*
- Acquire knowledge of methods for stakeholder analysis

### 6.1.2 Integrated Health Network

Forty years after the Declaration of Alma Ata (WHO 1978), health services are still working to improve the health of the population, the quality of health services, efficiency and job satisfaction of health workers.

The promulgation of the Integrated Health Networks marked a milestone in the effort to achieve benefits within a Network. Likewise, the implementation of the Integrated Health Networks is the commitment towards the improvement of the Health Systems (Douglas 2012).

The concept of health service Networks has been built and elaborated on by different authors, while modifications have been made in its configuration in health systems. Variations in this concept demonstrate the lack of consensus that exists around this scope.

A network is defined by Provan and Milward (2001) as a set of programs and services that cooperate with each other, through actions and stakeholders that seek to stimulate the alignment of interests to achieve a common goal, which benefits not only the institutions, but also their parties. In this context, key aspects should be considered for the constitution of a network, such as the construction and interaction between the different participating actors, who must engage synergies for an adequate organization of the network.

Health service Networks, in general, involve people, processes and infrastructure (Friedman et al. 2017), which must be interrelated and coordinated to guarantee adequate and quality care for the user, also considering the efficiency of the organization and the population needs. Gillies defines them as:

Organizations who order or provide a continuum of coordinated services to a defined population and take responsibility for clinical and fiscal outcomes, as well as the health status of the beneficiary population. (Gillies 1993).

Continuing with the construction of the concept, with the previous definition, Lo et al. (2003) added to this description of the most important characteristics for the configuration of Networks concerning the integration of care, quality, georeferenced access, and efficiency, from a perspective of proper use of the resources.

### **6.1.3 Stakeholders**

A good Integrated Health Networks is necessary to propose an analysis of all the parties involved.

When it comes to any organizational or policy project, all of the individuals or organizations, either from within the organization or remaining outside of it, which the project will involve or affect in any way, are called its stakeholders. In other words, a stakeholder is any actor that has a vested interest in the project being subject to implementation (Schwalbe 2009).

A Stakeholder analysis is a method which is being used to find out which stakeholders should be involved and how they should be involved in the process of implementation of any political agenda. The analysis appears as a process of identifying these people or organizations before the project begins; grouping them according to their levels of participation, interest, and impact on the project; and determining the best way to involve and communicate each of these stakeholder groups throughout (Herremans et al. 2016).

### **6.1.4 Professional Network**

This concept refers to building a professional relationship with other people who could have a different background or knowledge, but have common goals or interests in a specific project. The main purpose of Networking is to develop a professional Network (Hodigere & Bilimoria 2015).



### 6.1.5 Control Questions

Health service Networks, in general, involve:

- a) People
- b) Processes
- c) Infrastructure
- d) All options are correct

To make a good Integrated Health Networks is necessary to propose an analysis of:

- a) All the parties involved
- b) Other countries
- c) Other Networks
- d) Patients

The main purpose of Networking is:

- a) To develop a big hospital.
- b) To develop a project without different professionals.
- c) To develop a professional Network.
- d) To develop an emotional intelligence.

## 6.2 Stakeholder's Analysis

The chapter Stakeholder's analysis explains the individual steps of stakeholder management.



### 6.2.1 Learning Objectives

- Understand stakeholder identification
- Understand stakeholder prioritization methods
- Understand stakeholder analysis and management

### 6.2.2 Identifying Possible Stakeholders

This stage may begin with brainstorming with your team a list of all possible stakeholders for the project, thinking of people who could be involved with your work, who could have an impact on or power over it, or that have an interest in its success. The list may be extensive at this stage and may be subject to reduction later, but it is important not to miss a potentially pivotal stakeholder at this early stage (Ferenc et al. 2017).

In the case of local or regional health policy projects, the list should include local administration units or political organizations, including patient organizations, health care providers, health care professionals along with their organizations, associations, labor unions and industry actors/entrepreneurs.

To make the process more efficient, you can try to categorize stakeholders, e.g. by dividing them into those active internationally, nationally, regionally, those being public or private bodies, or by sector (health care, industry, social environment etc.). For each stakeholder you should define the interest connected with your project as well as describe each stakeholder in as many details as possible. This description should include all the attributes of the stakeholder, their position in your project, power, resources, and their ability to mobilize them (Hawrysz & Maj 2017).

### 6.2.3 Prioritizing Stakeholders

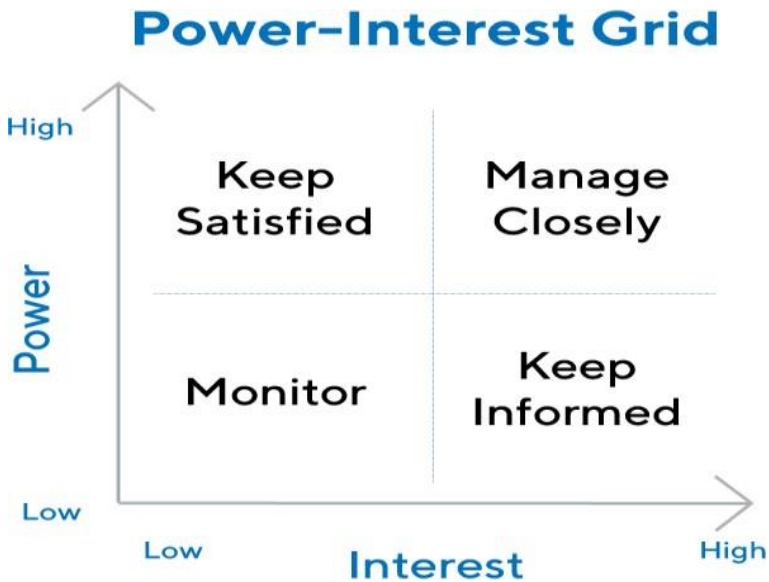
Stakeholders are mostly analyzed according to their:

- Interests (how your project may have an impact on it).
- Positions (do they support your project or not).
- Power (refers to power/authority distribution in the system: how strong is a given stakeholder and how strong may be their impact on your project)

You can prioritize stakeholders either via the criteria of how strong the interest, power, and position is that they have regarding your project, as well as other criteria, like the ability to approach them and engage in the implementation process. As the general catalogue of stakeholders may be very extensive, this stage is necessary to make a proper selection and good ground for the remaining steps of the analysis, as well as the implementation of the project.

For better clarity and effectiveness of the analysis, you may want to map stakeholders. An example of how to do this is by using the power/interest grid.

Following Mendelow (1981) we can group stakeholders into four categories:

**Figure 6.1:** Categories of Stakeholders (I)

Source: Extracted from Mendelow (1981)

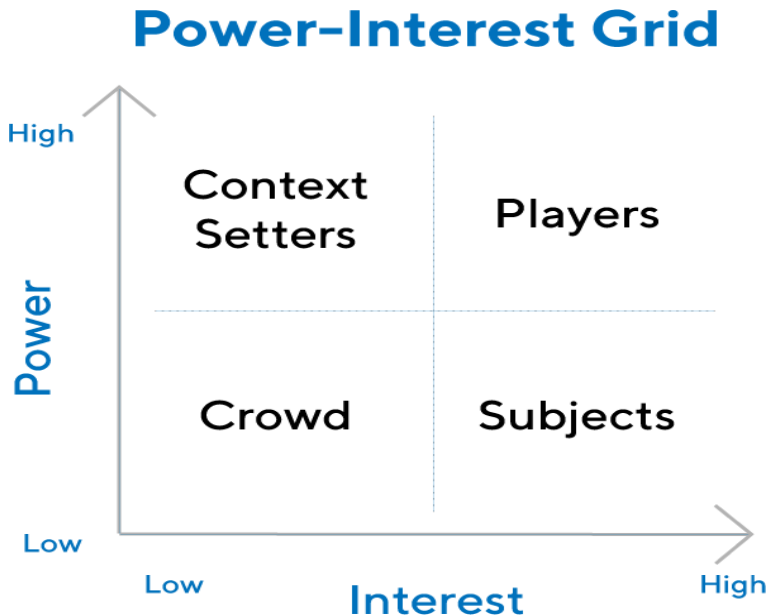
**High power, high interest (Manage closely):** These are your most important stakeholders; therefore, you must engage these people, making the greatest efforts to satisfy them with your project's progress.

**High power, low interest (Keep satisfied):** Because of their impact on your project, you should work to maintain these stakeholders motivated. But if stakeholders have not shown a serious interest in your project, you could lose them if you try to involve them too much in the project.

**Low power, high interest (Keep informed):** You will want to keep these stakeholders informed and check in with them regularly to make sure they are not experiencing problems due to the project implementation. Stakeholders in this category may occasionally offer details to your project.

**Low power, low interest (Monitor):** Just keep these people informed regularly, but do not bore them with excessive information.

Following another possible approach classes stakeholders into four different but related classifications:

**Figure 6.2:** Categories of Stakeholders (II)

Source: Extracted from Mendelow (1981).

**Players:** These are the high-power, high-interest stakeholders with whom you should cooperate and keep fully engaged.

**Subjects:** These are the low-power, high-interest stakeholders who can offer great insights and ideas for the project but you do not always need to agree with all their ideas or suggestions.

**Context-setters:** These are high-power, low-interest stakeholders, who can have a lot of influence on the project but do not want to be implicated in the details. Keep them up to date.

**Crowd:** Finally, the low-power, low-interest stakeholders are called the crowd. These individuals will require some ongoing communication about the project's progress but probably the least of all stakeholders.

All areas of stakeholder identification and prioritization require a lot of information to be collected. A correct analysis should include different sources, both direct, from the stakeholders and from external sources as there are possible discrepancies between what stakeholders declare and how they are perceived by other bodies. The final decision on how to place the stakeholder on the map should consider all sources and weight their credibility.

### **6.2.4 Understanding and Managing Stakeholders**

Once you have detailed which stakeholders fall into which category, it is time to think strategically about the best way to gain the ongoing support of each of these stakeholder types. First, you should ask yourself questions about your stakeholders such as:

- What motivates this stakeholder?
- What other priorities do they have, and how can we align our project with those priorities (or at least ensure the project will not threaten them)?
- Will a given stakeholder likely have a positive view of our project? If not, what can we do about it?

After you've built these profiles of each stakeholder type, you are ready to begin the next phase of the stakeholder management process — developing your stakeholder communication plan and building strategies to influence stakeholders' positions, reduce their opposition or increase their support towards your project by increasing/reducing the impact where needed, building supportive coalitions or making deals with offering benefits in other areas than the one addressed by the project being subject to implementation (Freeman et al. 2020).

### **6.2.5 Setting Goals and Identifying Costs of Stakeholder Analysis**

The costs may refer to the analysis as such, but this, along with the aims of the analysis, should be defined at the very beginning before the start of the analysis. In this step it is more important to assess the costs and aims of strategies to influence stakeholders' positions, which will enable you to calculate the feasibility of your project in the context of your capabilities, to make the decision to step off in case the feasibility is too low, or to select the strategies, which are most efficient in terms of the cost-effect relation (Kennon et al. 2009).

### **6.2.6 Evaluating and Revisiting the Analysis**

Once you are done with your analysis, and once you use its results in project implementation practice, you will need to collect information about how your assumptions confront reality. In this stage you will collect new information about stakeholders based on how they behave and what their reaction to your strategies was. This will be helpful in future analyses and it will also increase your abilities in terms of working with stakeholders, facilitating cooperation with them and, in



the end, in terms of increasing feasibility of any project to be implemented (Freeman et al. 2004).

### **6.2.7 Takeaways of a Stakeholder Analysis**

Policy or market projects require participation, guidance, and approval from a wide range of stakeholders. If they do not understand or agree with the project's objectives or execution plan, any of them can produce fundamental obstacles to the project's success.

However, if you enlist the help and approval of these stakeholders early on, you can turn many of these individuals into avid supporters of your initiatives. This is why it is a smart strategy to conduct a stakeholder analysis before launching any policy agenda, to identify all potential stakeholders and to determine how best to earn their support (Hargraves et al. 2021).



### **6.2.8 Control Questions**

A Stakeholder analysis is a method, which is being used to find out:

- a) Possible stakeholders for the project.
- b) How stakeholders should be involved in the process of implementation of any political agenda.
- c) A potentially pivotal stakeholder.
- d) All options are correct.

## 6.3 Professional Network

The Professional Network chapter introduces network management. This includes structure, communication and leadership.



### 6.3.1 Learning Objectives

- Gain knowledge of the components of professional management of networks
- Get an insight into leadership

### 6.3.2 General Overview

The purpose of networking is to create an active, sharing, and supportive relationship between different stakeholders with the same goals within an organization (Ellison et al., 2015).

The first step to follow when attempting to build a solid network will be the coordination, progress to cooperation and collaboration by all parties.

#### **Coordination:**

At this stage, the stakeholder learns about the organization. Self-interests and resources are defined. The coordination includes an exchange of information between the stakeholders.

#### **Cooperation:**

Cooperation between stakeholders provides a clearer understanding of their level of motivation to take part in an organization. We could say that it is the point where joint strategies begin to emerge.

#### **Collaboration:**

At this level, stakeholders are competent to work together on a specific plan.

“With collaboration, there is increased recognition of the values of each organization, trust, respect, a clear understanding of the benefits for each partner, and innovative ideas are presented to meet a common problem. There can be challenges, but they are usually well worth the effort to benefit a community” (Austin 2010).

### **6.3.2.1 Phases to Build a Network Include**

Greve and Salaff (2003) suggest that the phases to build an adequate network are as follows:

1. Identify and engage the stakeholders.
2. Establish personal relationships, and begin to build network.
3. Clarify the goals and objectives each partner wants to accomplish.
4. Choose and implement a partnership that is mutually beneficial.
5. Establish governance, procedures, ground rules, and decision-making structure.

The best way to build and keep a relationship with the stakeholders and project team is to involve them in the organization. This may include a strategy management.

### **6.3.2.2 Synergy in the Network**

A network's management involves different strategies:

#### **6.3.2.2.1 Effective Communication**

Effective communication is the ability to transmit two essential points concisely and clearly: what are our goals and how are we going to achieve them?

Therefore, it is of great importance to talk about the role played by each of the workers and their relevance within the organization. This will help motivate people to fulfill their tasks to reach the organization's objectives (Hargie et al. 2017).

#### **6.3.2.2.2 Brainstorming**

Brainstorming is a group technique, the objective of which is to generate new ideas on a specific topic or problem in a relaxed atmosphere.

The use of brainstorming is to solve problems, generate innovative solutions and overcome conformity in a given job or situation. Sometimes it can also help find ideal business opportunities to implement in a company (Rawlinson 2017).

#### **6.3.2.2.3 Dynamic Environment**

Dynamic group network's objectives (Cunningham et al. 2012):

- For each participant to value other members of the group.
- To facilitate recognition among members in the creation of a common network.
- To give the possibility of assessing group functionality.

#### **6.3.2.2.4 Authority and Responsibility**

Authority is the right to give orders and the power to expect obedience. Responsibility is a natural consequence of authority. According to Fayol, the legal authority inherent in one's function and the personal authority formed from intelligence, knowledge and aptitude must be distinguished. It is a requirement for someone working in a superior position to unite both types of authority.

In turn, authority is accompanied by the power of sanction, which has its source in the feeling of justice (Costa & Aparicio 2003).

#### **6.3.2.2.5 Effectual Planning**

Planning is the process of evaluating an organization's goals and creating a realistic plan, in which your action plans are set according to your strategies to achieve the objectives (Mohapatra 2009).

- Establish objectives.
- Identify resources.
- Set the related goal tasks.
- Prioritize goals and tasks
- Create activities and a calendar.

#### **6.3.2.2.6 Teamwork**

Although there are several definitions of teamwork, we recommend focusing on the one by Katzenbach and Smith (2000):

They define teamwork as work by a number of people with complementary skills, who are committed to a purpose, a set of performance goals and a common approach, for which they hold each other accountable.

There are five components of teamwork necessary for high performance: the five Cs of teamwork.

- Commitment
- Contribution
- Communication
- Co-operation
- Connection

#### **6.3.2.3 Leadership**

Considering the network as a set of actors with similar objectives, a new tool for managers of healthcare organizations emerges.

The World Health Organization (2008) defines leadership as having a vision and being able to communicate, motivate, negotiate, and manage resources and support to realize it. The technical dimension of this concept refers to the leader's abilities to perform his or her role, in this case the management of the healthcare network. They require knowledge in risk and change management, administrative, economic, and financial competences, negotiation skills as well as knowledge about the corporation.

A key aspect of the leadership role is innovation. Denis et al. (2002) and Dopson et al. (2002) suggest that its application is not always easy as it is often a process that depends on the interaction between acquired knowledge, local actors, and complex contextual variables such as the role of professional groups.

There is widespread agreement that there is space for improvement in healthcare leadership. A network is a complex organization, thus requiring a leader to ensure a culture that fosters quality and safety and to account for the goal to meet patients' needs as well as for the availability of resources, a competent workforce, and regular performance evaluation (Governance institute, 2009).

The leader invents and advances organizational culture. The implementation of this role makes a difference in the group's ability to achieve change and improve results.

This growth is frequently linked in the literature to self-efficacy – the belief in personal abilities to take the actions necessary to achieve goals –, pointing to a positive relationship between self-efficacy and transformational leadership (Salanova et al., 2011).

Bass and Avolio (1997) highlight, in order to explain the profile of the transformational leader, that it is their ability to change the culture of the organization. Culture is understood as the technical and economic conception of the organization, as well as its values and philosophy. According to Bass and Avolio (1997) the transformational leader introduces changes in the organization with respect to those topics that can be talked about, groups and identities, norms and means to lead, as well as beliefs about ideology, religion, morals, ethics, and human nature.

In terms of concrete actions to improve leadership, ACN (2006), Carter et al. (2010) and Higgins et al. (2014) highlight the importance of taking the needs of patients and the community at the center into account in a systematic way, of using role implementation tools, ensuring that all dimensions of roles are developed, communicating clear messages to raise awareness of roles in the organization, creating networks, promoting mentoring, and negotiating role expectations with all actors in the network.

The main points are summarized below:

Leadership is a process of influence that aims to motivate and convey the vision of the project to the whole network.

So far, the evidence has not been able to demonstrate a direct relationship between leadership and organizational results, but rather an indirect one based on mediating variables such as motivation, satisfaction, or group cohesion.

Transformational leadership has occupied a prominent position in the literature over the past few decades and is based on the inspiration and empowerment of the leader.

In the literature on leadership in healthcare, there is a consensus on the need to implement leadership styles in work teams with common objectives.



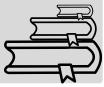
### 6.3.3 Control Questions

There are five components of teamwork necessary for high performance (please tick the wrong option):

- a) Commitment.
- b) Contribution and connection.
- c) Communication and co-operation.
- d) Consolidation.

A professional network is:

- a) A group of people with similar objectives.
- b) A group of people with different objectives.
- c) A group of people with similar curriculum vitae.
- d) A group of people with similar backgrounds.



