



#### D4.2: Second version of definition and taxonomy on medical deserts

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Table of contents

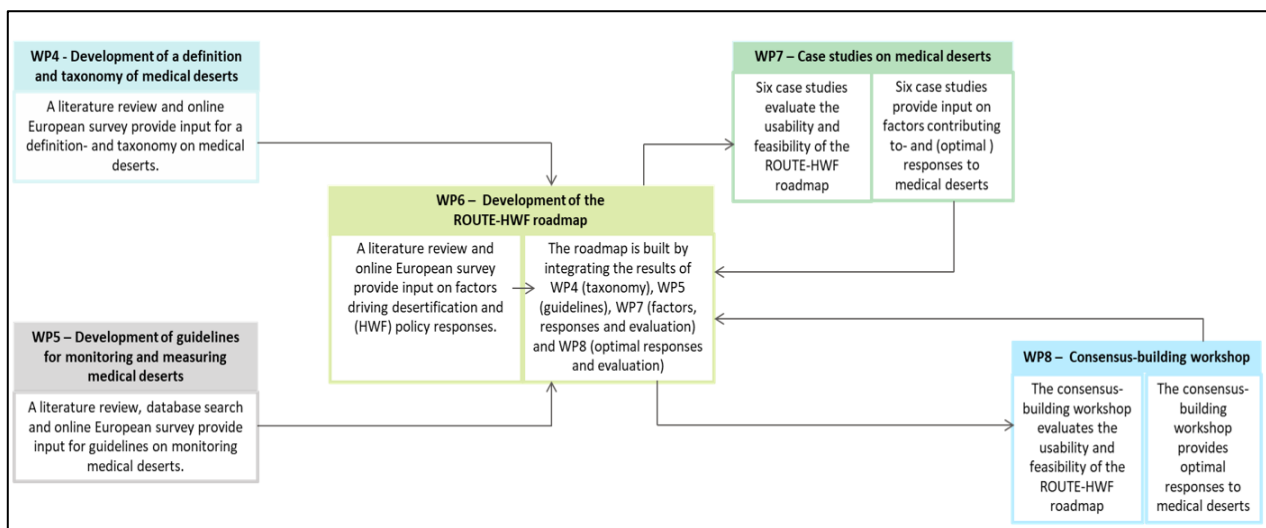
- 1. Introduction ..... 3
- 2. Approach and methods..... 4
- 3. Results: towards a second definition and taxonomy on medical deserts..... 5
- 4. Conclusion: The second version of definition and taxonomy on medical deserts ..... 8
- References..... 10

# 1. Introduction

The aim of this Deliverable 4.2, which is the second deliverable of Work Package 4, is to provide a second version of a definition and taxonomy on medical deserts. The guidelines are designed to help public authorities and health professionals to gain a better understanding of (1) the origin and development of medical deserts, (2) how to monitor them, and (3) how to investigate and evaluate the effects of health workforce (HWF) policy measures to mitigate or eliminate medical deserts which is now often lacking (Ono et al., 2014). The goal of the guidelines is to provide a practical set of tools that contribute to an improved measurement system for medical deserts across Europe.

Together with the measuring and monitoring guidelines (as developed in Work Package 5), the definition and taxonomy will feed into the creation of the ‘Roadmap out of medical deserts’ that will be created in Work Package 6. The interplay between the definition and taxonomy, measuring and monitoring guidelines and the ROUTE-HWF roadmap is presented in Figure 1 below, along with the corresponding WPs and methods of data collection and stakeholder engagement.

**Figure 1. The interplay between the ROUTE Work Packages on the definition and taxonomy, measuring and monitoring guidelines, that feed the ROUTE-HWF roadmap on medical deserts**



This second deliverable of Work Package 4 (a second version of a definition and taxonomy on medical deserts) will be followed by deliverable 4.3 that will be published later on in the ROUTE-HWF project. Deliverable 4.3 will provide a third version of the definition and taxonomy, based on six country case studies and the final event during which the guidelines will be presented to stakeholders and feedback received.

By connecting the definition and taxonomy of medical deserts with the measuring and monitoring guidelines (provided in Deliverables 5.1 and 5.2), the project is paving the way towards creating the ROUTE-HWF roadmap out of medical deserts. The ROUTE-HWF roadmap will support EU Member States in a tailored manner, i.e., supporting them to design and implement specific policies related to specific types of medical deserts. It will provide a rationale for public authorities and health professionals at national and subnational levels to apply an optimal mix of HWF policies to their particular medical deserts – taking the context-sensitivity of these policies and medical deserts into account. The final goal is to mitigate the effects of medical deserts and dissolving these, and hence to improve access to healthcare as well as quality of healthcare for citizens living in these areas, now and in the future.

