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*Equitable access to primary health care in Germany: addressing access
dimensions to reduce geographic variation*

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Abbreviations

Ärzte-VZ	Ordinance on the licensing of physicians (in German: <i>Zulassungsverordnung für Vertragsärzte</i>)
ANOVA	Analysis of Variance
AVE	Average variance extracted
BBSR	Federal Institute for Research on Building, Urban Affairs and Spatial Development (in German <i>Bundesinstitut für Bau-, Stadt- und Raumforschung</i>)
BMV-Ä	Federal Framework Contract (in German <i>Bundesmantelvertrag Ärzte</i>)
BPRL	Capacity planning directive of the Federal Joint Committee (in German <i>Bedarfsplanungsrichtlinie</i>)
CFA	Confirmatory factor analysis
CFI	Comparative fit index
CO ₂	Carbon dioxide
CPCI	Components of Primary Care Index
DIHWPQ	Deprivation Index for Health and Welfare Planning in Quebec
df	Degrees of freedom
EEA	European Environment Agency
FTE	Full Time Equivalent
G-BA	Federal Joint Committee (in German <i>Gemeinsamer Bundesausschuss</i>)
GDR	German Democratic Republic
GG	German Basic Law (in German <i>Grundgesetz</i>)
GIMD	German Index of Multiple Deprivation
GISD	German Index of Socioeconomic Deprivation
GKV-VSG	SHI Care Strengthening Act (in German <i>GKV-Versorgungsstärkungsgesetz</i>)
GKV-VStG	SHI Care Structures Act (in German <i>GKV-Versorgungsstrukturgesetz</i>)
GP	General Practitioner
ICT	Information and Communication Technology
IMD	Index of Multiple Deprivation

KBV	Federal Association of Statutory Health Insurance Physicians (in German <i>Kassenärztliche Bundesvereinigung</i>)
KV	Association of Statutory Health Insurance Physicians (in German <i>Kassenärztliche Vereinigung</i>)
MAUP	Modifiable area unit problem
NDC	New Deal for Communities
OECD	Organisation for Economic Co-operation and Development
PCAS	Primary Care Assessment Survey
PSQ	Patient Satisfaction Questionnaire
PM	Particulate matter
RMSEA	Root mean square error of approximation
ROG	Federal Regional Planning Act (in German <i>Raumordnungsgesetz</i>)
RSCS	Risk Structure Compensation Scheme (in German <i>Morbiditätsorientierter Risikostrukturausgleich</i>)
SEM	Structural Equation Model
SGB	Social Code Book (in German <i>Sozialgesetzbuch</i>)
SEFI	Socioeconomic Factor Index
SHI	Statutory health insurance
SRMR	Standardized root mean square residual
SVR	German Advisory Council on the Assessment of Developments in the Health Care System (in German <i>Sachverständigenrat zur Begutachtung der Entwicklung im Gesundheitswesen</i>)
UN	United Nations
UPAS	Underprivileged Area Score
VANOCSS	Veterans Affairs National Outpatient Customer Satisfaction Survey

1. Background and research objectives

The main purpose of a health system is to provide equitable access to services for those in need of care. In Germany, equitable health service provision falls under the constitutional requirement of “equivalent living conditions throughout the federal territory” (Section 72, para 2, German Basic Law (GG)). Social code books specify these requirements with rules for social justice and security (Section 1, para 1, Social Code I (SGB I)). Essential social services and facilities must be available in a timely and sufficient manner (Section 1, para 2, SGB I), implying right of access to social insurance (Section 4, para 1, SGB I) and to services necessary to protect, preserve, improve, or restore health and personal productivity (Section 4, para 2, SGB I).

Solidarity financing in statutory health insurance (SHI) separates these rights from individuals’ financial status (Section 3, Social Code V (SGB V)), and aims to “maintain, restore or improve the health of the insured” (Section 1, SGB V). Along with health care providers, SHI must provide needs-based, equally distributed, medically sound, and economic health care services (Section 70, para 1, SGB V).

Regional access disparities and health care shortages contradicting these aims are revealed by many national and international studies (see chapter 1.2, Weinhold & Gurtner, 2014; Weinhold & Gurtner, 2018; Karmann, Weinhold & Wende, 2019). However, health care structure monitoring often falls short to adequately address the different dimensions of access to care and to take into account the perspective of different population groups. Planning mechanisms are thus hardly adequate to remove existing access barriers (see chapter 1.3). Throughout this thesis, I initially aim to systematize the forms and causes of regional health care shortages (chapter 2). Based on these fundamental results, I develop a patient-reported primary access measurement

questionnaire that can be used validly in different area types. I use this instrument in nine different German regions in order to evaluate the relevance of the different access dimensions for two outcomes, i.e., *satisfaction of the population with primary care* (chapter 3) and *coordination of outpatient care* (chapter 4). To nationwide evaluate regional structures and assess ecological, material, and social disadvantages with a potential impact on *population health*, I develop a measurement approach based on the regional deprivation concept (chapter 5). Finally, I derive implications for regional primary care planning and development, and discuss, in particular, the consideration of access from the patients' perspective and regional deprivation measures in health care structure planning (chapter 6).