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## 7 Project Management

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## 7.1 Successful Project Management

The following chapter gives a brief overview of the project management process and tools that can be used. The role and associated tasks and competences of a project manager require knowledge and experience, primarily in the form of professional competence, social competence, and project management competence (Sterrer & Winkler 2010). First, however, it should be clarified what a project is about in the first place.



### 7.1.1 Learning Objectives

- have a general understanding of project management
- get to know different project management tools
- be able to carry out a simple project and know what to consider in the process

### 7.1.2 Definition

**Projects** can be perceived in different ways, as:

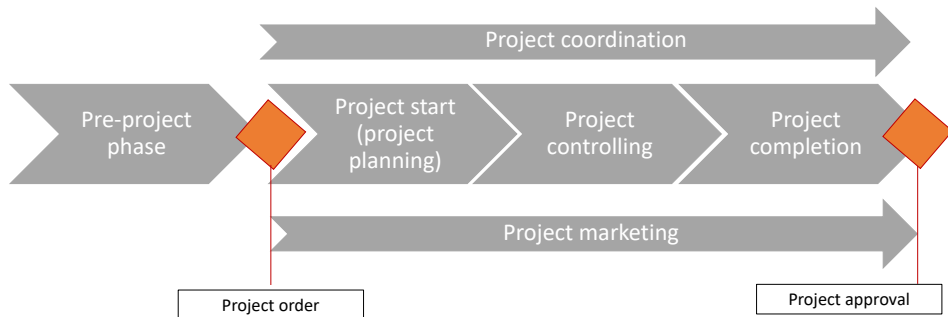
- complex tasks
  - mostly new
  - risky
  - target-determined
  - dynamic
  - limited in time
  - temporary organizations
  - social systems (that are clearly separated from their environment but also have relationships with the environment)
- (Sterrer & Winkler 2010; pma – Project Management Austria 2019)

Project management can be defined, according to a process-oriented approach, as planning, controlling, coordination, marketing and completion of a project. This enables the description of the processes as well as the elaboration of corresponding tools. Objects of consideration in project management are goals, deliverables, deadlines, costs and resources, organization and culture as well as the project context.

### 7.1.3 Project Management Process

Most of the time, a project follows a certain system – the project management process. This process can look like Figure 7.1.

**Figure 7.1:** Project Management Process



Source: own graphic according to Litke (2007).

The Pre-project phase is not part of the „real“ project phases, but refers to what happens before the project order, for example the emerging of project ideas, initial talks with team members and stakeholders, a first cost-benefits analysis, weighing the costs, thinking about what resources will be used and making decisions.

After that the project can start. This phase includes the transfer of know-how from the pre-project phase to the project. Also, the design of a project organization (with roles, organigram, culture, documentation, and communication) and team building are part of this phase. Project plans are created and the project goals will be agreed on, so the focus lies on the project development. A good development of risk management measures is also important.

Such project goals must be measurable, achievable, realistic, and time-based (SMART).

**Specific:** The goal should be comprehensible to all participants, clearly formulated and clearly targeted (focused).

**Measurable:** At the end of the health promotion measure, it should be possible to measure in how far the defined goals have actually been achieved in terms of various criteria (quantity, quality, time). With the same method and the necessary information, these measurements should also be reproducible by others.



**Achievable:** The defined goals should be achieved with the help of the available resources, available knowledge and within the set timeframe. Often a compromise must be found between what is desired (challenge) and what can realistically be achieved.

**Relevant:** The achievement of the defined goals should be linked with a health benefit for society and the individuals in the target population.

**Time-based:** Clear time points should be defined at which certain milestones should be reached.

**Project coordination** is a continuous process that starts with the **project order** and ends with the **project approval**. It includes all coordination activities of the project manager.

**Project marketing** is also a continuous task and ensures the internal and external marketing of the project and the communication of project results.

The **project controlling** process is not a continuous but a repetitive PM process. The aim of project controlling is to check the determination of the project status including financial, scheduling, performance-related and social fields of action. Furthermore, project progress reports are prepared in this process.

The **project completion** includes the final activities that will be carried out in the project. In this process results are communicated; know-how is transferred and the project team is dissolved.

## 7.1.4 Project Management Tools

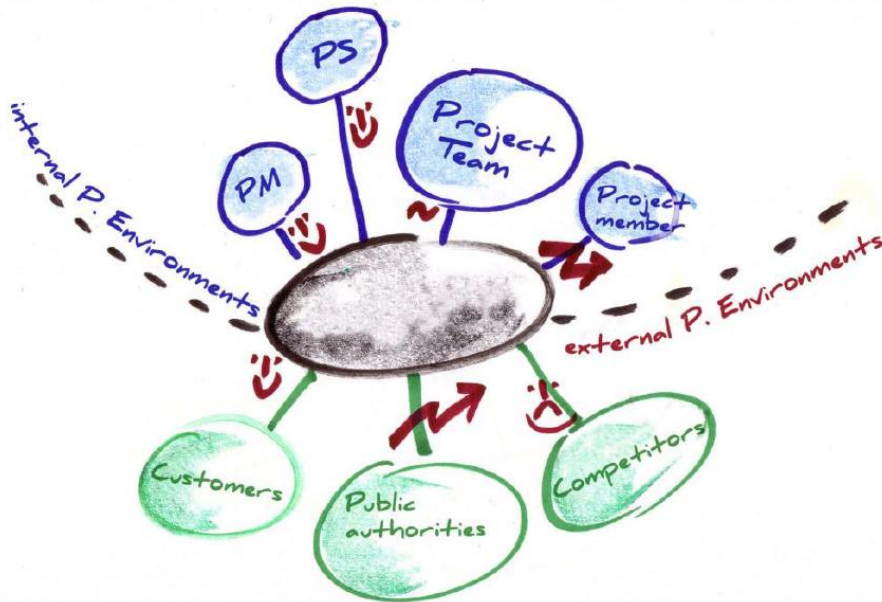
In this chapter a few of the most important project management tools are explained.

### 7.1.4.1 Project Environmental Analysis

The project environment analysis is one method of analyzing and evaluating the relationships, expectations and influences on the project through internal and external social environments. The results of the analysis are used to derive the necessary activities for designing the environment relationships. It must be determined which environments are "relevant" for the project and significantly influence the project success. Relevant project environments can differ in internal and

external project environments. External project environments include, for example, the customers, public authorities, and competitors. External project environments are primarily interested in the project end result.

**Figure 7.2:** Project Management Diagram



Source: pma – Project Management Austria (2019).

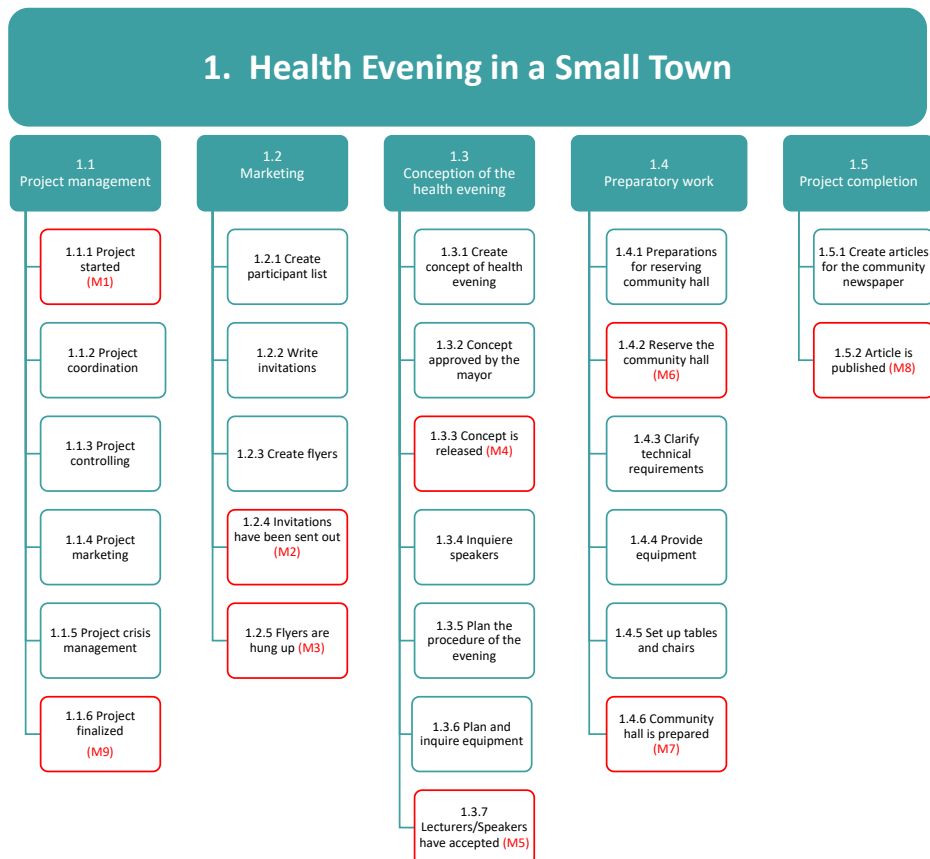
#### 7.1.4.2 Work Breakdown Structure

The objective of the work breakdown structure (WBS) is to display performance planning by phases as a tree diagram. Thinking in terms of project phases helps project members to structure projects in a process-oriented way. The WBS contains all the tasks to be performed in a project, displayed as work packages. Level 1 of the WBS tree displays the project, and level 2 is a process-oriented structure of the project by phases, wherever possible. The project phases are different for each project, although they can be standardized for certain types of projects. As of level 3, the tree displays the work packages (pma – Project Management Austria 2019)

The work breakdown structure is:

- A basis for the agreement of objectives (work packages) between the project
- A classification of the project into work packages that can be planned and managed
- The basis for implementation planning, scheduling, costing and resource planning
- A central communication instrument in a project

**Figure 7.3:** Preparation of Health Evening



Source: own work breakdown structure according to Hofer-Fischanger (2021).

### 7.1.4.3 Work Package Specifications

The contents and results of work packages are defined in work package specifications. They are used as a basis for the agreement on objectives between the project manager and the persons responsible for the work package (project team members).

The objectives of work package specifications are to:

- Clarify the content of each work package
- Clearly differentiate one work package from another
- Recognize interfaces/dependences between work packages
- Define results
- Define the evaluation and measurement of work performance progress of work packages (in connection with the results)
- Give orientation for the work of the project team members and establish commitment

Work package specifications do not specify all work packages, but just the most important ones (e.g. new, critical, complex and costly work packages) (pma – Project Management Austria 2019).

### 7.1.4.4 Gantt Chart

Gantt charts are one of the most common and effective methods of displaying activities (tasks and events) by time. On the left of the chart is a list of the project activities (work packages), and on a bar at the top – from left to right – is a matching timeline. Each activity is represented by a bar, which indicates the start date, duration and end date. Milestone planning is the crudest planning method and absolutely vital. The work breakdown structure with its work packages is used as the basis for this.



teams, creates a vision for success, and aligns everyone on what it takes to stay on track for success.



#### **7.1.4.7 Control Questions**

1. Create a project goal according to SMART criteria.
2. Of which phases does the project management process consist of?
3. Why is it important to create a work breakdown structure?

## 7.2 Knowledge Management

This chapter is about the knowledge that exists or can arise within networks. First, there is an introduction to the understanding of knowledge. Then it explains how knowledge can be processed and disseminated.



### 7.2.1 Learning Objectives

- Gain an understanding of knowledge management
- Acquire knowledge of different methods in knowledge management
- Acquire knowledge of how to address specific target groups

### 7.2.2 Introduction

The human factor is at the center of knowledge, because people generate, disseminate and evaluate knowledge (Dittmar 2002, p. 5). But what exactly is knowledge? Knowledge is the result of consciously processing, finding out, selecting, understanding, grasping and evaluating information and skills (Küchler 2017, p. 561). It is therefore very complex. In addition, knowledge is individual in nature (Qulling et. al 2013, p. 76). In order to pass on knowledge, it needs language or writing, otherwise the transfer does not succeed (Dittmar 2002, p. 6). There are two major challenges in knowledge transfer: representation and coordination. Thus, specialists have to de- and encode their knowledge and generalists have to localize, understand and apply the knowledge. Representation is the challenge in the first case and coordination in the second (Dittmar 2002, p. 6). So how can knowledge be successfully transferred? The answer is knowledge management.

Knowledge management describes the process of identifying, mobilizing and using knowledge. Important information and documents are processed and stored in such a way that they can be used to support decisions (Dittmar 2002, p. 6). Successful knowledge management also leads to an increase in the transparency of information and capabilities in the network (Ertl-Wagner et al. 2009, p. 144; Com.HeNet). In the long term, this can lead to an increase in the quality of networks. In a health region, knowledge management has the potential to promote public health issues. In addition, existing gaps between knowledge and practice can often be closed. This can be used to reduce a waste of time and money. The implementation of new health services as well as the treatment and management

of these can also be supported (Roohi et al. 2020, pp. 1-2). It is clear that the potential of knowledge management is high. But of course there are also challenges. Access to the required knowledge can be difficult or non-existent. Especially in these cases, the acquisition of knowledge requires a lot of time (Roohi et al. 2020, p. 2).

### **7.2.3 Issues of Knowledge Management**

Knowledge management is therefore about the dissemination and sustainability of knowledge (Qulling et al. 2013, p. 76). One aim is to reduce access barriers to required knowledge (Dobbins et al. 2010, p. 2). Network partners must be provided with the relevant information in order to be able to act in the interest of the network. The tasks of knowledge management are the analysis and use of knowledge. Analysis includes the systematic collection and provision of information. It is important that knowledge is used in a targeted manner. In this way, the competences of individual network members and the overall quality in the network can be increased (Qulling et al. 2013, p. 76).

In order to be able to manage knowledge, it is essential to generate knowledge. Different sources can be used for this purpose. Local information and data can be analyzed (Roohi et al. 2020, p. 2). Systematic research and the generation of meta-analyses are conducive to comprehensive knowledge generation (Dobbins et al. 2010, p. 2). Furthermore, interviews with relevant actors of the respective problems and topics are recommended. Other networks can also be consulted and involved (Com.HeNet).

The use of knowledge is referred to as knowledge implementation. Active knowledge implementation is characterized by the distribution of information to the network members. This is done on the network manager's own initiative. In passive knowledge implementation, network members retrieve information from the network manager. Three questions are particularly important in implementation:

1. Who needs the knowledge?
2. What type of knowledge is relevant?
3. How should the knowledge be transferred? (Qulling et al. 2013, p. 80)

In the run-up to implementation, these questions should be well considered. It is also important that a trusting atmosphere exists in the network during knowledge implementation (Qulling et al. 2013, p. 80). Once the knowledge has been imple-



mented, it should be regularly checked for its currency and relevance. The relevant network partners should have unrestricted access to the knowledge. However, misuse and misunderstanding of the information must be clearly excluded (Qulling et al. 2013, p. 85).

Network communication is part of successful knowledge implementation. This is because it can support the creation of new knowledge as well as sustainable work with knowledge. In the area of internal network communication there are the following four goals:

1. Increase awareness of the network's goals and identification with them.
2. Increase awareness of the goals, core competencies and willingness to cooperate.
3. Ensure access to relevant information.
4. Create an open, creative, cooperative and innovative communication culture.

To achieve these goals, it is important that a trusting communication atmosphere prevails. The awareness of achieved goals can be strengthened by presenting and celebrating successes (Helmcke 2008, cited in Qulling 2013, p. 84). This can increase motivation at the same time. Knowledge can, for example, be made available on platforms (Helmcke 2008, cited in Qulling 2013, p. 84).

There are also four major goals in external network communication.

1. Increasing awareness of the network and its objectives.
2. Creating a positive image
3. Public positioning of the network
4. Acquisition of new network partners

These goals can be supported by the network's regular reporting. Participation in public and political discussions can also raise public awareness of the network. Image-rich network partners can also increase awareness through a public connection to the network (Helmcke 2008, cited in Qulling 2013, p. 84).

#### **7.2.4 Knowledge Management Tools**

Various tools can be used for successful knowledge management: Technical means, social events or written information through press relations (Ertl-Wagner et al. 2009, pp. 143-144).

Social events can be used to collect and evaluate information. The practical experiences can then be transferred to projects and improvement processes. Possible event types are e.g. best practice communities, workshops or lessons learned (Ertl-Wagner et al. 2009, pp. 143-144). The use of lessons learned is recommended at the end of a project phase. All those present can formulate and share insights they have learned in the respective phase. Together they discuss what they have learned and what they would like to apply in future projects. A social event should be planned with a generous amount of time in advance. The target group should be defined as well as possible. Who is needed and why? Invitations should go out to the relevant people well in advance. Finally, in addition to planning the theme, further organizational planning is also necessary. This includes the catering as well as the type of event. Different moderation techniques have different advantages. At this point we refer to the chapter on Network Management, where moderation techniques are explained (Com.HeNet).

Another component of knowledge management is the retention of knowledge. This involves the codification and updating of knowledge. Various software packages can be used to support this. Virtual concepts enable simultaneous editing of documents including knowledge about who has edited something. In addition, authorization concepts can be used. For example, files can only be edited by certain persons (Ertl-Wagner et al. 2009, p. 144). An example of such documents is the SharePoint program, which is described as an example (Ertl-Wagner et al. 2009, p. 143). The program is derived from Microsoft Office 365 and is chargeable. It enables collaboration on a kind of platform. Documents, pictures and apps can be shared and edited together. In addition, a chat function can be used. The use of this software can support network management and help build social relationships through collaborative work (Com.HeNet). Other possible programs are e.g. Google Doc or also PARIHS.

Working with the press can increase the visibility of networks in the public eye. Among other things, sponsors and donations can hereby be acquired. It is not about an advertising message on the part of the network, but about public resonance of successful network cooperation (Quilling et al. 2013, p. 97). There are different types of public that can be addressed in different ways.

**Table 7.1:** Targeting Different Types of Public

Type of the public	Addressing instruments
Internal public	Invitations, committee meetings, minutes, annual reports, Internet, etc.
Subject (political) public	Events, technical papers, statements, newsletters, etc.
„Core“ public	Flyers, posters, advertisements, information stands, etc.
Media public	Press releases, professional articles, Internet, events, etc.

Source: Own representation according to Qulling et al. 2013, p. 99.

The different types of publicity are also linked to different objectives. Internal publicity is about one's own network partners as well as sponsors and advisory boards. The goal here is, among other things, the motivation and activation of the target persons. The professional (political) public is connected with the goals of reputation and support. The "core" public consists of stakeholders and initiatives as well as networks with similar goals. Here, too, reputation and activation are the goals. But building trust and bonding are also among the goals. In communication with the media public, public perception as well as the creation of sympathy towards the network are essential goals of communication (Qulling et al. 2013, p. 99). In communication with different target groups, the focus should always be on the objective of the communication. A target group-specific address as well as an appealing design of the communication channels should be considered. When using pictures and other sources, always pay attention to the licenses and related information (Com.HeNet).

A circular is particularly suitable for addressing the internal public. The following example informs about the foundation of a new working group in a health region and is described as a representative example of instruments for addressing the public.