## 2. Approach and methods

In Deliverable 4.1 (D4.1) of the ROUTE-HWF project, a first version of the definition and taxonomy on medical deserts was presented which is based on the iterative method by Nickerson et al. (Nickerson, Varshney, & Muntermann, 2013). According to Nickerson et al., a taxonomy should comply the following four basic rules:

- **It should be concise.** It should contain a limited number of dimensions or a limited number of characteristics in each dimension, because an extensive classification scheme with many dimensions and many characteristics would be difficult to comprehend and difficult to apply.
- **It should be sufficiently inclusive.** It should contain enough dimensions and characteristics to be of interest. For example, a taxonomy with only one dimension and two characteristics within that dimension would not be very interesting. This attribute can conflict with the conciseness attribute.
- **It should be comprehensive.** It should provide for classification of all current objects within the domain under consideration
- **It should be extendible.** It should allow for additional dimensions and new characteristics within a dimension when new types of objects appear.

In addition, Nickerson et al. formulated eight steps of “The taxonomy development method” that are embedded in three consecutive phases:

### **Phase 1: The empirical deductive approach**

1. Examine subset of objects
2. Identify general distinguishing characteristics of objects
3. Group characteristics into dimensions to create first taxonomy

### **Phase 2: The deductive empirical approach**

4. Conceptualize new characteristics and dimensions
5. Examine objects for new characteristics and dimensions
6. Revise taxonomy to create next version

### **Phase 3: The use of the taxonomy**

7. Identify missing objects in taxonomy
8. Design new objects

The result of the first three steps are reported in the first version of the definition and taxonomy (D4.1). The executing of phase 2, i.e. steps four to six, are reported in this report (Deliverable 4.2). Steps seven and eight (phase 3) will be reported in the final report of the ROUTE-HWF project (D4.3).

Below we will subsequently describe the execution of step four and five, by building upon the first version of the ROUTE-HWF taxonomy conceptually and empirically. Based on the results step six is executed, the revision of the ROUTE-HWF taxonomy into its new and second version.

### 3. Results: towards a second definition and taxonomy on medical deserts

*Executing step 4-6 of the taxonomy development method: (step 4) Conceptualize new characteristics and dimensions, (step 5) examine objects for new characteristics and dimensions, and (step 6) revise taxonomy to create next version*

#### Step 4: Conceptualize new characteristics and dimensions

In this step we build upon our first version of the ROUTE-HWF taxonomy, which is based on four characteristics and dimensions that basically drive the process of desertification. The four characteristics and dimensions were derived from our literature review combined with expert consultations (see the D4.1 report). In Figure 2, the four characteristics and dimensions are depicted in a conceptual model that also shows their interrelations which are further explained in this step.

**Figure 2. Conceptual model behind the ROUTE-HWF taxonomy, showing the interplay between four characteristics and dimensions that drive desertification - two at the demand side (above, in orange) and two at the supply side (below, in green) of a regional health system**