Chapter 1 presents the theoretical background that forms the framework of this thesis, and chapter 1.1 introduces and explains the concepts of health equity and access to care. Chapter 1.2 outlines regional differences in health and health care that contradict the goals of health equity and equitable access. Health care capacity and distribution planning applied to achieve these goals are described in chapter 1.3, with conceptual and methodological shortcomings that impede them. Chapter 1.4 summarizes research objectives and the structure of this thesis.

1.1. Health equity and access to health care

Health economics often refers to the requirement of equitable access as a principle of health equity, implying that every individual should have a fair chance to achieve their full health potential (Culyer & Wagstaff, 1993; Sen, 2002); health opportunities and access to care must be provided, so that avoidable and unjust differences in health are reduced to the lowest possible level (Culyer & Wagstaff, 1993; Whitehead, 1991). Equity must be distinguished from equality, which implies an equal distribution of

quantity and quality to everyone. In contrast, equity explicitly embodies the idea of variation in needs – health care services should be provided according to individual needs and preferences and may vary as long as these differences are not considered unfair from a societal perspective (Whitehead, 1991).

The discussion of equity in health sciences and policy therefore implies a normative dimension (Culyer & Wagstaff, 1993; Whitehead, 1991); the extent to which differences are unnecessary and avoidable, but also seen as unjust. In order to assess unfairness, the reasons for these differences must be examined as related to the rest of society (Whitehead, 1991). Health differences determined by biological and demographic factors, such as age and sex, are not considered inequities, since they are unavoidable and are the result of natural individual variation. There are also numerous behavioural, cultural and socioeconomic factors that determine health differences; those considered unfair are the ones believed to be unknowingly chosen or beyond individual control. Illness from exposure to unhealthy living conditions, for which there were no alternatives, or from a lack of access to health services would be considered inequitable, whereas an illness that results from self-inflicted behaviour, would not (LeGrand, 1982).

Equity must also be assessed in relation to individual need for health care, implying equality of service quantity and quality for people with the same needs, but also inequality; people with different needs receive different treatment (Culyer & Wagstaff, 1993). Objectively, health care needs can be defined as the quantity of medical services that experts–informed by evidence-based medicine–believe individuals should consume to maintain or improve their health, and achieve their full health potential (Jeffers, Bognanno, & Bartlett, 1971; Sachverständigenrat zur Begutachtung der

Entwicklung im Gesundheitswesen (SVR), 2001). Central to a health care need, is that a disease or impairment threatens or exists, and can be effectively treated (Culyer, 1995). In other words, a marginal need can only be asserted, if interventions that improve the medical prognosis of a disease with a certain probability, actually exist (Acheson, 1978); the marginal expected health utility is positive (Culyer & Wagstaff, 1993).

This requirement also follows from an economic perspective. The economic definition considers that financial, human and technical resources within a society are limited; thus, if an additional unit of health care does not provide additional health benefit, or if an existing health potential could have been addressed with less resources, that health care is not aligned with either individual, nor population needs (Culyer & Wagstaff, 1993). In line with these considerations, German legislation states that SHI insured individuals are entitled to the coverage of any adequate and necessary treatment, as long as it is provided economically and according to current medical standards (Section 70, para 1, SGB V).

Following this reasoning, and considering that resources are limited, health care need is best defined as ‘the minimum amount of resources required to exhaust a person's capacity to benefit’ (Culyer, 1995). Therefore, objective health care needs correspond to the subset of a population's total morbidity burden that can be avoided or treated effectively and economically, i.e., without wasting resources (Sundmacher et al., 2018). The difference between objective need and actual utilization of health services illustrates the inequity in health care (Culyer & Wagstaff, 1992; Whitehead, 1991). It can be attributed to both supply-side determinants (such as physician competition and financial incentives as discussed by Labelle, Stoddart, & Rice, 1994), as well as

differences in demand curves (that may stem from socioeconomic or educational differences as described by Culyer & Wagstaff, 1992). Thus, it is necessary to distinguish between need, demand, and utilization of health services, and at the same time account for framework conditions of care access within the health system and the broader social and regional environment (Andersen, 1995; Culyer, 1995; Ozegowski & Sundmacher, 2014). The successful transition from objective need to demand, and finally to health service utilization, depends on how well the health system's framework meets the subjective needs and opportunities of those with an objective medical need for care (Andersen, 1995; Levesque, Harris, & Russell, 2013; Penchansky & Thomas, 1981). Figure 1 illustrates this differentiation as a dynamic and recursive process, accounting for multiple influences and feedback loops, such as the impact of access and outcomes on need and health behaviour.