**Figure 7.5:** Example of a Circular Letter

Circular letter from the network manager to all members

**Creation of the new thematic working group „Obesity in primary school age“**

*Initial situation* *For these reasons, a working group will address this issue and identify ways to reduce obesity in primary school children*

*New working group* *Reduction of obesity at primary school age*

Name	Affiliation
Peter Meier	Health Department Viersen
Sandra Koch	Primary school Viersen I
Tim Hirten	Sports club Viersen

*Important dates* *Important dates of the working group*

---

01/04/2022 Start of the group work

01/06/2022 Presentation of the project idea in the network

01/09/2022 Start of the measures

Marie Senne  
Regional Health Network Manager Viersen  
02/02/2022

Source: Own representation according to Dittmar 2002, p. 8.

When drafting a circular, attention should be paid to visual breakpoints, a clear structure, exact presentation of the content and clear mention of the main aspects (Dittmar 2002, p. 8).

### 7.2.5 Conclusion

Successful knowledge management is important for the work in networks. Only well-informed networks can work successfully and thus achieve a high quality of projects and results. Communication can be used successfully to generate and transfer knowledge. Here, attention must be paid to a targeted approach. Various tools and methods can be used for sustainable knowledge retention.



### 7.2.6 Control Questions

1. Create a definition of the term *knowledge*.
2. Why is positive knowledge management so important in the network?
3. Create a circular to inform your network partners about the election of a group spokesperson in a working group.

## 7.3 Integration Capacity

This chapter is about team integration, the integration capacity is the process of turning a group of people into a united team. It will be a group of people organized to work together, in an interdependent and cooperative manner, to meet the needs of their customers, achieving common goals and objectives.



### 7.3.1 Learning Objectives

- Gain an understanding of integration capacity.
- Get to know different conflicts management tools.
- Be able to carry out an analysis of organizational problems.
- Gain knowledge of different methods of communication.
- Gain knowledge of how to development of articulation/solving problems.

### 7.3.2 Introduction

Integrated health service networks are made up of linked sets of people, distinguishable by the type of decisions they make.

Integration capacity means to be competent to recognize interdependencies between various projects, programs and portfolios and cooperating with interested stakeholders in order to develop their assertiveness in achieving related strategic organizational objectives. Implies the capability to impact and negotiate with internal users with different interests (Chin & Hamid 2015).

Integration capacity is a necessity part of Human resources management in an organisation. Project managers are efficient when they can communicate well with stakeholders (Fisher 2011). Integrity is an important characteristic that defines a project manager in order to maintain long-term relationships with the stakeholders. The project manager needs to recognize the strengths and weaknesses of the parties involved in a project (Fisher 2011). Integration capacity involves different skills, and a good project manager should know how to develop these competencies using techniques and procedures to answer the expectations.

### **7.3.3 The Project Manager's Competencies**

According to the Project Management Institute (2007), we can identify several competencies of a project manager:

Conflict management, careful analysis, multidisciplinary knowledge management, communication (argumentation skills), problem solving, negotiation, anticipation of facts.

These skills are essential to reach the desired expectations of a good project manager at level 3 (Highly effective). (Carvalho & Rabechini Junior 2015).

#### **7.3.3.1 Conflict Management**

Conflict resolution is integrated as the project manager must be able to resolve conflicts between stakeholders, users and the project team, be able to keep them satisfied at all times and additionally not add extra charges to the organization.

Following Villa (2012) some of the conflict resolution techniques are:

- **Problem solving:**  
Gather in one person from the conflicting parties to identify the problem and solve it in a frank discussion; this will help improve the conflict environment.
- **Higher order goals:**  
Set a common goal that cannot be achieved without the cooperation of the parties in conflict, i.e., a settlement will not be achieved without the cooperation of the parties involved.
- **Resource Expansion:**  
When a conflict is caused by a shortage of resources (money, opportunities for advancement, office space), expanding them can be a good solution for everyone. It is better to maintain a pleasant atmosphere, expressing each party's discomfort.
- **Avoidance:**  
In some cases it is better to avoid being part of a conflict in order not to prolong the existing problem.
- **Compromise:**  
Downplaying the differences while emphasizing the common interests of the parties in the conflict.
- **Settlement:**  
Each party in the conflict gives up something of value in order to achieve a favourable settlement for each party. It is important to contribute something that makes the other party feel better.
- **Mandate:**  
Management uses its formal authority to resolve the conflict and communicates its wishes to the parties.
- **Modifying the human variable:**  
Apply behavioural change techniques, such as human relations training, to alter attitudes and behaviours.



➤ **Modify the structural variables**

Change the formal structure of the organization and the relationship schemes of the parties in the conflict by changing the design of positions, transfers, creation of coordination positions, etc.

### 7.3.3.2 Careful Analysis

How is it possible for project managers to manage this?

The cause and effect diagram is now a very common applied technique for analysing organizational problems. The fishbone diagram is a graphical way of analysing and describing the cause and effect (Coccia 2018).

The group engages in evaluating each of the problems/defects to find the source causes of these problems. This analysis needs to be done in a coordinated approach and it is essential in order to understand all the causes impacting to the defect or the problem.

Kaoru Ishikawa developed this methodology in 1943. The great value of his idea was to elaborate a graphical analysis to make it more understandable.

This diagram, also known as the cause-effect diagram, is based on the premise that every problem has a cause; that something is wrong with a process. It is then necessary to identify where the actions that are shaping the problem arise from.

Another value of the method is its flexibility to adapt to any industry, activity, area, context or situation.

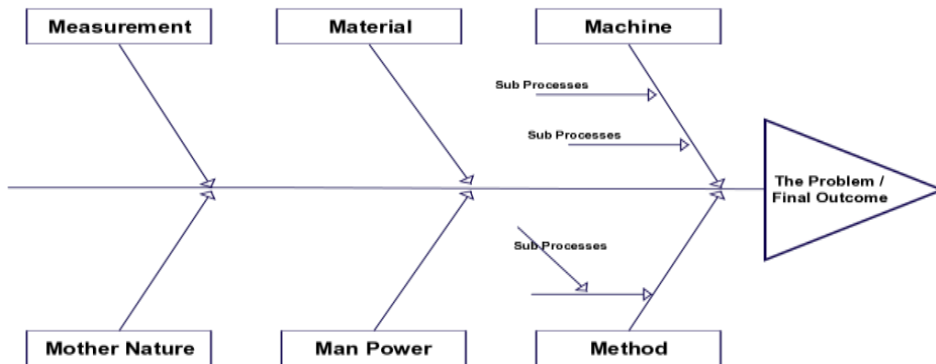
The Ishikawa diagram received its name from its structural similarity to the skeleton of a fish. This is not a coincidence: each element represents a reason and leads to the resolution of the exposed problems (Kern 2021). The elements of the fish diagram are:

- **Head:** It emerges from the central spine. In this part the problems are represented.
- **Spines:** Protruding from the central spine, there may be many or few spines, depending on the possible causes of the problem in question.
- **Minor spines:** Large spines also include smaller spines, i.e. there are small spines for minor causes, but those spines in turn have other spines that allow for the location of other causes that have determined the previous causes.

An analysis of the processes reveals the problem at different levels: from small, low-impact failures to serious obstacles that can severely affect operations, whether in a department, a group or even the whole network.

The Ishikawa diagram is useful to achieve different objectives such as analysing, solving or being faster and more efficient in general.

**Figure 7.6:** Example of the Ishikawa Diagram



Source: Kern (2021).

### 7.3.3.3 Communication (Argumentation Skills/Skillful Transit throughout the Organization)

Communication is a very important skill because connections and relations are constructed through the exchange of opinions and knowledge. The project manager's communication with the project team and stakeholders is associated with project success.

The project manager can choose between different communication techniques: Written, oral, verbal, non-verbal and visual communication. These techniques can be combined with each other (Ellison 2015).

- Verbal communication:

Is characterized by the exchange of the message between sender and receiver, through a certain channel. Verbal communication distinguishes between two options: oral and written communication.

- Non-verbal communication:

In this case, communication is carried out without words, but is based on postures, body movements, gestures, etc.

- Visual communication:

The message is transmitted through visual media and is perceived through sight. This type of communication is widely used by brands to offer us their message through images that make an impact.

#### **7.3.3.4 Articulation/Problem-solving**

Problem solving is very significant for the project manager as when a problem occurs, the project manager can focus on solving the conflict and finding the best alternative/solution for the team (Jonassen 2000).

The parties involved in the conflict debate by excluding personal emotions with the sole intention to reach the goals that are best for the team (Schneider 2012).

An effective project manager will be applying some of the methods below during the development of articulation (Brett & Thompson 2016).

##### a) Negotiation:

Negotiation skill is one of the most important skills. It is through effective negotiation that the project manager is able to eradicate differences and the team can find a joint solution.

The project manager can implement a defined approach for negotiation, although negotiation is an art which one can learn with time and experience

##### b) Arbitration:

It is a mechanism by which the parties involved assign a third party known as an arbitrator to settle their dispute. The arbitral decision must be accepted voluntarily by both parties.

##### c) Mediation:

A third party who assumes a neutral position in favor of the elimination of the dispute. The mediator fulfills the function of bringing the parties to the protagonists of the conflict and to accompany them in the exploration of a solution.

##### d) Conciliation:

It is an alternative resource in which two or more people try to settle the discrepancies, autonomously and with all legal guarantees, assisted by a third party called conciliator.

e) Amicable composition:

It is an alternative mechanism with the following goal: two or more persons entrust one or more third parties, acting as their agents, with finding the solution for the conflict. These agents are called “amicable composers” and need to have a certain prestige among the conflicting parties. Furthermore, they require a specified objective and need to be provided with enough financial capital in order to solve the controversy.

### **7.3.3.5 Anticipation of Facts**

The risk identification process is integrated as there are external and internal stakeholders and the risk of their prospects not being met. The project manager must be able to manage all of these possibilities.

Such risk categories can be scheduled as easily accessible information for the project team and stakeholders.

- The evaluations of the experiences that have been developed in other environments such as North America are not conclusive in relation to the type of integration that allows achieving higher levels of care coordination.
- However, as can be seen in Table 7.2, there is a degree of consensus in the literature on the key external and internal elements that influence the results in coordination and continuity.
- Between them, a shared vision and some global goals and strategies for the network; a common culture and a leadership oriented toward integration; an organic structure based on the coordination of the care process and, on the part of the purchaser, the allocation of resources through formulas that encourage coordination and efficiency, such as funding mechanisms.

**Table 7.2:** General Risk Categories

EXTERNAL	INTERNAL	PROJECT MANAGEMENT
<ul style="list-style-type: none"> <li>• Regulatory</li> <li>• Weather</li> <li>• Suppliers</li> <li>• Market Place</li> <li>• Customer</li> <li>• External Stakeholder Groups</li> <li>• Political</li> <li>• Environmental</li> </ul>	<ul style="list-style-type: none"> <li>• Work culture</li> <li>• Processes &amp; Systems within the organization</li> <li>• Resources</li> <li>• Prioritization</li> <li>• Project Dependencies</li> <li>• Funding</li> <li>• Technology</li> <li>• New technology</li> <li>• Requirements</li> <li>• Interfaces between systems</li> <li>• Performance and reliability</li> <li>• Quality</li> </ul>	<ul style="list-style-type: none"> <li>• Planning</li> <li>• Executing</li> <li>• Estimating</li> <li>• Communication</li> </ul>

Source: Own creation, based on The effectiveness of risk management: an analysis of project risk planning across industries and countries. Zwikael & Ahn 2011.

### 7.3.3 Conclusion

In a Network context, some advantages stand out, such as:

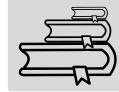
1. Having high-performance workers available due to the demands of the internal and external context of companies where creativity and technology management are essential to strengthen projects.
2. Higher levels of productivity are guaranteed because it optimizes time and directs each person to focus on the aspects of the project in which he/she is most competent.
3. It achieves better cohesion and collaboration among staff.
4. It improves the employees' job satisfaction and fosters their interaction as they feel supported, developing greater trust in the personal and business spheres.

5. It is a collaborative work that works as a learning process in which the skills and knowledge of each worker are pooled, resulting in a more competent staff thanks to group integration.
6. You already have more precise information about what is the integration of work teams, which shows its wide scope in any type of company that seeks to have high performance employees.



#### **7.3.4 Control Questions**

1. Integration capacity involves different skills. Could you please describe them?
2. Why is integrity an important characteristic of the project manager?
3. According to the Project Management Institute (2007), can you identify the project manager's competencies?



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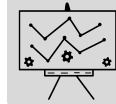
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## 8 Strategic Management and Planning

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**List of Abbreviations**

HR	Human Resources
KPI	Key Performance Indicator
WHO	World Health Organization

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## 8.1 Planning of Activities and Resources

This document aims to guide the reader through the topic of strategic management and planning, especially related to activity and resources. We will begin with an overview of planning, highlighting the importance of health planning of activities and resources as the key elements of it and how they can be managed best within a health care network, in the quest to daily improve the management of health services and the health status of the population.



### 8.1.1 Learning Objectives

- Get a general overview of planning in a Health Network (concepts, types and stages of the process)
- Know how to define a strategy, the strategic goals and the strategic management process
- Get a general overview of the planning of activities

### 8.1.2 Planning

Nowadays, in almost all societies, more and more people are living longer, which is an important social achievement, but we also have greater needs for care and health care. The implications are many, but perhaps the most important ones show an exponentially rising demand for health resources while resources are limited. It is thus necessary to optimize them, to avoid a waste of resources, and, above all, to meet the health needs of the population (Repullo Labrador & Segura Benedicto 2006, WHO 1998).

Planning, from the point of view of different management pioneers, can be conceptualized in the following ways:

"Planning is selecting information and making assumptions about the future to formulate the activities necessary to realize organizational objectives." (Steiner 2010, p. 50)

"Planning is largely the task of making things happen" (Wallace & Kremzar 2002, p. 221)

It is the specialized process of organizational administration or management in which opportunities for future improvement are explored, in which decisions are

made about what changes are needed, and how they can be made within the framework of the organizations involved and its environment. When planning is applied to the field of health, it is called health planning.

Thus, the WHO defined it as the orderly process of defining health problems, identifying unmet needs and resources to set realistic and feasible priority objectives and to plan administrative actions (WHO 1998).

“Planning is transforming decisions into actions” (Spiegel & Hyman, 1991).

"It is a continuous process of forecasting the resources and services needed to achieve prioritized objectives, enabling the optimal solutions to be chosen from among many alternatives" (Pineault et al., 1987).

The three definitions include three common elements: a population with health needs, the available resources and the actions required for the optimal use of resources to meet the needs of the population.

Is health planning the same as health care planning? NO

Health planning: the aim is to modify all or some of the determinants of health (environment, lifestyles, social welfare services, e.g. health promotion projects and integrated health education activities). Health care planning: personal health care services; aims at optimizing their performance, e.g. activities carried out in health regions to provide adequate health care services.

**Table 8.1:** Components and Orientation in Planning

<b>COMPONENTS OF PLANNING</b>	<b>ORIENTATION</b>
<b>Future</b>	To analyze problems; exploring future opportunities
<b>Decision</b>	To decide on the necessary changes and the best alternatives
<b>Action</b>	To implement changes in organizations

Source: Own creation, based on *Sistemas y servicios sanitarios*. Repullo Labrador (2014).



According to Touati et al. (2007), the key elements in planning are:

The needs, the resources to achieve their adequacy, the objectives to be achieved and the administrative tool, plan, or program (that links all the previous elements).

### **8.1.2.1 Type-Categories of Planning**

According to the purposes to be achieved and the organizational level at which it is carried out, we can find several types:

- **Normative Planning:** Broad orientations towards which long- and medium-term policy objectives should be oriented. Highest levels of health administration; goals related to the fulfillment of the health sector's mission. Main health policies. Examples: achieving the best level of health in the population, improving the quality of care in the health system. (Repullo Labrador 2012).
- **Strategic Planning:** Making the most important decisions as well as selecting priorities for action, based on the goals indicated by the health policy. It is the second level, with a higher degree of specificity. Goal examples: to increase accessibility to health and public health services or to ensure that the entire population of a country has a primary care team less than half an hour from their home and a hospital less than an hour away. (Steiner 2010; Terwindt & Rajan 2016).
- **Operational Planning:** Includes activities aimed at achieving operational or specific objectives, and involves making short-term decisions regarding timing, activities to be carried out, etc. Developing detailed programs to execute the strategies defined at the strategic level. Focuses on how, when, and where activities will be carried out and in which results are monitored, evaluated, and reoriented. Its product is the program. For example: Achieving that 100% of high-risk pregnancies are medically monitored.

### **8.1.2.2 Strategic Planning**

According to Mallon (2019), the strategic plan for the management of the integrated health services network includes the criteria for the day-to-day decision-making of the organization and, unlike conventional planning, establishes the references for the evaluation of the procedures and operations necessary to achieve

the proposed objectives. Integrated health service networks are made up of linked sets of people, distinguishable by the type of decisions they make.

#### **8.1.2.2.1 Strategy, Vision and Mission**

Active process of determining and guiding the course of action towards the objectives. Medium term < 5 years. A management tool used by health providers (Tomey 2009).

#### **8.1.2.3 Strategic Goals**

Objectives state what is to be achieved, by whom, and when, without specifying how, to fulfill the strategic vision of the company (Nickols 2016).

With the strategic objectives we aim to: define the vision of where the health care network wants to go, develop a concept of the activity, transform the mission into specific outcome objectives, elaborate the appropriate strategy to achieve the intended results, implement the selected strategy and finally evaluate the process.

#### **8.1.2.4 Strategic Management Process**

The strategic direction for the management of the integrated health services network is made up of a set of conceptual, operational, and indicative plans developed by those responsible for the different health services (Ricklin & Kushner 2010).

### **8.1.3 Planning of Activities**

Activity planning means knowing how to manage available resources and how to define priorities as orderly as possible.

#### **8.1.3.1 General Overview**

Following Huggins & Izushi (2011), operational planning is based on the strategic plan and consists of defining the activities for a whole year and developing detailed programs to execute the strategies defined. It must answer the questions of how, when, and where the plan is put to action.

### 8.1.3.2 Conceptualization

We can find some important concepts in the planning of activities (Green 2007):

- **Activity:** the actions that are executed in order to achieve the specific objectives.
- **Task:** the minimum component of an activity. The tasks are not recorded in the programming matrix, but in the work plan of the person responsible for the activity.
- **Project:** a temporary entity established to deliver specific (often tangible) services with pre-defined time, cost and quality.
- **Program:** a portfolio made up of several projects that are managed and coordinated as a unit.
- **Schedule / deadline:** the sequence of time for the work to be done.
- **Procedures:** the set of rules to carry out a job that will guarantee the maximum use of resources, efforts and policies, and the set of guiding principles to carry out a job instead of rigid commandments
- **KPIs:** key performance indicators.

Planning and measurement are essential for any successful business. Evaluating in detail the operation of strategies and processes allows us to correct mistakes, to detect new opportunities and to make better decisions. To be able to carry out this evaluation, KPIs or performance indicators are key.