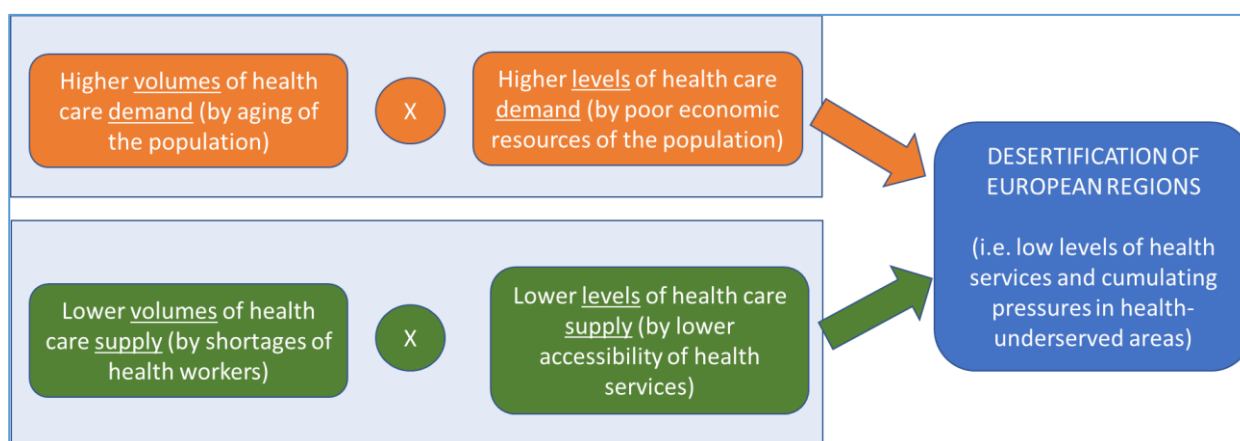


Figure 2 shows that two characteristics/dimensions drive the demand for health services in European regions – addressing *volumes* of healthcare demand on the one hand, and *levels* of healthcare demand on the other. Likewise, two characteristics/dimensions drive the supply of health services (and desertification) in regions – addressing *volumes* of healthcare supply on the one hand, and *levels* of healthcare supply on the other. The four characteristics/dimensions were subsequently specified by key elements. First, aging is a key element that drives desertification by higher *volumes* of healthcare needs in a region, while poor economic resources of the population typically drives *levels* of healthcare demand and needs. Second, we define that shortages of healthcare workers is a key element that drives desertification by lower supply *volumes* available in a region; while lower accessibility of health services drives lower *levels* of healthcare supply.

The conceptual model behind our ROUTE-HWF taxonomy also implies that the demand and supply side of (regional) health services are *interconnected*. Therefore, the four characteristics/dimensions (or: elements) need to be considered in balance and conjunction, to identify and understand the existence and emergence

of medical desert regions in European countries (i.e. the process of desertification). In addition, the conceptual model entails that the two elements defined at both the demand and supply side ('volume' and 'level') are interconnected as well, and particularly can be seen as a '*multiplier*' relationships that drive the process of desertification in regions.

#### Step 5: Examine objects for new characteristics and dimensions

In this next step 5, the four characteristics and dimensions (or: elements) are operationalized into four 'objects' to enable the construction of a taxonomy that adheres to the key rules of Nickerson et al (see section 2). To this end, each element at the supply and demand side is operationalized as an *dichotomous object* that can be 'true' or 'false' for a region within a country. For instance: the element aging (that drives desertification by higher demand volumes) is defined into an object that is 'true' if the proportion of inhabitants that is aged 65 and over living in a region is higher than this proportion of all inhabitants in the country. The three other elements are defined likewise:

- The element poor economic resources of the population is defined into an object that is 'true' if the proportion of inhabitants below the poverty line living in a region, is higher than this proportion of all inhabitants in the country;
- The element shortages of healthcare workers is defined into an object that is 'true' if the health professional-to-population ratio in a region, is lower than this ratio in the country;
- The element lower accessibility of health services is defined into an object that is 'true' if the average travel time by public transport to the nearest public healthcare facility in a region is larger than the average travel time at the national level of the country.

These four dichotomous objects are not only concise and comprehensive, but they also allow the construction of a taxonomy that defines *unique types of medical deserts* (i.e. regions or areas in Europe). By defining all possible combinations of the four objects (i.e. all 'true' combinations), 15 unique and mutually exclusive types of medical desert areas can be defined. Figure 3 shows this taxonomy, as was also described as the first version in D4.1..

**Figure 3. First version of the ROUTE-HWF taxonomy to define and classify 15 different types medical deserts by four objects ('x' in the cells indicate that the object is 'true' or applicable for the specific type of medical desert area/region)**

Type of medical desert	DEMAND FOR HEALTH SERVICES – POPULATION AND HEALTHCARE DEMAND OBJECTS		SUPPLY OF HEALTH SERVICES – AREA AND HEALTHCARE SUPPLY OBJECTS	
	Object 1: Percentage population aged 65 and over	Object 2: Economic resources of the population	Object 3: Population-provider ratio	Object 4: Travel time to public health facilities by public transport
	<i>The proportion of inhabitants aged 65 and over living in this area, is <u>higher</u> than this proportion of all inhabitants in the country</i>	<i>The proportion of inhabitants below the poverty line living in this area, is <u>higher</u> than this proportion of all inhabitants in the country</i>	<i>The health professional-to-population ratio in this area, is <u>lower</u> than this ratio in the country</i>	<i>The average travel time by public transport to the nearest public healthcare facility in this area is <u>larger</u> than the average travel time at the national level of the country</i>
↓				
1	x	x	X	x
2	x	x	x	
3	x	x		x
4	x		x	x
5		x	x	x
6	x	x		
7	x		x	
8	x			x
9		x	x	
10		x		x
11			x	x
12	x			
13		x		
14			x	
15				x

### Step 6: Revise taxonomy to create next version

In this next step, the first version of our taxonomy as presented above is revised. This revision is based on both empirical as conceptual grounds.