### 8.1.3.3 Activity Planning Elements

An activity plan is a document that includes a set of tasks necessary to achieve a specific action or objective. It begins with the development of an activity schedule, with the date / duration, and subtasks. We can also add a person in charge per activity.

An online activity schedule is a tool to simplify and oversee the planning. The main objective of an activity plan is to identify what activities we will need. KPIs are very important for evaluating the success of actions/processes and the need for corrections if necessary (de Castro & Alcalá 2003).

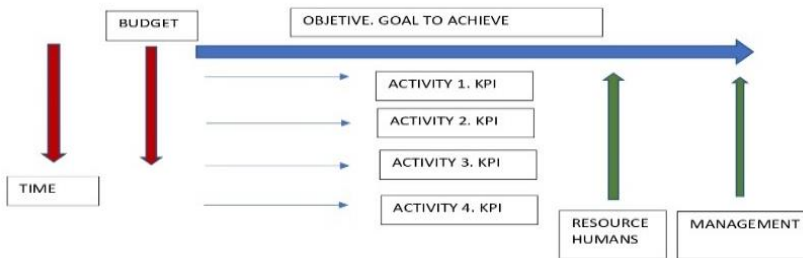
#### **8.1.3.4 Types of Activities**

In general, we can classify the activities in healthcare into administrative work and teaching. Healthcare activities include direct attention to people, such as prevention, promotion, cure and rehabilitation. Administrative activities are related to the institution itself and its coordination with other levels or centers as well as to the work of professionals, such as information, communication and registration activities. The teaching-assistance activities refer to those that allow to meet the training objectives.

#### **8.1.3.5 Design of the Activity Plan**

The design of the activity plan must answer the following points (Pérez et al. 2010):

- What goal do we want to achieve when the project is finished?
- How much time do we have?
- What is our budget?
- To divide the project into blocks of activities.
- Set a target or KPIs for the end of each block to track effective projects. This is called a milestone or key moment to review the achieved objectives or not.
- To choose one of the two ways to identify the tasks of your activity plan: To start from the end or to start from the beginning.
- To identify the subtasks of each activity. For project activity planning, always start from the largest to the smallest.
- To assign a number of people.
- To assign specific managers.

**Figure 8.1:** Activity Plan

### 8.1.4 Planning of Resources

#### 8.1.4.1 General Overview

According to Flanagan (2003), the identified activities as well as the objectives to be achieved must be operationally translated. This involves the identification and allocation of resources that are needed to produce those activities or services.

#### 8.1.4.2 Types of Resources

The main types of resources are Human Resources.

**Human Resources:** personnel trained to carry out the planned actions. According to Highhouse et al. (2015), human resources planning is a systematic process of developing strategic planning, within the framework of the strategy of the comprehensive health network, which will make it possible to have, at all times and in the right place, the necessary people, with the right skills, in order to achieve its objectives, within the established period and form. The purpose is to provide good health services to the population, acceptable coverage, and on-time assistance, with enough professionals, endowed with the required skills, with a balanced distribution, to provide health care in an integrated health care network.

The planning of human resources favors the integration of professionals linked directly to the health region, knowing their interests, counting on their collaboration in the planning process. According to Rovere (2006) Human Resources (HR) planning should focus on:

- The composition and profiles of the health teams that make up the Comprehensive Health Network.

- Estimating current and future HR gaps to give an answer to the system as a whole, according to the health model, the distribution in the network and their installed capacity.
- Defining policies and strategies for the management of the work life cycle of health personnel, optimizing recruitment and selection systems, the health career and incentive-remuneration systems.
- Infrastructure: buildings, hospitals, health centers, etc.
- Equipment and materials / medical equipment.
- Information: books and method manuals, records, reports, research.
- Social relations factors: public opinion, government or private support, community groups, etc.
- Technical and environmental resources: electricity, climate, transportation, etc.
- Budget: the money needed to obtain other resources. It can come from the government, private institutions or the community.

Following Tomey (2009), the financial requirements for the necessary existence of the different resources must be estimated. A detailed description of the project costs should be included in a budget.

The budget must cover the entire period of the project throughout the year.

List each strategy and the associated activities, the materials and equipment for each activity, operating costs under appropriate headings such as personnel, communication or transport. It is convenient to have a summary of total capital cost per item, and total recurring cost per item.

- Time: the time necessary for the operation of the plan must be considered (Tomey 2009).
- Obstacles and limitations that may arise.

#### **8.1.4.3 Resources Planning Phases**

The phases of resource planning are (Repullo Labrador 2012):

1. List of tasks/jobs that must be completed, expressed in hours, days or % of occupation.
2. Identification of limitations of each job/task.
3. Identification of the types and number of resources needed to complete each task; they can be expressed in hours or days.

4. Control of the availability of the resources of each category (employees, equipment, spaces, etc.). This is sometimes called "capacity."
5. Matching available resources for tasks or jobs.

Resource planning is a proper and judicious planning of resources. Three processes are involved. Resources are put to use according to the availability and needs for the process development.

#### **8.1.4.4 Resources Allocation Criteria**

The most frequent resource distribution criteria used when there is public funding and which is usually allocated through budgets usually fall under the following headings (Repullo Labrador 2014; Gibson et al. 2005):

- By allocated population (per capita). It will be determined by considering the volume of population that the integrated health network must serve. It can be adjusted, for example, according to the average age of the population or other considerations, such as gender.
- By act, service or process, whereby the necessary resources are allocated according to the production of services of each comprehensive health network. In this case, the disadvantage is that it is conditioned by the supply of existing services, with differences between networks.

The application of one criterion or another is conditioned to the level of development and implementation of the network of health services in the geographical area as well as the determining factors of the population included in said network.



## **8.2 Control Questions**

1. Describe the uses of KPIs in the planning of activities and resources.
2. Try to identify the most important limitations in resources planning.
3. Explain why time is the most valuable resource in a healthcare network.

## 8.3 Network Management

For a successful management of health regions, various aspects have to be considered. These include, for example, agreement on common values or successful moderation. These and other success factors are explained in this chapter.



### 8.3.1 Learning Objectives

- Gain an understanding of network management
- Acquire knowledge of how to build and maintain networks
- Gain an understanding of network facilitation and its tools

### 8.3.2 Introduction

Network management consists of three interrelated areas: planning, coordination and organization of the network (Qulling et al. 2013, p. 62). This includes both building and maintaining a network. There are various tools for ideal management. Communication is also important. Successful network management is highly relevant in order to collect knowledge from the individual network partners and to combine it profitably with official information. In this way, unique knowledge can emerge (Uzzi & Dunlap 2006, p. 2), which can increase the quality of network cooperation.

Depending on the network, different needs are important in network management. However, there are components that are of overarching importance, i.e. for several networks.

**Table 8.2:** Important Components for Network Management

Qualified and competent management	Willingness and competence to work in partnership	Creation of a basis of trust
Common interest in achieving goals	Agreement on conflict and feedback rules	Critical faculties

Source: Own representation based on Büttner & Voigt 2015, p. 6.

These components are extremely important for the success of networking and they remain important in all project phases. By paying attention to them, cooperation can be improved, the potential for impact can be increased and successful



responses can be given in conflict situations. These components should be discussed together with the network partners. This increases acceptance as well as the sense of community in the network (Com.HeNet).

### **8.3.3 Network Management Issues**

The tasks of network management include the development of activities and measures to achieve the network's goals. In addition, necessary resources should be made available (Qulling et al. 2013, p. 62). These include not only financial resources but also, for example, premises and infrastructure (Com.HeNet). Another task is communication and administration in the network. Depending on the network structure and needs, controlling can also be integrated into network management (Qulling et al. 2013, p. 62).

Network management plays an important role in all project phases. After the initiation phase, it is important to stabilize and maintain the network (Büttner & Voigt 2015, pp.13-19).

The initiation of networks includes the steps of selection, allocation, regulation and evaluation. First, suitable actors are selected for the network cooperation. At the same time, the goals and also the benefits of the network are worked out (Büttner & Voigt 2015, p.13). These results can be used to acquire new network partners (Com.HeNet). In the allocation phase, tasks, resources and responsibilities are distributed (Büttner & Voigt 2015, p.13). Here, attention should be paid to balance in the network and to the respective competences of the actors (Com.HeNet). In the regulation phase, the steps from the allocation are developed. In the evaluation phase, the activities of the network and its relationships are assessed. It is also recommended to always document and regularly review the results of the network cooperation (Büttner & Voigt 2015, p.14).

Once a network has been developed, it is important to stabilize it. This can be achieved by setting up working groups. This step is recommended for groups of 15 or more people. The following should be taken into account for working groups:

- Composition according to competences and performance capabilities
- Clearly defined goals and time horizons
- Regular reporting in the network
- Dissolution of the working groups when goals are achieved (Büttner & Voigt 2015, p.17).

Information systems, network conferences and public relations can also be used to stabilize networking (Büttner & Voigt 2015, p.17, Com.HeNet).

Network maintenance includes maintaining and deepening relationships and gaining new actors for one's own network (Büttner & Voigt 2015, p.19). To strengthen relationships, regular and intensive exchange is important. In addition to personal exchange, technical solutions (emails, Internet, etc.) can also be used. At this point, tools from the field of knowledge management and solid IT technology can be used. It is important to work in a transparent and integrative way (Wessling 2002, p.191-193). The values and attitudes of the network can be strengthened if the regional health network managers themselves exemplify them (Wessling 2002, p.196). Regular evaluation of the network can also increase quality (Büttner & Voigt 2015, p.19).

If a network already exists, it makes sense to carry out a network diagnosis. There are different possibilities for this. As an example, the mapping of a network is explained. For this method, the existing contacts are mapped in table 8.3.

**Table 8.3:** How to Map Your Network (based on Uzzi & Dunlap 2006)

<b>Contact name</b>	<b>Who introduced me to the contact?</b>	<b>Who have I introduced this contact to?</b>
Simon Harley	Michael Lende	Marie Holu
Zenek Koc	Me	
Henrietta McCan	Marie Holu	

The contact is entered in the first column "Contact name". In the middle column, the person who provided the contact is entered. The right column shows to whom the contact was referred (Uzzi & Dunlap 2006). In this way, the development of the network and one's own networking behavior can be determined. If "Me" is indicated in more than 65% of the middle column, this is the self-similarity principle. This indicates that people from one's own sphere of interest are preferably integrated into the network. This may result in the danger that the information within the network as well as the creativity and the finding of solutions to problems may be limited (Uzzi & Dunlap 2006). Diversity is of great importance because it may help the network to develop further and also more broadly.

Network management is about managing partnerships. There are three important ones for this:

- Regular and intensive exchange
- Performance decomposition
- Recruitment management

The exchange can be achieved through digital as well as personal channels. The channels should be customized according to the expectations and needs of the network. If possible, these steps should be supported by good knowledge management as well as sound IT technology. When decomposing services, care should be taken to divide tasks according to the strengths of the network partners. Finally, the attitudes of the network need to be managed. Values need to be established that include, for example, trust, helpfulness and respect. This works best by finding examples of these values (Wessling 2002, pp. 189-197).

If necessary, the controlling of the network is integrated in the area of network management (Qulling et al. 2013, p. 91). The main tasks of controlling are the planning, management and control of all areas in the network (Weber 2022). Within the network it has to be decided individually which areas should be covered by controlling. The following are possible, among others:

- Business information: Costs and revenues
- Temporal information: Goal-related & success-oriented control of the network cooperation (Weber 2022)

Before starting the network cooperation, an analysis of the current situation is recommended. The current status and possible risks or obstacles are determined (Qulling et.al 2013, p. 91). In risk management, solution approaches are formulated to match the identified risks. At the time of the COVID-19 pandemic, the elimination of face-to-face project meetings is a risk to successful networking. The solution is to virtualize these project meetings. However, the different levels of technical access of different institutions must be taken into account when planning virtual meetings (Com.HeNet).

#### **8.3.4 Mediation**

An important component of network management is mediation. This includes the areas of communication, management and function. With regard to communication, it is important to be able to conduct conversations appropriately and to give and accept feedback (Longmuß & Teller 2007, p. 107). In the area of management, different interests must be integrated (Wetzel et al., 2001, p. 28). Proposals are structured and support is given in case of conflicts. A central task of the regional health network manager is to shape the social, organizational and strategic

dimensions of the network (Longmuß & Teller 2007, p. 107). The network mediation sets itself the following goals:

- External and neutral support of group processes
- Creation and monitoring of target agreements
- Promotion of group development with regard to target agreements (Longmuß & Teller 2007, p. 107).

There are various tools for successful facilitation. In the following, the Metaplan and the Word Café are presented as representative of the wide range of tools.

The Metaplan method is suitable for quickly finding individual questions and ideas in the network (Longmuß & Teller 2007, p. 122). It is an accompanying and impulse-giving method (Reich 2003, p. 1). The advantage is that every voice is worth the same, as the ideas are first noted down individually. The moderator poses few questions to the participants of the network, e.g. where the greatest potentials are seen in the network (Longmuß & Teller 2007, p. 122). When creating the questions, attention should be paid to the following points.

**Table 8.4:** Design of Questions in the Metaplan Method

Requesting opinions and suggestions	Open Questions
Understandable questions	Challenging questions (not exposing)

Source: Own representation, based on Reich 2003, p. 14.

Then the network partners answer the questions on prompt cards. The cards are collected e.g. on a flipchart and clustered together with all participants. In this way, focal points can be identified. If there is a large number of ideas and questions, it can be helpful to have the ideas prioritized. For this purpose, all participants receive three sticky dots and distribute them according to priority. It is important that only one sticky dot is given per card (Longmuß & Teller 2007, p. 122). Another advantage of this method is that the collected results can be easily documented. A photograph of the flip chart or other kind of backdrop is sufficient for this purpose (Reich 2003, p. 1).

The World Café method is suitable for groups of ten or more people. The effect of this method increases with the number of participants. The aim is to explore moods, tendencies and potentials in larger groups. The setting is similar to a classic café. About five people sit together at each table. The table is covered with a

paper tablecloth. It can be decorated, e.g. with flowers or other images. The moderator asks all participants one question (Longmuß & Teller 2007, p. 125). The following points should be taken into account when creating the questions.

**Table 8.5:** Hints for Creating Questions in the World Café

Exciting wording	Create curiosity
Conversation-stimulating topics	Simple and understandable wording

Source: Own representation, according to <http://www.methodenkartei.uni-oldenburg.de/>.

The participants then exchange ideas at their tables and write down their findings on the tablecloth. Afterwards, all participants, except for one person, move on to the next table. The remaining person is the host for the next group and explains the thoughts that have arisen at the table so far. The facilitator gives a follow-up question, which is discussed in the same style at the table. After the second round, there can be further rounds if needed. If this is not necessary, the facilitator collects the findings in the plenary session. The advantage of this method is that each person has speaking time. In addition, personal relationships are strengthened at the same time (Longmuß & Teller 2007, p. 125-126).

### 8.3.5 Conclusion

Positive network management has the potential to increase the quality of network cooperation and the relationships within the network. Different methods are suitable for this. A central point in network management is communication or mediation. There are also different methods for mediation in networks, such as the Metaplan or the World Café. The appropriate methods must be chosen individually depending on the network structure and set-up.



### **8.3.6 Control Questions**

1. Analyze an existing network in which you are or were active. How did the contacts come about?
2. What steps are involved in network management?
3. Think about a problem that could arise in a prototypical health region. Which facilitation tool would you use for the analysis?

## 8.4 Monitoring and Evaluation in Health Network Management

This chapter describes the basic assumptions of monitoring and evaluation (M&E) in health networks. The following sections outline the various forms of monitoring and evaluation, the benefits of such activities, and the steps involved in creating an M&E plan. The chapter also includes a description of the basic principles to be followed in the evaluation process and a general description of the criteria for selecting indicators.



### 8.4.1 Learning Objectives

- Gain an understanding of monitoring and evaluation processes
- Acquire knowledge of monitoring and evaluation planning
- Acquire knowledge of basic features of monitoring and evaluation indicators

### 8.4.2 Introduction

Health networks and their managers face a challenging task of providing the local community with high-quality services that meet both health needs and expectations. Well established monitoring and evaluation helps network managers to comply with those requirements, by providing a clear view of programs and projects developed by the network, their output and impact on health problems.

### 8.4.3 Meaning of Monitoring and Evaluation

According to International Labour Organization (ILO) monitoring can be described as a continuous process of collecting and analyzing information about a program, assisted by comparing actual results to what the program intended to achieve. The process is based on using the data developed by the program itself (such as data on individual participants, enrolment and attendance information, end of program situation of target population and costs of the program) and it makes comparisons across individuals, types of programs and geographical locations (ILO 2022, p. 1).

The evaluation benefits from information gathered in monitoring, however its purpose is different. According to Scriven this is a process that determines the value and benefits of objects, and the assessment is its product. Evaluation is not limited to accumulating and summarizing the data relevant to the decision to be taken because it is only the first of its components. The second is to set appropriate standards and values based on which the assessment will be carried out (Scriven 1991, p. 391).

Even with regard to close collaboration between M&E processes, differences between these two should not be omitted. Monitoring is very useful to clarify program objectives. Due to its factual nature, it also helps to establish links between activities, resources and objectives. Monitoring requires a translation of the objectives into performance indicators, which in turn allow the program manager to set targets for each indicator. The day-to-day activities carried out under monitoring are focused on routine data collection on the present state of indicators, which allows for reporting progress for the manager and for providing early warning of problems detected (Kusek & Rist 2004, p. 11).

Evaluation helps to understand why intended results were or were not achieved. It assesses how the activities contributed to results. An important part of evaluation is the examination of implementation processes, which should allow for finding answers to questions such as:

- What worked?
- What did not work?
- And why?

The evaluation provides program managers and teams with a better understanding of unintended results. One of the most important advantages of evaluation is that it provides lessons for the future, highlighting significant accomplishments or program potentials, and recommending improvement (Kusek & Rist 2004, p. 11).

#### **8.4.4 Benefits of Monitoring and Evaluation**

Both monitoring and evaluation provide a multitude of benefits, however these benefits may turn out differently for different entities. For public authorities M&E provide evidence justifying financial support for the program, or in other cases rationale for denying public funding. Therefore lessons learned in previous evaluations make future decisions more informed (Lankester 2019, p. 154).



For program manager and staff, evaluation is also a source of knowledge on what works and what does not in terms of designing, implementing and evaluating programs and specific actions. M&E also has a fundamental significance when analyzing progress in project objectives, output and outcomes and making necessary adjustments based on evaluation results (Lankester 2019, p. 153).

For partners and other stakeholders, monitoring and evaluation results are a vital part of the decision making process. It might be an incentive for supporting the network activities if results confirm successful implementation and a positive outcome of the program. In case of partners already involved in the program, M&E makes it more transparent and credible (Lankester 2019, p. 153).

For local communities M&E provide tangible proof that the network is responding to their health needs which in turn raises awareness of the programs carried out by the network and increases involvement of community members (Lankester 2019, p. 154).

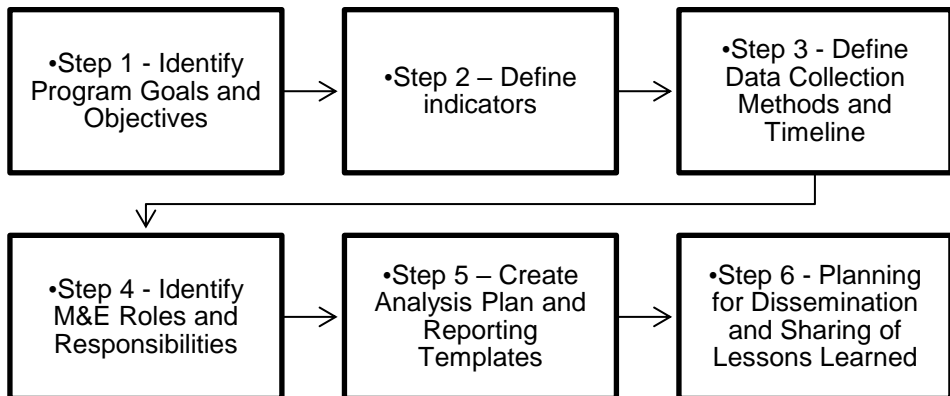
#### **8.4.5 Principles of Evaluation**

If the evaluation process is to live up to the hopes placed in it, then it must be based on a clear set of principles (Taylor et. al. 2005, p. 2).

- Evaluation has to be viewed and performed as a continuous process, informing planning and delivery as the project develops;
- All those with an interest in the program should be able to participate in the process and have an influence on the evaluation questions;
- Well prepared and conducted evaluation uses imaginative and creative approaches, which engage those involved;
- Monitoring and evaluation help programs and projects to be more accountable to the wider community;
- It can also be used to challenge discriminatory and oppressive policies and practice, and to overcome inequality and disadvantage;
- Good evaluation highlights and celebrates successes and achievements and encourages an honest appraisal of progress, so you can learn from what hasn't worked as well as from what has.

### 8.4.6 Developing a Monitoring and Evaluation Plan

**Figure 8.2:** Developing a Monitoring and Evaluation Plan



Source: Own representation, according to <https://www.thecompassforsbc.org/how-to-guides/how-develop-monitoring-and-evaluation-plan>.

Planning a monitoring and evaluation is a process consisting of six steps (Fig. 8.2) (Compass 2022), which is finalized with the development of a written document (a plan), describing such elements as:

- A proposed timeline for M&E
- Relevant M&E questions to ask at different stages of the project life cycle
- Different methodologies
- An effective implementation strategy
- Expected results
- Defining who would implement the various components of the M&E plan
- Appropriate M&E tools for data collection

In the first step project managers and staff will have to find answers to the following questions: What problem is the program trying to solve? What steps are being taken to solve that problem? How will program staff know when the program has been successful in solving the problem?

The links between problems and program activities and outcomes are established with the use of logic framework or the theory of change approach. Even at this early stage the program manager and staff has an opportunity to evaluate if those connections were properly identified and the problem can be solved through the proposed set of actions.

The next step leads to identifying indicators for monitoring and evaluation. Choosing the right set of indicators determines the final outcome of M&E. The NHS Institute for Innovation and Improvement, in collaboration with the Association of Public Health Observatories (APHO), developed a set of five criteria for determining the value of an indicator (APHO 2008, pp. 23-27).

First of all, indicators should be important and relevant, which means that they should refer to activities of a program provided by a health network and measure a sufficiently important question and/or service.

The second criterion of a good indicator is its validity. In this context you should make sure that the indicator measures what it is claiming to measure.

The third criterion is possibility. An indicator complies with this criterion if it is actually possible to populate the indicator with meaningful data. In addition, program managers should assess whether sufficiently reliable data are available at the right time, for the right organizations with the appropriate comparators, and if not, is the extra effort and cost of obtaining such data justifiable?

The next criterion to consider is the meaning of an indicator, which requires recognition of what is the indicator telling and how precise is it. Another aspect of this criterion is the ability to understand (and deconstruct) an indicator in order to understand the particular reasons for the results.

The last feature of a good indicator are its implications. With regard to his criterion an answer to following questions is required:

Is there sufficient understanding of the system so that any issues identified can be investigated further and addressed effectively?

Are the results likely to induce perverse incentives and unintentional consequences?

Can the indicator monitor the issue regularly enough so that further investigation and action can be taken before the issue is revisited?

In the next step of M&E plan development, program management and staff need to make decisions on obtaining data for monitoring and evaluation. Such a plan has to clarify how the data will be recorded, how often it has be recorded and obtained, and where you can find the necessary data (Compass, 2022).

One of the most important steps in M&E planning is identifying roles and responsibilities of those involved in a process. At this stage, the program manager has to decide who will be responsible for collecting data for each indicator and make sure that the relevant person is appointed to each indicator.

The fifth step of the process is to create an analysis plan and reporting templates. The analysis plan should clarify what data will be collected and how the results are going to be presented. During this phase of M&E plan development, program staff and management has to decide whether they will use any statistical tool and tests, and if so what kind of tools is the most appropriate. To avoid any misunderstandings it is recommended for the program staff to create templates for reporting and include them in the M&E plan.

The last step of the process is planning for dissemination and donor reporting, which requires making decision on the following:

- How will M&E data be used to inform staff and stakeholders about the success and progress of the program?
- How will it be used to help staff make modifications and course corrections (if necessary)?
- How will the data be used to make progress in the respective field and make program practices more effective?

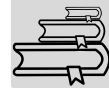
#### **8.4.7 Conclusion**

Successful monitoring and evaluation is determined by a set of factors. First of all, it requires intensive use of the M&E information provided by the system, on every part of the program. The information itself should be reliable and of high quality. Finally, a system created for M&E should be sustainable, meaning that despite any changes in the program itself, management and staff all of the activities will still be carried on without major disruptions (Mackay, pp. 4-5).



### **8.4.8 Control Questions**

1. In what sense are monitoring and evaluation similar, and what distinguishes them?
2. Taking into account the benefits of M&E described in chapter 3.5, what do you think are the strongest incentives for this type of activity?
3. Try to justify why good evaluation implies participation and influence on the process by all stakeholders?
4. Consider what indicators you could use in a health program aimed at changing eating habits in the local community?
5. Try to design a M&E template for a program that you are involved in or you would like to participate in.



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## 9 Database Systems, Data Protection and Security

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**List of Abbreviations**

CPDP	Commission for Personal Data Protection
DPO	Data Protection Officer
DoS	Denial of Service
DTD	Document Type Definition
GDPR	General Data Protection Regulation
JSON	JavaScript Object Notation
MAC	Message Authentication Code
RNG	Random Number Generator
SQL	Structured Query Language
SQL-DDL	SQL Data Definition Language
SQL-DML	SQL Data Manipulation Language
TOM	Technical and Organizational Measures
XML	eXtensible Markup Language
XSD	eXtensible Stylesheet Definition

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## 9.1 Database Systems

In today's digital world, every manager must have knowledge of how the information he works with can be restructured so that it can be stored and processed with the help of a computer. Therefore, in this course the students will gain knowledge about Relational Databases, as the most widespread and stable solution for storage and processing of data. Then they will learn the Structured Query Language (SQL) and use it to create the database structure and to retrieve data, already stored in the database. After that they will be introduced to methods for gathering data from heterogeneous sources of information, using micro-services and semi-structured data.



### 9.1.1 Learning Objectives

- Learn the skills for structuring the information so that it can be stored and processed with the help of a computer
- Acquire knowledge of how to describe the structure of a relational database using SQL-DDL
- Acquire knowledge of how to retrieve data, already stored in a relational database using SQL-DML
- Acquire knowledge about the methods for gathering data from heterogeneous sources of information using microservices and semi-structured data

### 9.1.2 Database Modelling

Nowadays, the most widespread and stable solution for the storage and processing of data are the Relational Databases. They store the data in separate tables (called relational tables or relations) with links between them (called relationships).

It is not efficient to store all data in a single table, because this leads to data repeatability, which causes higher memory consumption and to the possibility of errors when entering the same data, as for example the data about medical examinations in a hospital, as shown on Table 9.1.

In this solution, for each examination a doctor has performed, we must repeat all their data and if we mistype only a single letter, then the corresponding examination will not appear in the reports for this doctor. The same applies to patient data, names of diseases, etc.

**Table 9.1:** Data about Medical Examinations, Stored in One Single Table

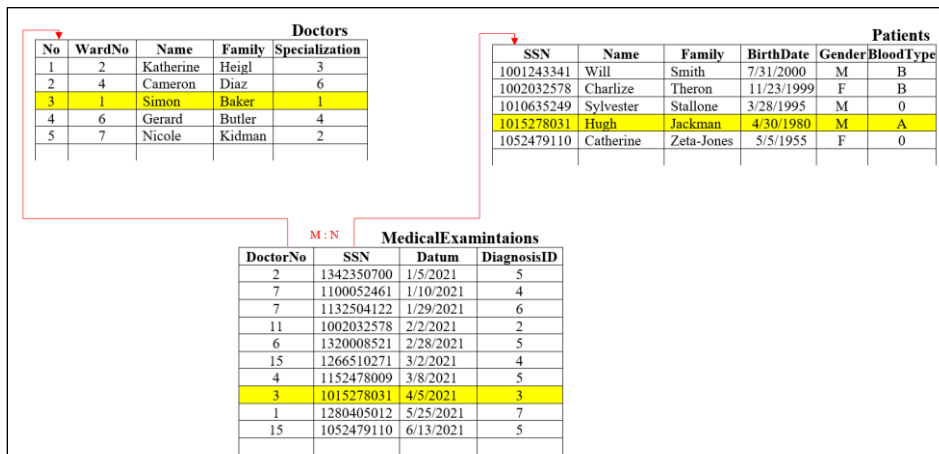
**MedicalExaminations**

DoctorName	DoctorFam	Ward	SSN	PatientName	PatientFam	BirthDate	Gender	BloodType	ExamDate	Diagnosis
Cameron	Diaz	otorhinolaryngology	1342350700	Bruce	Willis	2/2/1962	M	B	1/5/2021	covid-19
Nicole	Kidman	gynecology	1100052461	Catherine	Zeta-Jones	4/30/1980	F	A	1/10/2021	ulcer
Nicole	Kidman	gynecology	1132504122	Will	Smith	7/31/1985	M	0	1/29/2021	irreparably crazy
Simon	Baker	urology	1002032578	Sylvester	Stallone	5/5/1955	M	AB	2/2/2021	hyperlipidemia
Cameron	Diaz	otorhinolaryngology	1002032578	Sylvester	Stallone	5/5/1955	M	AB	2/28/2021	covid-19
Gerard	Butler	psychotherapy	1342350700	Bruce	Willis	2/2/1962	M	B	3/2/2021	ulcer
Nicole	Kidman	gynecology	1152478009	Charlize	Theron	11/23/1999	F	0	3/8/2021	lumbago
Cameron	Diaz	otorhinolaryngology	1152478009	Charlize	Theron	11/23/1999	F	0	4/5/2021	covid-19
Cameron	Diaz	otorhinolaryngology	1002032578	Sylvester	Stallone	5/5/1955	M	AB	5/25/2021	acute bronchitis
Simon	Baker	urology	1100052461	Catherine	Zeta-Jones	4/30/1980	F	A	6/13/2021	diabetes mellitus

Source: Ilitchev V., Lecture Notes in “Databases” (2017; the focus of the presentation lies on the structure, not the content)

The reasonable solution is to divide this big table into smaller tables, with unique information about doctors, patients etc., as shown on Figure 9.1. Thus, on the highlighted row of the table entitled Medical Examinations, we can read that doctor No 3, which is Simon Baker, examined patient with SSN 1015278031, which is Hugh Jackman, on April 5, 2021 and diagnosed him with diagnose No 3, which is lumbago.

**Figure 9.1:** Data about Medical Examinations, Broken down into Small Tables

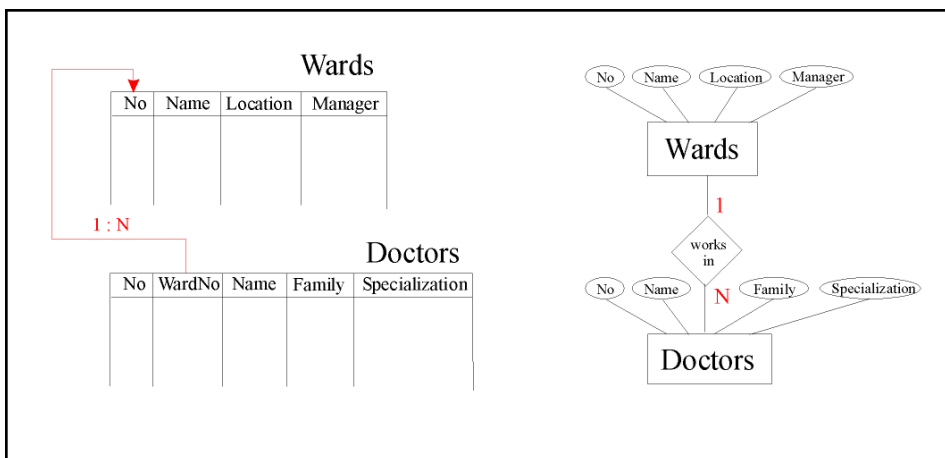


Source: Ilitchev V., Lecture Notes in “Databases” (2017)

The advantage of this solution is that we enter the information about the doctors and the patients only once. In this way we save memory capacity and avoid mistakes during data entering.

The type of relationships between the tables differs regarding their cardinality ratio. Figure 9.2 shows the relationship between doctors in a hospital and the wards in which they work. Because many doctors can work in one ward, but one doctor can work in only one ward, we say that the relationship between the two tables has a cardinality ratio 1:N or *one to many*.

**Figure 9.2:** 1:N Cardinality Ratio of a Relationship



Source: Ilitchev V., Lecture Notes in “Databases” (2017)

On the right the same database structure is displayed, but represented with the so-called *Entity-Relationship Model*. The rectangles are called entities. The rhombuses are called relationships between entities. Ellipses enclose the so-called attributes.

Through the transformation of this model into relational tables:

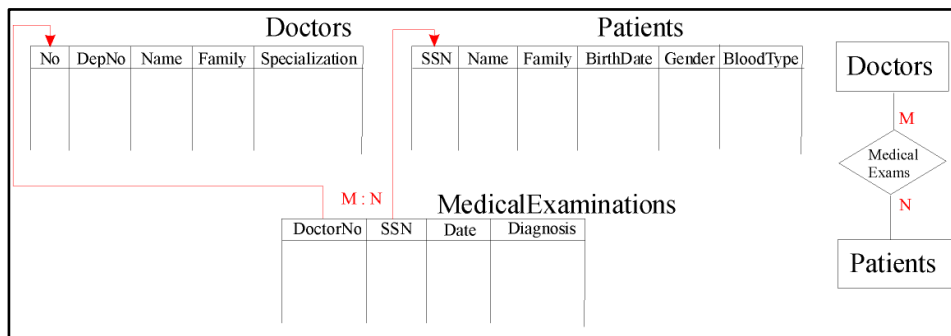
- the entities will be transformed into relational tables
- the attributes will be transformed into table columns or fields

It can be seen that some of the attributes like WardNumber and DoctorNumber have unique values. Thus, with their help we can distinguish each row of the table. Such attributes are called *primary keys*. Examples for primary keys can be: SSN, passport number, tax registry number of a company etc.

If a relationship between two entities has a Cardinality ratio  $1:N$ , then this relationship must be transformed into an additional attribute in the table on the “N” side of the relationship. Such attribute is called *foreign key*. It serves as a link between the tables.

Figure 9.3 shows the relationship between doctors, patients and medical examinations. In this case the relationship has a Cardinality ratio of  $M:N$  or *many to many*, because one doctor may have examined more than one patient and one patient may have seen more than one doctor.

**Figure 9.3:**  $M:N$  Cardinality Ratio of a Relationship



Source: Ilchev V., Lecture Notes in “Databases” (2017)

This type of connection shall be transformed into a separate table, which has two foreign keys, each of which points to a primary key of the main tables. In this case, the primary key of the binding table will be composite, i.e. it will consist of two attributes, DoctorNo and SSN (Social Security Number).

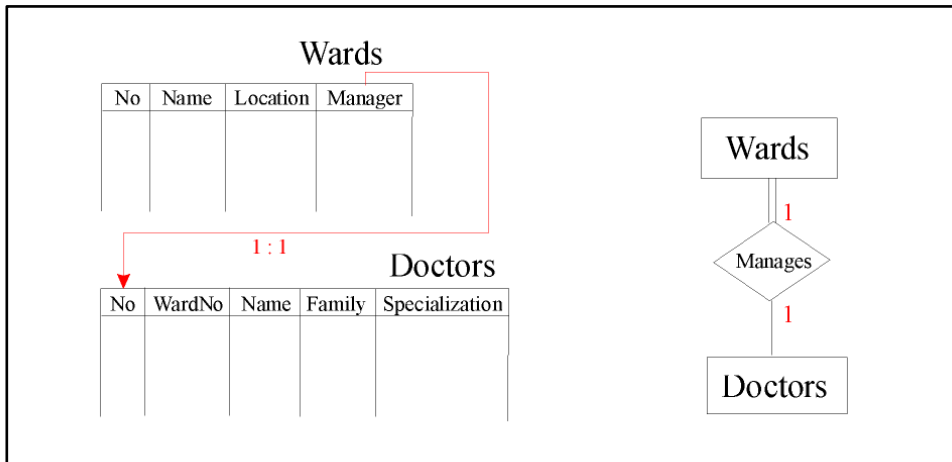
(to save space, the attributes in the corresponding Entity-Relationship Model on the right are not drawn)

Figure 9.4 shows the relationship between Doctors and Wards, which has a Cardinality ratio of  $1:1$ , because each ward can have exactly one doctor as a manager and one doctor can be a manager of one ward at the most. However, every ward must have a manager, while most doctors are not managers of any ward. On the Entity-Relationship Model on the right, this is drawn with a double line on the wards side (which means that the wards have a *full participation* in this relationship) and a single line on the doctors' side (which means that the doctors have a *partial participation* in this relationship).



To transform this dependency into relational tables, a foreign key shall be added on the side of the entity with full participation. That foreign key shall point to the primary key of the entity with partial participation.

**Figure 9.4:** 1:1 Cardinality Ratio of a Relationship



Source: Ilchev V., Lecture Notes in “Databases” (2017)

In case both entities participate completely in the relationship, they must be combined in one single table. Our example does not apply to that case, because if we try to combine the two entities in one single table, empty columns would appear in this table, which is unwanted.

### 9.1.3 Data Processing Using SQL

The commands of the Structured Query Language (SQL) can be classified in two groups:

- commands used to create the structure of the relational tables and to define the relationships between them; these commands make up the part of the language called *Data Definition Language (DDL)*;
- commands used to manipulate data and to formulate queries; these commands make up the part of the language called *Data Manipulation Language (DML)*.