The empirical ground is based on the ROUTE-HWF stakeholder workshops executed in the five countries of the ROUTE-HWF consortium (The Netherlands, Croatia, Finland, Poland and Spain). Through the interpretations of its joint results, it became clear that the 'granularity' of 15 different medical deserts types is actually too large to have added value in practice. While all 15 types can indeed appear in theory, in it was concluded that the medical desert types 6 to 15 (in Figure 3 above) are less relevant to consider as they address 'only' one or two of the four objects. In practice, action and policy priority was merely at stake in regions that are underserved due to a *cumulation* of desertification drivers. Also, the urgency of finding tailored solutions and comparing European regions as 'medical deserts' was particularly felt when focusing on areas that are (and will be) most at risk. While countries largely differ in their scale and absolute scores on the four elements, the relative definition of the objects (with national averages as a benchmark) ensured cross-national comparison.

It can also conceptually be argued why a next version of the taxonomy should be limited, i.e. by defining areas or regions as a medical desert if *at least three* of the four objects apply. By this restriction, each

medical desert type is defined by at least one object regarding the demand and supply side of the regional health services system. And this complies with the principles behind the conceptual model as described above in Figure 2, being the acknowledgment of the inseparable interplay between the demand and supply drivers of desertification.

Applying these arguments to the first version of the ROUTE-HWF taxonomy, results in ruling out ten of the fifteen types of medical deserts. The resulting five types of medical deserts, building the second version of the ROUTE-HWF taxonomy are shown in figure 4.

**Figure 4. Second version of the ROUTE-HWF taxonomy to define and classify 5 ‘main’ different types medical deserts by four objects/dimensions (‘x’ in the cells indicate that the object is ‘true’ or applicable for the specific type of medical desert area/region)**

	DEMAND FOR HEALTH SERVICES – POPULATION AND HEALTHCARE DEMAND OBJECTS		SUPPLY OF HEALTH SERVICES – AREA AND HEALTHCARE SUPPLY OBJECTS	
	Object 1: Percentage population aged 65 and over	Object 2: Economic resources of the population	Object 3: Population-provider ratio	Object 4: Travel time to public health facilities by public transport
Type of medical desert	<i>The proportion of inhabitants aged 65 and over living in this area, is <u>higher</u> than this proportion of all inhabitants in the country</i>	<i>The proportion of inhabitants below the poverty line living in this area, is <u>higher</u> than this proportion of all inhabitants in the country</i>	<i>The health professional-to-population ratio in this area, is <u>lower</u> than this ratio in the country</i>	<i>The average travel time by public transport to the nearest public healthcare facility in this area is <u>larger</u> than the average travel time at the national level of the country</i>
↓				
1	x	x	X	x
2	x	x	x	
3	x	x		x
4	x		x	x
5		x	x	x

#### 4. Conclusion: The second version of definition and taxonomy on medical deserts

In this deliverable, the development of the second version of the ROUTE-HWF taxonomy is described, by the three steps following the approach of Nickerson et al.. After explaining the conceptual model behind our taxonomy, its four main dimensions are operationalized in elements and measured in objects. The conceptual model is founded by the approach that medical deserts share the same drivers at both the demand and supply side of their (regional) healthcare system, and that their interplay is critical to understand desertification as a process. At the same time, the conceptual model allows to distinct different medical deserts areas that can appear in practice, as not all drivers can or should be in place while defining regions as such. The first version of our taxonomy therefore defined 15 (unique) types of medical deserts by combining the four dichotomous objects, as the ‘full range’ or ‘population’ of medical deserts that regions in Europe can be classified into.

By empirical and conceptual arguments, a second version of the ROUTE-HWF taxonomy is developed as a more concise yet comprehensive and applicable taxonomy. The taxonomy now defines five *distinctive types* of medical deserts that can be considered *as a nominal variable* based on a *limited number of unique combinations* of the objects. The rationale is that a single object cannot define *if (or the degree to which)* a

region can be identified as a medical desert. Instead, it is the unique *combination* of at least three (out of four) of the relevant key objects that constructs the taxonomy, and its classification.

This second version of the ROUTE-HWF taxonomy contributes to the ROUTE-HWF roadmap, to support countries by (1) identifying their specific types of medical deserts and (2) helping them to exchange tailored solutions for these different types of medical deserts. This will enable mutual learning between countries, to explore specific policies for possible solutions for each type of medical desert. Still, this second version ROUTE-HWF taxonomy obviously needs to be further verified, in particular empirically. Therefore we refer to Deliverable 5.2., where this second version taxonomy was applied using Eurostat data. The aim was to explore if the second version taxonomy can be applied to compare European countries (and their relevant regions) based on secondary data.

Next, the second version of the ROUTE-HWF taxonomy is included in the studies conducting in this ROUTE-HWF project. These case studies explore the similarities and differences of the five medical desert types for six countries (being Poland, Croatia, the Netherlands, Spain, Germany and Ireland; see Deliverable 7.1). Based on the case studies the third and final version of the taxonomy will be developed, and described in the next Deliverable 4.3.

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