### 9.1.3.1 SQL – Data Definition Language (DDL)

To create the relational table *Patients* from the previous lesson we shall write:

```
create table Patients
(
SSN integer not null,
Name varchar(12),
Family varchar(15),
BirthDate Date,
Gender char(1),
BloodType char(2),
primary key(SSN)
);
```

Between the brackets we describe the columns of the table one by one and the type of data in them where:

- *integer* means that this column can hold only integer values;
- *varchar(12)* means that this column holds a string of symbols (characters) with a maximal length of 12 vs. *char(12)*, which can hold exact 12 symbols;
- *numeric(7, 2)* means that this column can hold fractional numbers with a maximum of 7 digits, of which 2 are for the fractional part;
- *date* means that this column can hold a calendar date; different database engines have additional commands for defining date and time, such as *DateTime*, *TimeStamp* etc.;
- *not null* does not mean that this column can't hold "0" as values, but means that this column cannot be left empty;
- *primary key(SSN)* defines the column *SSN* as the primary key, as mentioned above.

Thus, to create the relational table *Doctors* from the previous part, we shall write:

```
create table Doctors
(
Not integer not null,
WardNo integer,
Name varchar(12),
Family varchar(15),
SpecializationID integer,
primary key(No),
foreign key(WardNo) references Wards(No),
```

foreign key(SpecializationID) references Specializations(ID)  
);

The only new item here is the description of the relationship between the two tables, Doctors and Wards. In this relationship the column WardNo from Doctors corresponds to the column “No” from Wards. This was described by defining the *foreign key (WardNo)*.

For practical reasons, it is good to separate the types of specializations in a separate table, as this will avoid mistyping errors. The second *foreign key (SpecializationID)* will be used to describe the connection to this table.

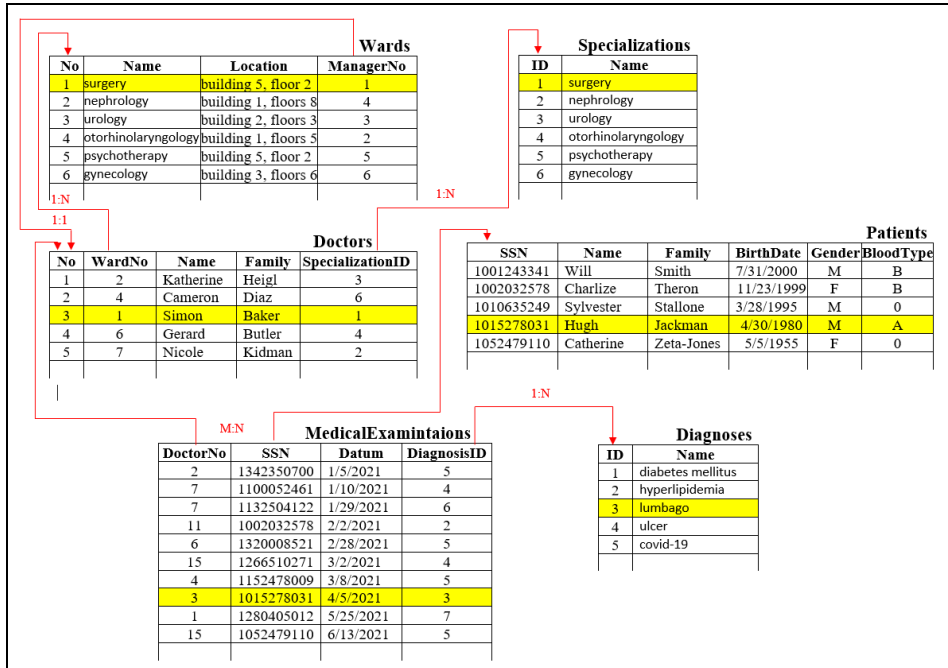
To create the relational table “MedicalExaminations” from the previous lesson we shall write:

```
create table MedicalExaminations
(
  DoctorNo integer not null,
  SSN integer not null,
  Datum date,
  DiagnosisID varchar(50),
  primary key(DoctorNo, SSN),
  foreign key(DoctorNo) references Doctors(No),
  foreign key(SSN) references Patients(SSN)
);
```

As it can be seen here we have a *composite primary key* (over both columns, DoctorNo and SSN) as well as two foreign keys. The name of the column, which contains the date of examination, is “Datum”, because *date* is a key word in SQL.

The final structure of the sample database is shown on Figure 9.5.

**Figure 9.5:** Structure of the Sample Database



Source: Ilitchev V., Lecture Notes in “Databases” (2017)

This same structure, described with SQL-DML, will be:

create table Wards

(

No integer not null,

Name varchar(20),

Location varchar(20),

ManagerNo integer,

primary key(No),

foreign key(ManagerNo) references Doctors(No)

);

create table Doctors

(

No integer not null,

WardNo integer,

Name varchar(12),

Family varchar(15),

SpecializationID integer,

```
primary key(No),
foreign key(WardNo) references Wards(No),
foreign key(SpecializationID) references Specializations(ID)
);
```

```
create table Patients
(
SSN integer not null,
Name varchar(12),
Family varchar(15),
Address varchar(33),
primary key(SSN)
);
```

```
create table Diagnoses
(
ID integer not null,
Name varchar(50),
primary key(ID)
);
```

```
create table MedicalExaminations
(
DoctorNo integer not null,
SSN integer not null,
Datum date,
DiagnosisID integer,
primary key(DoctorNo, SSN),
foreign key(DoctorNo) references Doctors(No),
foreign key(SSN) references Patients(SSN),
foreign key(DiagnosisID) references Diagnoses(ID)
);
```

### 9.1.3.2 SQL – Data Manipulation Language (DML)

The SQL Data Manipulation Language is a declarative language. With procedural languages like Java, C++, C#, Python etc. we have to describe the path (the algorithm) to the goal step by step. With a declarative language like SQL-DML,

we only have to define what we want to achieve, and we left the computer to figure out the way of how to achieve it.

The general structure of an SQL query to the database is called a “select-from-where” block or SFW-block. In this structure the *from clause* contains the names of the tables from which we draw the necessary information. The *where clause* describes the conditions and the *select clause* lists the columns we want to see in the final result.

Because SQL-DML is most easily learned through examples we will do so.

### **Query 1:**

*Give me all the patients with all their attributes*

**select \* from Patients**

In the *from clause* we mention the table from which we draw the necessary information. The star in the *select clause* means that we want to see all attributes (columns)

### **Query 2:**

*Give me only the female patients, with their SSN, Name, Family*

**select SSN, Name, Family from Patients where Gender = 'F'**

Here in the *where clause* we describe the condition, which states that the content of the column *Gender* should be 'F' (for female). In the *select clause* we mentioned the columns *SSN, Name, Family*, which we want to see in the final result.

### **Query 3:**

*Give me the male patients, born in 1950*

In this case we will use the function *year( )*, which takes only the year from a given date.

**Select SSN, Name, Family from Patients where Gender = 'M' and year (BirthDate) = 1950**

**Query 4:**

*Give me all the doctors and the wards they work at*

In this case we need information from two tables, namely *Wards* and *Doctors*. They are bound together by the relationship between their attributes *No* from *Wards* and *WardNo* from *Doctors*. To retrieve the necessary information we must join them. To do so, we write in the “where” clause *Wards.No = Doctors.WardNo*.

**select Wards.Name, Doctors.No, Doctors.Name, Doctors.Family from Wards, Doctors where Wards.No = Doctors.WardNo**

**Query 5:**

*Give me the doctors who work in the ward 'psychiatry'*

**select D.No, D.Name, D.Family from Wards W, Doctors D where W.No = D.WardNo and W.Name = 'psychiatry'**

To reduce writing, we use aliases for the names of the tables here, namely *W* for *Wards* and *D* for *Doctors*.

We also put an additional selection on the name of the ward.

In such a case it is reasonable to place the *selection* operation before the *join* operation, so the database engine will select at first only the required ward and will perform the join operation based only on this. This will reduce the number of intermediate-generated facts, which will increase the execution speed of the request.

This is how the optimized query will look:

**select D.No, D.Name, D.Family from Wards W, Doctors D where W.Name = 'psychiatry' and W.No = D.WardNo**

A step by step suggestion on how to write SQL-queries:

Let's have the same query:

*Give me the doctors who work in the ward 'psychiatry'*

First step

Determine the tables which contain the necessary information and list them in the “from” clause:

select

from **Wards W, Doctors D**

where

Second step

Describe the join condition(s) in the “where” clause:

select

from Wards W, Doctors D

where **W.No = D.WardNo**

Third step

Describe the selection condition(s) in the “where” clause:

select

from Wards W, Doctors D

where **W.Name = 'psychiatry' and W.No = D.WardNo**

Fourth step

List the table attributes you want to see in the query result:

select **D.No, D.Name, D.Family**

from Wards W, Doctors D

where W.Name = 'psychiatry' and W.No = D.WardNo

-----

Since 1999, it has been possible to write the *join* operation in the “from” clause, thus our query may also be written as:

select D.No, D.Name, D.Family

from Wards W **join** Doctors D **on(W.No = D.WardNo)**

where W.Name = 'psychiatry'



**Query 6:**

*Give me information about all the examinations with the doctors and patients involved*

In this case we need information from three tables, namely *Doctors*, *MedicalExaminations* and *Patients*, whereat we must describe two join operations.

```
select D.No, D.Name, D.Family, P.SSN, P.Name, P.Family, ME.Datum from  
Doctors D, MedicalExaminations ME, Patients P where D.No = ME.DoctorNo  
and ME.SSN = P.SSN
```

**Query 7:**

*Give me the patients, examined by doctor John Smith in the period between March 3 and March 27, 2022*

This query takes information from the same three tables. The only difference are the additional selections on the doctor's name and on the time period in the "where" clause.

```
select P.SSN, P.Name, P.Family, ME.Datum from Doctors D, MedicalExami-  
nations ME, Patients P where D.Name = 'John' and D.Family = 'Smith' and  
ME.Datum between '2022-03-03' and '2022-03-27' and D.No = ME.DoctorNo  
and ME.SSN = P.SSN
```

**Query 8:**

*Give me a list of all the COVID-19 patients in 2021.*

In this case we need information from other three tables, namely *Patients*, *MedicalExaminations* and *Diagnoses*, as well as additional selections on the name of the diagnosis and the year.

```
select P.SSN, P.Name, P.Family from Patients P, MedicalExaminations ME,  
Diagnoses D where D.Name = 'Covid-19' and year(ME.Datum) = 2021 and  
P.SSN = ME.SSN and ME.DiagnosisID = D.ID
```

**Query 9:**

*Give me a list of all male patients over 60, with the diagnosis COVID-19.*

This query has a similar structure to the previous one. The age of the patient is calculated by subtracting the year of birth from the current year.

```
select P.SSN, P.Name, P.Family from Patients P, MedicalExaminations ME, Diagnoses D where D.Name = 'Covid-19' and P.Gender = 'M' and (year(Today()) - year(BirthDate)) > 60 and P.SSN = ME.SSN and ME.DiagnosisID = D.ID
```

**Aggregation functions**

These are the functions *count()*, *sum()*, *avg()*, *min()* and *max()*.

They allow us to perform these operations on groups of rows in tables.

**Query 10:**

*Give me the number of patients for each disease*

First, with the help of the “group by” clause, we create packages of medical examinations where each disease was diagnosed and then we count the number of rows in each of these packages.

```
select D.Name, count(*) from MedicalExaminations ME, Diagnoses D where ME.DiagnosisID = D.ID group by D.Name
```

**Query 11:**

*Give me, separately for men and women, the number of patients over 60 with a diagnosis of 'heart attack'.*

Here the grouping criteria is the gender of the patient.

```
select P.Gender, count() from Patients P, MedicalExaminations ME, Diagnoses D where D.Name = 'heart attack' and (year(Today()) - year(BirthDate)) > 60 and P.SSN = ME.SSN and ME.DiagnosisID = D.I group by P.Gender
```

**Query 12:**

*Give me the number of patients examined in each of the wards.*

```
select W.Name, count() from Wards W, Doctors D, MedicalExaminations  
ME, Patients P where W.No = D.WardNo and D.No = ME.DoctorNo and  
ME.SSN = P.SS group by W.Name
```

**Query 13:**

*Give me the number of patients examined in each of the wards for the year 2021.*

```
select W.Name, count() from Wards W, Doctors D, MedicalExaminations  
ME, Patients P where year(ME.Datum) = 2021 and W.No = D.WardNo and  
D.No = ME.DoctorNo and ME.SSN = P.SS group by W.Name
```

**Query 14:**

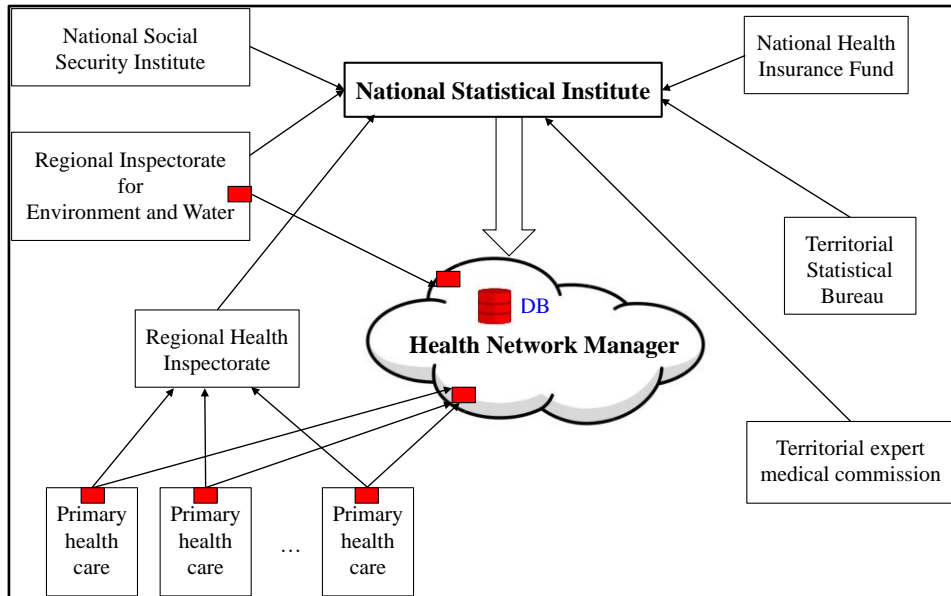
*How many of the doctors in the whole hospital have a specialization in 'infectious diseases'?*

```
select count() from Doctors where Specialization = 'infectious diseases'
```

Here we use the aggregation function *count()* without a “group by” clause, because in this case we have only one group.

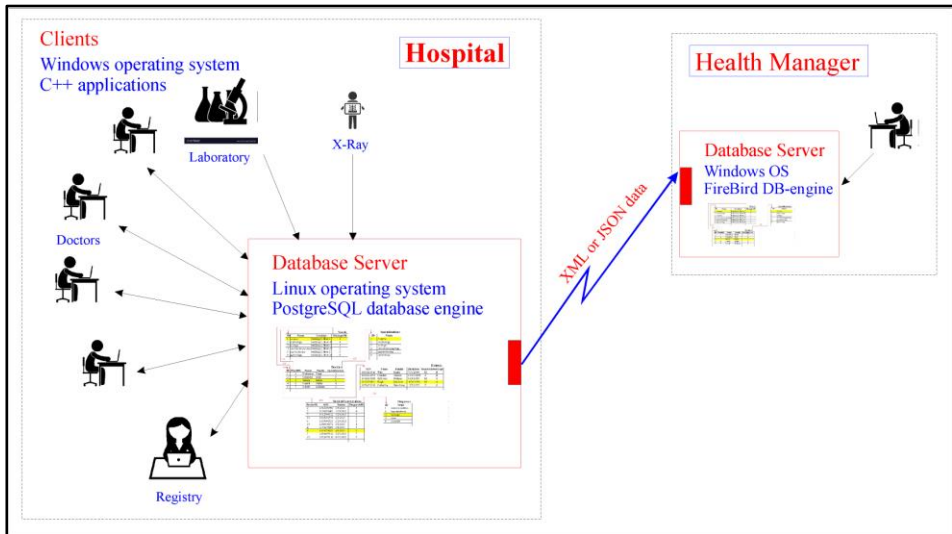
#### **9.1.4 Gathering Data from Heterogeneous Sources of Information**

In today's world of global digitization, almost every institution (whether public or private) has its own computer system for collecting and storing information it needs for its activities. The problem is that the information in these systems is structured differently, even if these systems store the same type of information. Healthcare facilities can be given as an example, because they use software from different developers, and although the type of information is the same, each developer has structured it differently. Thus arises the problem of communication between these systems. Moreover, there are also institutions that need aggregated information from these systems.

**Figure 9.6:** Gathering Data from Heterogeneous Sources of Information

Source: ComHeNet Project – Report of Intellectual Output 4 (2022).

One such institution is the *Health Manager of a Region*, developed and described in the project *ComHeNet*. In order to perform his duties, this health manager needs up-to-date information about what is happening in his region. Figure 9.6 shows the sources of that information, based on the health and administrative structures in Bulgaria. Regardless of the country, the health manager should possess his own database, which will contain only those indicators necessary for his work. The supply of this information from corresponding institutions and keeping this information up-to-date shall be done with the help of microservices, which are small pieces of a program code that transform the data from the internal database of each institution into a uniform data transfer format. Usually, microservices use SQL-queries to extract the required information from the database. On the side of the health manager, there also is such a microservice, which transforms the data received in the uniform data transfer format into the internal structure of the database of the health manager (the structure of which, in turn, is different from that of the other institutions).

**Figure 9.7:** Gathering Data from Heterogeneous Sources of Information

Source: Ilchev, V., Lecture Notes in "XML-Technologies" (2019).

Figure 9.7 shows only that part of Figure 9.6 which relates to "primary health care" institutions, in this case to a hospital. Every single doctor and/or ward (which we call clients) in this hospital possesses their own computer. However, they all use a common database uploaded to a separate computer, which we call a database server.

Languages such as XML, JSON etc. are typically used to depict the transferred data. The data itself are in plain text and are not as well structured as the data in a relational database, but are stored in their natural form, which allows repeatability of information, thus making this presentation format significantly more voluminous and more difficult to manage and process. This is the reason why this format should only be used for data transfer. Although such data are poorly structured, they still have some structure. That is why they are called semi-structured data. Their structure can be described in two alternative ways: using a DTD or an XSD.

The following example shows data in XML-format about diseases, diagnosed in a specific hospital.

```
<report>
  <report_type>diseases</report_type>
  <hospital_name>St. Maria</hospital_name>
  <time_period>
```

```

    <start_date>01.03.2022</start_date>
    <end_date>31.03.2022</end_date>
  </time_period>
  <diseases>
    <age_group_0_16>
      <disease>
        <name>hay fever</name>
        <number>12</number>
      </disease>
      <disease>
        <name>covid-19</name>
        <number>5</number>
      </disease>
      <disease>
        <name>measles</name>
        <number>3</number>
      </disease>
    </age_group_0_16>
    <age_group_16_40>
      <disease>
        <name>hay fever</name>
        <number>44</number>
      </disease>
      <disease>
        <name>covid-19</name>
        <number>25</number>
      </disease>
      <disease>
        <name>measles</name>
        <number>1</number>
      </disease>
    </age_group_16_40>
    <age_group_40_60>
      .....
      .....
      .....
    </age_group_40_60>
    <age_group_60_plus>
      .....

```

```
.....  
.....  
    </age_group_60_plus>  
  </diseases>  
</report>
```

In XML, words like *report\_type*, *hospital\_name*, *time\_period* etc. are called *tags*. We can think of them as parentheses that enclose the corresponding data, only where those brackets have names, such as `<hospital_name>`. Here `<hospital_name>` is the opening bracket and `</hospital_name>` - the closing one. Everyone is free to create his or her own tags, thus extending the language for describing the data according to his or her own needs. That is why this language is called *eXtensible Markup Language* or *XML* for short.

As seen in the example, the XML can also describe complex data, as `<time_period>`, which consists of `<start_date>` and `<end_date>`. It can also be seen that there is repetition of data, such as in the name of the disease in the different age groups. This makes XML significantly less efficient than relational databases when it comes to data storage and processing. This is the main reason why XML should only be used for data transfer.

Although XML data are poorly structured, their structure can be described in two alternative ways: using a DTD or an XSD. At XSD we use an XML document to describe the structure of other XML documents. XSD stands for *eXtensible Stylesheet Definition*, so even the name itself indicates that we can extend this definition to the needs of the particular case.

This is the way for the requesting institution (in our case the health manager) to say to the supplier of data (in our case a hospital): "I want the data you give me to have the following structure!"

Thus, the microservice on the hospital side will use this XSD-definition to generate a XML-report based on the data retrieved from its own relational database and to send this XML-report to the health manager. The microservice on the health manager side will use the same XSD-definition to verify whether the data received from the hospital are properly structured and only then to import these data into its own relational database.

The definition that describes the structure of disease data in a hospital would look like this:

```
<xsd:shema>
```

```

<xsd:element name="report">
  <xsd:complexType>
    <xsd:sequence>
      <xsd:element name="report_type" type="xsd:string"/>
      <xsd:element name="hospital_name" type="xsd:string"/>
      <xsd:element ref="time_period"/>
      <xsd:element ref="diseases"/>
    </xsd:sequence>
  </xsd:complexType>
</xsd:element>

<xsd:element name="time_period">
  <xsd:complexType>
    <xsd:sequence>
      <xsd:element name="start_date" type="xsd:date"/>
      <xsd:element name="end_date" type="xsd:date"/>
    </xsd:sequence>
  </xsd:complexType>
</xsd:element>

<xsd:element name="diseases">
  <xsd:complexType>
    .....
  </xsd:complexType>
</xsd:element>
<xsd:shema>

```

This XSD-definition means that our data are enclosed in a main tag named *report*. This tag contains complex data, which are structured in: *report\_type*, *hospital\_name*, *time\_period* and *diseases*. Two of them, *report\_type* and *hospital\_name*, are regular strings, so they do not need further description. The other two, *time\_period* and *diseases*, contain complex data, which is why their structure must be additionally described.

Hence, further down in the definition we can see the description of the *time\_period* tag, which consists of *start\_date* and *end\_date*. The data in both variables is of type calendar date.



The process of describing the structure of data continues until all schema elements are reduced to simple data types, the structure of which is previously known.



### 9.1.5 Control Questions

1. Insert you as a doctor and one of your friends as a patient in the sample database.
2. Enter a medical examination in which you examine your friend and diagnose him/her with COVID-19.
3. Retrieve a list of patients from the database showing which patients were diagnosed with COVID-19 (your friend must be in that list).
4. Retrieve a list of doctors who had patients with COVID-19 (your name must be in that list).
5. Retrieve the number of patients, diagnosed with COVID-19, for a time period, which includes the day you examined your friend (the number of these patients must have increased by one).

## 9.2 Data Protection and Security

This part shall introduce the students to the EU Data Protection Regulation, especially the part of protecting personal data. This is very important for the work of the health manager, because he or she will have access to information about the health status of large groups of people. Therefore, the students will learn data protection methods, including anonymization, encryption, etc. Last but not least, they will be introduced to the hacking techniques and the measures to block them.



### 9.2.1 Learning Objectives

- Gain knowledge about the EU Data Protection Regulation, especially the part of protecting personal data
- Find out about data protection methods including anonymization, encryption, etc.
- Acquire knowledge about hacking techniques and measures to block them

### 9.2.2 Legislation Concerning the Protection of Personal Data

One of the objectives of the General Data Protection Regulation (GDPR) is to protect the fundamental rights and freedoms of individuals, in particular their right of protection of their personal data. Another objective of the GDPR is to create a uniform and harmonized level of personal data protection in the EU, so it does not impede the free movement of personal data within the Union. This is achieved through direct application of the regulation in the various member states and through the same rules applicable throughout the Union. The GDPR also aims to include the modernization of the rules set out in the 1995 Data Protection Directive and their adaptation to today's digital world. Thus, the objectives of the regulation can be presented in three main groups: personal protection, minimum security requirements and movement of personal data.

The EU Data Protection Regulation introduces a series of requirements for handling sensitive personal information. In addition to the fact that each organization must have a data protection officer, the regulation introduces a series of requirements in terms of handling sensitive personal information. What information is needed to comply with GDPR requirements? Personal data and any set of data that allows the unambiguous identification of the individual (European Union Agency for Fundamental Rights 2020).

An administrator is the person (company, service, person) who collects and accumulates individual personal data. The processor is the person who, under contract with the controller, processes personal data collected by the controller. For example, if Soft Ltd. uses external accounting, then the external accounting firm processes Soft Ltd's personal data. An organization that stores any personal data – for employees, customers and partners – must comply with the requirements of the GDPR related to the data of each of them. It is therefore advisable to collect as little data as possible to carry out the workload. This reduces the potential harmful impact of possible damage (leakage) of personal information. The GDPR does not only apply to the territory of the EU but covers all places where EU personal data is processed. This means that the regulation is valid outside the Union – if a person's personal data is stored and processed by an organization in Australia, for example, it must also comply with the regulation. Data centers and cloud service providers that store personal data of people from the EU should also comply with the requirements of the GDPR. With the GDPR, the rights of individuals regarding control over their personal data increases. Each form of collection of personal data requires the person to confirm his consent, not in general, but for the specific case and for the specific purpose. In particular, this strongly concerns the activity of medical services and their relations with patients.

All organizations that collect, store and process significant amounts of personal data (for over 200 people) must be prepared at all times to provide information to individuals about their personal data stored along with the time when it was collected, for what reason and what changes to these personal data were made and when – in addition to how and why it is accessed. This means that it is mandatory to keep records of all actions that relate to individual personal data stored inside the organization. Any organization that processes a significant amount of personal data should designate a Data Protection Officer (DPO). The person must have a university degree, be directly subordinate to the executive director of the organization and have experience in working with personal data protection. All organizations must implement a code of personal data protection in their practice. This code requires all employees in the organization to be aware of what personal data is, how it is kept, what can and cannot be done inside the organization in order to protect the privacy of stored personal data. All newcomers to the organization should undergo training on organization-specific data protection measures. There is a need of constant monitoring of personal data with clarity about its condition, protection measures, and actions taken – including who accesses the information and when, how and for what reason personal data was added or what changes have been made. This requires both technical measures

to follow each action and appropriate procedural steps. Any individual may request that his or her personal data stored in an organization be deleted. Every organization should have an established procedure for "forgetting" an individual. The right to be "forgotten" is not only applicable in certain cases where the law requires certain data to be stored for certain periods of time. In the event of a breach of personal data protection, the control authorities should be notified within 72 hours – in this case, the Commission for Personal Data Protection. The regulation also requires the notification of individuals whose personal data is affected by the incident. The GDPR is introduced into national law with the presumption of guilt, i.e. the infringement of personal data automatically gives rise to being found guilty until proven otherwise. For a breakthrough in personal data protection, the sanctions are huge and relative compared to the scale and capabilities of the companies in question. They are projected to be EUR 20 million or up to 4% of the annual turnover of the previous financial year – whichever is higher. If the breach is limited to the territory of one country, the sanction may be imposed only on the region.

Personal data can be divided into the three categories of general personal data, sensitive personal data and details of crimes (European Union Agency for Fundamental Rights, 2020). The following information is sensitive personal data: Details of racial or ethnic origin; political, religious or philosophical beliefs; union affiliation; processing of genetic data and/or biometric data for the purpose of unambiguous identification of the individual; health details; information about a person's sexual life or sexual orientation. Personal data that do not fall into the category of "sensitive personal data" may be referred to as "general/ordinary personal data". Ordinary personal data may include personal identification data such as name and address, customer relationships, personal finances, tax issues, debts, sick days, work-related circumstances, family circumstances, residence, car, qualifications, applications, CV, date of work, position, field of work, work phone as well as key data: name, address, date of birth, IP address or other similar insensitive information. Details of crimes can be qualified as information which leads to a person who has committed a particular crime, but it can also be e.g. information that a person is serving a custodial sentence. In other words, the details of crimes are information that can be used to conclude that a person has committed a crime. The rules for the processing of criminal information are not laid down in the GDPR but in individual countries.

Personal data belonging to special categories may be processed under the GDPR or separate processing or agreements that are required in addition to the GDPR. Special categories of personal data may be processed under the GDPR

in the following cases: 1. When the data subject has given his or her explicit consent to the processing of the personal data in question, 2. When the processing is necessary to protect the vital interests of the data subject or another person – if the data subject is physically or legally incapable of giving consent, 3. When personal data is processed in the course of legitimate activity concerning a foundation, association or other non-profit body for political, philosophical, religious or trade union purposes and the processing is adequately protected. Such processing may relate only to members or former members of the body in question or to persons who have regular contact with it in relation to its purposes. Data may not be disclosed outside that authority without the consent of the data subjects, when the processing relates to personal data which is manifestly made public by the data subject, such as by publishing them on the data subject's own website or when processing is necessary for the establishment, exercise or defense of legal claims. Processing is also permitted whenever the courts act as a court.

In the following cases, processing is not only possible under the GDPR, but requires more specific provisions or other procedures. Where processing is necessary for the performance of the duties and the exercise of specific rights of the controller or data subject in the field of labor law and social security and social protection law, in so far as permitted by Union or Member State law or a collective agreement under the law of the Member State. In relation to this, measures to protect the fundamental rights and benefits of the data subject must also be covered. Processing is necessary for reasons like overriding public interest based on Union or Member State law. Provisions allowing processing must be proportionate to the aim pursued and respect the nature of the right to data protection. Due to this matter, measures to protect the fundamental rights and benefits of the data subject must also be taken care of. Where the treatment is necessary for the purposes of preventive or occupational medicine, assessment of the employee's ability to work, medical diagnosis, provision of health or social care or treatment or management of health or social care systems and services on the basis of Union law or the Member State or under a contract with a healthcare professional. Such processing requires the data to be processed only by a professional or a person subject to a legal obligation of confidentiality. Where processing is necessary due to reasons of public interest is in the field of public health, on the basis of Union or Member State law, which also provides for measures to protect the rights and freedoms of the data subject, in particular professional secrecy. The processing is necessary for archiving purposes in the public interest, for scientific or historical research purposes or for statistical purposes in accordance with the

GDPR and on the basis of Union or Member State law. Provisions allowing processing must be proportionate to the aim pursued and respect the nature of the right to data protection. In this relation, measures to protect the fundamental rights and benefits of the data subject must also be considered and established.

Every data controller has the obligation to ensure the security of personal data, in accordance with the principles of integrity and confidentiality. Regarding this point, it is necessary to develop appropriate technical and organizational measures (TOM). In order to comply with the GDPR requirement, the controller or processor must carry out a risk assessment after deciding which TOMs to apply and document the proceedings. Documentation is important for compliance with the principle of accountability. The following should be considered for this assessment: the nature of the personal data (whether special category, confidential, public, etc.); possible threats and vulnerabilities of the systems and the state of the art, i.e. the best practices in the industry, not the average practices and costs.

Technical measures can be defined as the measures and controls provided to systems and any technological aspect of the organization, such as devices, networks and hardware. The protection of such aspects is crucial for the security of personal data and is the best measure of protection against data breaches. Here are some of the most common technical measures to be aware of: cybersecurity, encryption and pseudonymization, physical security, appropriate disposal, passwords and access rights.

Organizational measures may consist of internal policies, organizational methods or standards and controls and audits that controllers and processors may apply to ensure the security of personal data. They can help ensure consistency in the protection of personal data during the full processing cycle. These may include, but are not limited to: information security policies, a business continuity plan, risk assessments, other policies and procedures, awareness and training and reviews and audits.

### **9.2.3 Data Anonymization**

The actions that result in making it impossible to determine the ownership of personal data by a specific personal data subject without the use of additional information is called depersonalization of personal data. The depersonalization of personal data must provide not only protection against unauthorized use, but also the possibility of their processing. For this to happen, the anonymized data must

have properties that retain the basic characteristics of the personal information. Anonymized data include the following properties: relevance, semantic integrity, completeness, structuring, applicability, and anonymity.

The properties (methods) for the depersonalization of personal data, which determine the possibility of providing the specified properties to depersonalized data, include: compatibility, reversibility, variability, resistance of the method against attacks of the identification of the personal data subject and indirect de-identification.

In the depersonalization of personal data, there are two terms: pseudonymization and anonymization.

According to paragraph 5 of Art. 4 GDPR, "Pseudonymization" is the processing of personal data in such a way that they can no longer be attributed to a specific data subject without the use of additional information, provided that this additional information is stored separately and technical and organizational measures are in place to prevent its attribution to an identified or unidentified natural person. According to Preamble 26 of the GDPR, the data protection principles must apply to any information related to the identified individual. Personal data subject to pseudonymization, which may be related to a natural person if there is additional information, should be considered as information related to an identified person, i.e. continue to be personal data and are subject to all relevant provisions. This is also stated in Preamble 28, according to which the use of "pseudonymization" does not imply the abandonment of any other measures for the protection of personal data. Applying pseudonymization to personal data reduces the risks for the data subjects in question and helps data controllers and processors to fulfill their data protection obligations. The basic pseudonymization techniques that can be applied in practice are the following: Counter, Random Number Generator (RNG), Cryptographic hash function, Message authentication code (MAC) and Symmetric encryption.

The following advanced pseudonymization techniques may also be used: asymmetric encryption, ring signatures and group pseudonyms, chaining mode, pseudonyms based on multiple identifiers or attributes, pseudonyms with proof of ownership, secure multiparty computation and secret sharing schemes.

Unlike pseudonymization, which increases data security but still keeps it private, anonymization makes data anonymous. In accordance with Preamble 26 of the GDPR, the principles of personal data protection do not apply to anonymous information, namely information that does not relate to the identified or identifying individual, as well as to personal data provided anonymously enough so that the

data subject cannot be identified. The processing of anonymous information, including for statistical or research purposes, does not apply to the GDPR. According to the GDPR, anonymization implies the impossibility of identifying an individual, even if additional information is available. If you cannot recognize a person from a photo, for example, but you have access to Google to search for images, then that image is not anonymous, but pseudonymous information. The boundary between pseudonymization and anonymization is where the data subject cannot be identified.

The reliability of each method of atomization can be assessed on the basis of three criteria: the possibility for an individual to separate from many other individuals (singling out); the possibility to establish a link between data related to an individual (likability); whether the information can be the subject of a successful "logical attack" (inference).

The administrator should be aware that anonymized data can be a source of residual risks for all entities. The development of technologies that allow anonymization and re-identification are actively developing. New discoveries and research in this area are constantly being published, as a result of which, if the subject is not identified today, he or she may become one tomorrow. Anonymized data as statistics can be used to supplement existing subject profiles, creating new data protection risks. If anonymization does not allow any party in principle to separate a subject in a data set to be linked to two records in that data set, this means that it is effective. Therefore, as a rule, the removal of elements directly identifying a person is not in itself sufficient to make the identification of the data subject no longer possible. Additional measures need to be taken to prevent identification, again depending on the context and purposes of the processing for which the anonymized data are intended. There are many techniques and approaches that can be used to anonymize different data. First, we must identify the form and content of the data that needs to be anonymized. Then we need to define of what type the data in question is: personal data, images, videos, files or geospatial information. It is important to know what the anonymized information is needed for, as this will determine the trade-off between the usefulness of the data and maintaining confidentiality.

Disclosure of personal data is currently attracting the most attention because of the information that can be retrieved. However, this represents the majority of the privacy concerns. When personal data is disclosed, this is usually done in one of the following formats: Microdata, Tabular data and Query databases.

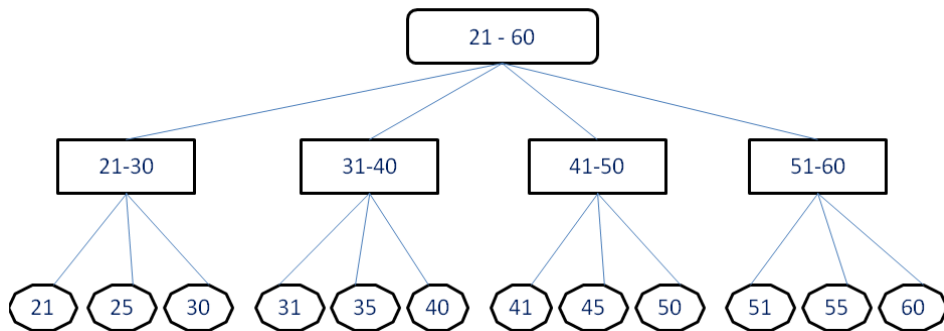


Microdata publications contain the most detailed information and are therefore more difficult to anonymize. Microdata containing records of personal data, also called personal information, are considered, where each record refers to a different person, consisting of a set of attributes, each which describes the characteristics of a person, such as name, age, marital status, etc. Attributes in microdata are classified according to the following non-exclusive categories: **Identifiers:** These are attributes that provide a unique re-identification of the person to whom the record relates and are called direct identifiers. **Quasi-identifiers:** The quasi-identifier attribute does not in itself cause the record to be re-identified. However, the combination of quasi-identification attributes can provide unambiguous re-identification of some individuals. **Confidential attributes:** Attributes containing sensitive personal information are considered confidential. **Non-confidential attributes:** these are attributes that do not belong to any of the previous categories.

In the process of anonymization, two sets of data are implicitly considered. The first one is the original data set containing the native data, and the second is the anonymized data set, which derives from the application of one or more anonymization methods linked to the original data set. The latest data set is subject to publication. The success rates of data anonymization are quantified by the extent of which the data in the anonymized data set is exposed to certain disclosure risks.

Maintaining the confidentiality of data is associated with reducing the risks of disclosure. There are various privacy protection methods and models that can be applied. These methods make it possible to generate an anonymized data set either by masking the original data or by creating synthetic data. The masking methods generate an anonymized data set by modifying the records of the original data set, creating a link between the records of the two. Masking methods can be divided into two categories depending on how they are applied to the original data: Non-perturbative masking and Perturbative masking. Below is a brief description of some of the most commonly used methods.

**Generalization:** These methods provide anonymization by reducing the detail of the source data. They can be used for numeric, categorical and date type data. For number and date attributes, generalization means replacing the original value with a sampled version. To reduce the level of detail, such methods use a structure called a hierarchical or taxonomic tree. Each quasi-identifier requires one structure that contains all possible values that can be accepted. An example of a hierarchical tree is shown in Figure 9.8.

**Figure 9.8:** Hierarchy Example for Age Quasi-Identifier

Source: Pseudonymisation Techniques and Best Practices (2021)

**Top-and-bottom coding:** This is a special case of generalization. The method is used for attributes of numeric or category type. The idea behind this method is to define a threshold value for each quasi-identifier and to express all values as greater than, equal to or less than the threshold value.

**Local suppression:** This method is based on the practice of suppressing certain values of certain attributes in order to expand the set of records containing a combination of key values. The values that are suppressed are those that are rare in the original data set, i.e. pose a high risk of disclosure for the records that contain them.

**Micro aggregation:** This method is for numeric attributes only. The rationale for micro aggregation is that privacy rules allow the publication of microdata sets if the records are in groups of  $k$  or more people, in which not a single attribute dominates the group and  $k$  is a threshold. These sets are created by replacing individual values with values calculated by small aggregates. This means that for each attribute, its average value in each group is calculated and replaces each of the initial values.

**Synthetic data:** This method of anonymizing a dataset aims to create an independent dataset that is not extracted from the original. This is called synthetic data generation and is based on creating a new set of records that retain some of the properties from the original set. There are three types of synthetic datasets: fully synthetic, partially synthetic and hybrid.

Once the methods of anonymizing certain types of attributes have been considered, the most appropriate privacy model should be selected and it should be determined which method is to be applied. When choosing a privacy model, the goal is to reduce the risks of disclosure. In this case, at least one model must be

chosen that opposes the disclosure of identity and one that goes against the disclosure of attributes.

**K-anonymity** is a popular privacy model used to reduce the risk of disclosure of personal data. This is sometimes considered as meeting the minimum requirement to limit the risk of disclosure and is later supplemented by protection against attribute disclosure. The general idea is to create groups in a data set where each group contains at least  $k$  records, and the group records have the same value for each quasi-identifier. In other words, within a group, the records are indistinguishable from each other. This model can be realized using various methods, including generalization and micro aggregation.

**k-Map** is a very close model of  $k$ -anonymity. The main difference is that the  $k$ -Map model is able to take into account another set of data, in addition to the original, to achieve the requirement of confidentiality. The limitation of this model is that it assumes that the infringer processes are dependent only on the information provided by the anonymized data set, without access to any external sources that provide additional data information that can be used for re-identification purposes.

Other well-known confidentiality models are Population uniqueness,  $\delta$ -Disclosure privacy,  $\beta$ -Likeness,  $l$ -Diversity,  $t$ -Closeness, Differential privacy,  $\delta$ -Presence, and Profitability. It is worth mentioning that most privacy models provide options for specific applications in specific contexts or for specific features of the original data set.

#### 9.2.4 Cryptographic Methods for Information Protection

Cryptography is the science of transforming information in order to protect it from unwanted or illegal use. This transformation is an encryption of information, which is designed to make it practically impossible for illegal users to read or change it. Encryption must provide the ability to easily obtain the original information from the ciphertext by legitimate users who have a key to the decryption algorithm. It is assumed that digital encrypted information is transmitted to a generally available communication channel for all users – legal and illegal, who have free access to it. In applied cryptography, the word "virtually impossible to break (crack) the cipher" means that illegal users will be forced to allocate resources unacceptable to them (time, energy, space, money, equipment, etc.) to perform the necessary volume of computing or other cipher-breaking works. Mathematical or theoretical cryptography seeks to show that the problem of breaking a cipher is a problem

with strictly provable properties. The solution of this task has a certain complexity within the framework of the information-theoretic or complexity-theoretic approach.

The main tasks or problems of practical cryptography are the construction of robust encryption systems and the analysis of the robustness of these or other specific encryption systems. Resilience refers to the system's ability, through a number of operations, to resist hacking attempts. The word "cracking" means the determination of discovered information with known encrypted information in one or other conditions. In this case, basically all efforts are directed towards creating a key. An encryption system is durable if all the methods considered give almost no ways to recover the key and no other ways of obtaining the discovered information.

Cryptology is divided into two branches: cryptography and cryptanalysis. The goals of these directions are completely opposite. Cryptography aims to find and study mathematical methods for information conversion. Cryptanalysis, on the other hand, deals with the possibilities of deciphering information without the knowledge of its keys.

Modern cryptography includes 4 major sections: Symmetric cryptography, Public key cryptography, Electronic signature system and Key management (Katz and Lindell, 2020).

The main directions for using cryptographic techniques are: transfer of confidential information through communication channels; establishing the authenticity of the transmitted messages and storing information (documents, databases) on media in an encrypted form.

Cryptography enables information to be transformed in such ways that its recovery is only possible with the knowledge of the key. Information that is subject to encryption and decryption is considered text, built on the basis of alphabets.

Encryption – the process of conversion: the source text is being replaced by encrypted text. Decryption – the reverse method of the encryption process. Based on the key, the ciphertext becomes the plaintext. Key – information necessary for smooth encryption and decryption of the text. The cryptographic system represents the family of  $T [T_1, T_2, \dots, T_k]$  transformations of the plaintext. Members of this family are indexed. They are denoted by the symbol  $k$ . The  $k$  parameter is the key. The key space  $k$  is the set of possible key values. A key is usually a string of alphabetic characters.

Cryptosystems are divided into symmetric and public keys. In symmetric cryptosystems, the same key is used for both encryption and decryption. In public key systems, two keys are used – public and private – which are mathematically related to each other. The information is encrypted using a public key, which is available to everyone, and decrypted using the private key known only to the recipient of the message.

The terms key distribution and management refer to the processes in information processing systems, the content of which consists in the preparation and distribution of keys between users. An electronic (digital) signature is required in addition to the text of its cryptographic transformation, which allows to verify the authorship and authenticity of the message when receiving the text from another user. Crypto resistance is a characteristic of a cipher that determines its resistance to decryption without knowledge of the key (i.e. cryptanalysis).

The encryption-decryption method is called a cipher. Some encryption algorithms are based on the fact that the encryption method itself is a secret. Now these methods are only of historical interest and have no practical significance. All modern algorithms use a key to manage encryption and decryption; a message can only be successfully decrypted if the key is known. The key used for decryption may not match the key used for encryption, but they do so in most cases. Algorithms using a key are divided into two classes: symmetric or secret-key algorithms and asymmetric or public-key algorithms. The difference is that symmetric algorithms use the same key for encryption and decryption, or the decryption key is simply calculated from the encryption key. In asymmetric algorithms, different keys are used and the decryption key cannot be calculated from an encryption key. Symmetric algorithms are divided into stream and block ciphers. Stream ciphers allow information to be encrypted bit by bit, while block ciphers work with some set of bits of data (often a block size of 64 bits) and encrypt that set as a whole (Menezes et al. 1997).

Asymmetric ciphers are called public-key algorithms, or public-key cryptography. The public key is assumed to be available to everyone (it may even be published in a newspaper). This allows anyone to encrypt the message. Decryption of this message can only be done by the right person – the one who has the decryption key. An encryption key is called a public key and a decryption key a private key or secret key. The most popular symmetric algorithms are DES and IDEA. Perhaps the best asymmetric algorithm is RSA (Menezes et al. 1997). Some of the asymmetric algorithms can be used to generate an electronic signature. A digital signature is called a block of data generated by using a secret key. In doing so, the public key can be used to verify that the data was indeed generated using this

private key. The algorithm for generating a digital signature must ensure that without a private key you cannot create a signature that, upon verification, will prove to be correct. Electronic signatures are used to confirm that the letter is indeed coming from the sender. Only the sender is assumed to have a secret key matching its public key. Also, signatures are used to timestamp documents: a party we trust signs a timestamped document using a private key and thus confirms that the document already existed at the time declared in the timestamp. Digital signatures are used to certify the fact that a document is owned by a person.

A digital signature of a document is usually created like this: a message digest is generated from the document and information about who signed the document, timestamp, etc. is added to it. The resulting line is further encrypted with the signer's secure key using one or the other algorithm. The generated structure is encoded set of bits and represents the digital signature. The signer's public key is usually applied to this signature. The most famous one is the RSA algorithm. Cryptographic hash functions are commonly used to generate a message digest when creating an electronic signature (Frankenfield 2021). Hash functions transform a message that has a fixed size of hash value in such a way that the entire set of possible messages is distributed evenly across different hash values. This cryptographic hash function makes it nearly impossible to map a document to a particular hash value. Cryptographic hash functions are typically produced by values of a length of 128 or less. This number is significantly higher than the number of messages that will ever exist in the world. Many good cryptographic hash functions are freely distributed. The most popular of these include MD5 and SHA.

Cryptanalysis is the science of deciphering coded messages without knowing the keys. There are many cryptanalytic methods. Some of the most important ones are:

**ciphertext-only attack.** This is a situation where the attacker knows nothing about the content of the messages and he or she only has to work with the ciphertext. In practice, it is often possible to make a plausible guess about the structure of the text, because there are standard titles.

**known-plaintext attack.** The attacker knows or can guess the contents of all or part of the ciphertext. The task is to decipher the rest of the message. This can be done either by computing the encryption key or without it.

**chosen-plaintext attack.** An attacker has the ability to obtain an encrypted document for any text he or she needs, but does not know the key. The task is to find

the key. Some encryption methods, and RSA in particular, are extremely vulnerable to attacks of this type. When such algorithms are used it must be ensured that an attacker cannot encrypt the plaintext they specify.

**Man-in-the-middle attack.** The attack targets the exchange of encrypted messages and in particular the key exchange protocol. The idea is that when two parties exchange keys for secret communication, for example using a Diffie-Hellman cipher, an attacker interferes between them in the message line. The attacker then gives each party their keys. As a result, each party will have different keys, each known to the attacker. The attacker will now decrypt each message with his own key and then encrypt it with another key before sending it to the recipient. The parties will have the illusion of secret correspondence, when in fact the enemy is reading all the messages.

**timing attack.** This new type of attack is based on consistently measuring the time required to perform the operation of raising to a power modulo of an integer. The following ciphers are susceptible to this attack: RSA, Diffie-Hellman, and the elliptic curve method.

There are many other cryptographic attacks and cryptanalytic methods. The choice of specific information systems should be based on a thorough analysis of the strengths and weaknesses of certain protection methods.

### 9.2.5 Hacking Techniques and Measures to Block Them

The first computer hack occurred in the late 1960s when Bell Labs successfully hacked and modified the Unix operating system. In the 1980s, people began hacking into computer systems to gain access to confidential information. In the late 1990s, law enforcement began to take hacking seriously. This provoked the tightening of laws against hacking. Three types of hackers are considered. One group is that of enthusiasts, skilled programmers, or users. The other group uses computers to gain unauthorized access to data and directs the knowledge to criminal activities, such as the distribution of pirated software, games, viruses and worms that can actually destroy information systems. The third type is a hybrid between good and evil.

Hackers are classified according to three categories: white hat, gray hat and black hat.

**White hats** are the 'good guys' in the hacking world. Some of them work successfully by hacking company systems and fixing security holes. White hackers are the creators of antivirus software and firewalls. They do their best to outwit

the Black Hats at every turn. White hats build security systems and black hats try to break into them.

**Gray hats** are hackers who, as the name suggests, cover the gray area of hacking. A large number of them hack into systems without malicious intent, but without the permission of the owners of the systems. Others look for and find flaws in systems and then sell them to companies or to the highest bidder. In general, these hackers are not liked by either the white hats or the black hats (Regalado et al., 2018).

**Black hats** are the worst kind of hackers. These hackers hack information systems for malicious purposes or for personal gain. They are also known as "crackers". This is the popular media view of what a hacker is.

The most common hacking techniques that every businessman, economist, doctor and even the average user should know are:

Using the **Bait and Switch** hacking technique, an attacker can buy ad space on websites. Later, when the user clicks on the ad, they may be redirected to a page infected with malware. In this way, they can additionally install malware or adware on your computer. The ads and download links displayed in this method are very attractive and users are expected to click on them eventually. A hacker can launch malware that the user thinks is genuine. Thus, once the malicious program is installed on your computer, the hacker gets unprivileged access to it.

Browser cookies store our personal data, such as browsing history, username and passwords, for the different websites we access. Once the hacker has access to your cookie, they can even authenticate as you in the browser. A popular method of performing this attack is to encourage the user to use IP packets to pass through the attacker's computer. This attack is called **Cookie Theft**.

**ClickJacking Attacks** is also known by another name: UI Redress. In this attack, the hacker hides the actual user interface that the victim has to click on. This behavior is very common when downloading apps, streaming movies, and torrenting sites. While they primarily use this method to earn advertising dollars, others may use it to steal your personal information. In other words, the attacker intercepts the victim's clicks that are not for a specific page, but for the page the hacker wants you to be on. It works by tricking the Internet user into performing an unwanted action by clicking on a hidden link.

**Viruses or Trojan horses** are malicious programs that install themselves on the victim's system and continue to send the victim's data to the hacker. They can



also block your files, display fraudulent ads, redirect traffic, sniff your data, or spread to all computers connected to your network.

A **Denial of Service (DoS/DDoS) attack** is a hacking technique designed to flood your web server with many requests to the point where it overloads the web server, causing the website to crash. To do this, hackers deploy botnets or zombie computers whose sole job is to flood your website with requests for data.

Hackers are constantly inventing new ways to eavesdrop on digital conversations. Voice over IP calls that are made over an IP connection are recorded using protocol analyzers. The data can be converted into audio files for analysis by the hacker. This attack is called **Eavesdropping**.

Basic Hacking techniques and measures to block them are discussed below (Harsh, 2019):

A **keylogger** is a computer program that records every keystroke made by a computer user in order to fraudulently gain access to passwords and other sensitive information. It can also be used to study human-computer interaction. There are two main purposes for using keyloggers: to monitor the work of employees and to have access to confidential information.

There are different types of Keyloggers, divided into two main groups: Hardware Keyloggers and Software Keyloggers.

Hardware keyloggers are small electronic devices used to collect data between a keyboard device and an I/O port. These devices usually have built-in memory where information about pressed keys is stored, so they must be removed by the person who installed them to get the information. Hardware keyloggers are not detected by antivirus software or scanners because they run on a hardware platform (O'Flynn, 2021).

Software Keyloggers monitor information systems, collect keystroke data on the target operating system, store it on a disk or in remote locations, and sends it to the attacker. They can operate for an indefinite period of time while the information is transmitted remotely.

There are several ways to prevent keyloggers: anti-virus (spyware) and firewalls, automatic form fillers, alternative keyboard layouts and on-screen keyboards (Harsh, 2019).

**Malware** is short for "malicious software". It is software specifically designed to gain access to or damage a computer without the owner's knowledge (Sikorski et al., 2012). Malware is a file or code, usually transmitted over a network, that

infects, probes, steals, or behaves in a way the attacker desires. Malware typically has one of the following goals: to grant the attacker remote access to the infected machine, to send spam from an infected computer to unsuspecting recipients or to steal confidential data.

**Adware** is a type of malware that automatically delivers advertisements. Common examples of adware include website pop-ups and advertisements displayed by the software. In the context of software, a **bug** is a flaw that leads to an undesired result. These flaws are usually the result of human error and often exist in the program's source code or compilers. Security errors are the most serious type of error and can allow attackers to bypass user authentication, replace access rights, or steal data. A **rootkit** is a type of malware designed to remotely access or control a computer without being detected by users or security programs. Once a rootkit is installed, the attacker behind the rootkit can remotely execute files, gain access, or steal information. **Ransomware** is a type of malware that essentially takes over a computer system and demands a ransom. Malware restricts the user's access to the computer by encrypting files on the hard drive or by locking the system.

**Phishing attacks** are not new and are part of the hackers' repertoire. The prevalence of phishing attacks, both simple and sophisticated, continues to frustrate security professionals around the world. As information spread about the phishing scheme, the need for a quick and organized response became apparent.

A **waterhole attack** is a targeted attack aimed at compromising users in a specific industry or user group by infecting the websites they normally visit and luring them to a malicious site. The ultimate goal is to infect the user's computer and gain access to the organization's network. Waterhole attacks, also known as strategic website compromise attacks, are limited in scope because they depend on the element of luck. However, they become more effective when combined with email invitations to drive users to websites.

A **man-in-the-middle (MITM) attack** is a form of eavesdropping where communication between two users is monitored and modified by an unauthorized party. Typically, an attacker actively eavesdrops by intercepting the public key message exchange and retransmits the message by replacing the requested key with his own. The man in the middle is best known to others as "session hijacking" and to the general public as "hijacking". These hackers primarily target specific transaction data on computers. This could be anything from an email to a bank transaction – one can say the hackers are launching an investigation against the interested party.

The signs that your computer has been attacked by a hacker are:

- Programs open and close by themselves.
- Your computer turns itself on and off.
- There are programs on your computer that you do not remember installing etc.

When your computer has been hacked, you need to perform the following actions:

- The first thing to do is to disconnect your computer from the Internet by disconnecting the Ethernet cable or manually disconnecting the router.
- Run a virus scan on your computer.
- Try to remove any programs the hacker has installed on your computer.
- Contact a professional if problems persist.

In order to protect yourself from hacker attacks, it is necessary to take proactive and active prevention:

- Install anti-virus software.
- Install a firewall / make sure you have one.
- Store backup copies of any important information on your computer separately (external hard drive).

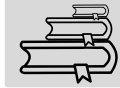
To carry out Active prevention it is recommended to:

- Update both your computer and your programs when prompted.
- Whenever you choose a password for an account, be sure to make it long enough to include numbers, letters, and special symbols. Make it something unique and not obvious (for example a birthday). Use different passwords for each account.
- Use common sense when surfing the Internet. Don't follow links to sites you don't trust and don't share your password with anyone.



### **9.2.6 Control Questions**

1. What are the categories into which personal data is divided according to the law? What types of data belong to each of these categories?
2. What is the difference between symmetric keys and public keys in modern cryptosystems?
3. Describe the main methods for data anonymization. Which of them is most appropriate when a hospital sends information to a health fund?



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## **10 Conclusion**

*Yvonne Behrens*

The Competences in Health Network Management textbook is based on the findings of the Com.HeNet project (Erasmus+). Over a period of three years, expert interviews and literature research were conducted and translated into an interdisciplinary teaching module for the training of regional health network managers. This teaching module includes classroom teaching and self-study.

This successfully developed book contains teaching chapters that can be used for training regional health network managers. It spans topics from health sciences, project management and information technology. All these contents are important for the professional field of regional health network managers. With competences in these fields, health regions can be successfully coordinated.

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