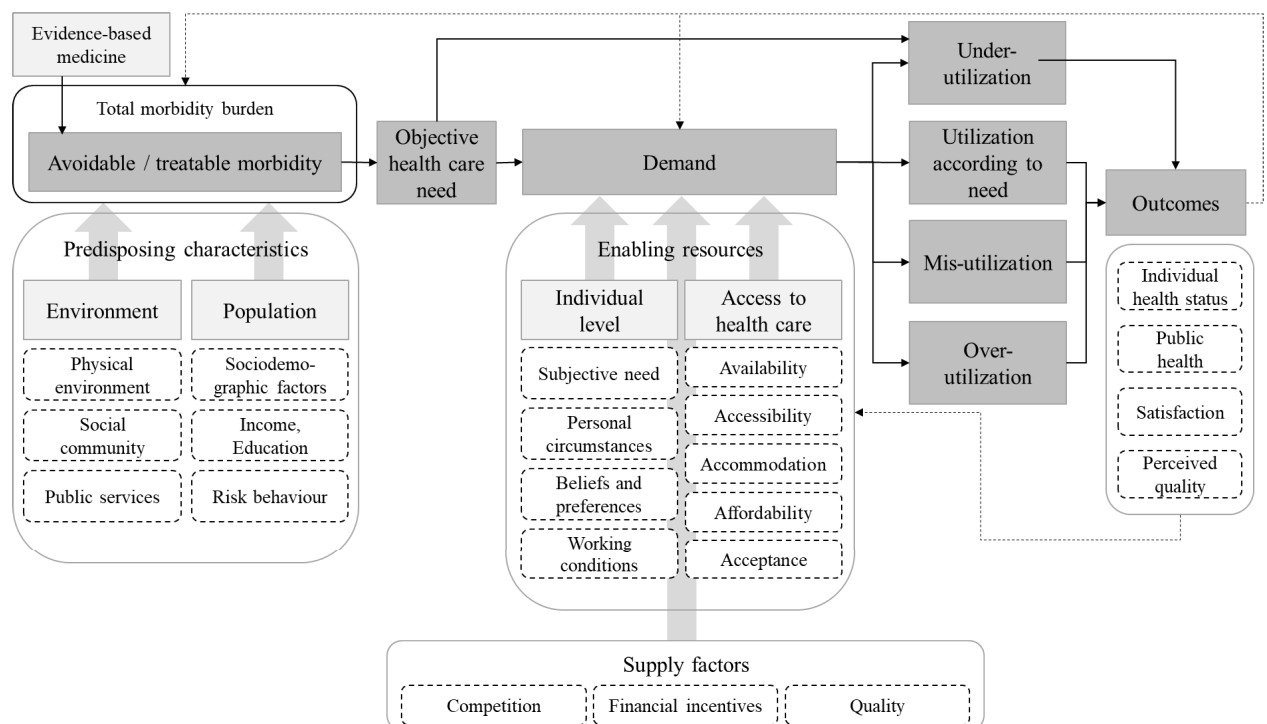


Figure 1: Conceptual framework differentiating health care need, demand, utilization, and outcomes
 Author's illustration based on Andersen, McCutcheon, Aday, Chiu, & Bell (1983); Andersen (1995); Penchansky & Thomas (1981); Sundmacher et al. (2018)

The objective need, as depicted in Figure 1, is defined by the presence of avoidable or treatable morbidity, and is determined by the current state of evidence-based medicine (Sundmacher et al., 2018). Morbidity is, in turn, influenced by predisposing characteristics of the population—in terms of sociodemographic, economic and behavioural factors—as well as an individual’s physical or social environments and the availability of public services (Andersen, 1995).

The objective need for health care does not inevitably lead to demand for health services and adequate utilization (Andersen, 1995; Jeffers et al., 1971). This pathway is determined by individual and structural factors, and any deviation between objective need and ‘utilization according to need’ (in the form of under-, over- or misutilization of services) determines inequity. In order to even generate an actual demand for health services, subjective need is required first (Jeffers et al., 1971). Demand can then be enhanced by enabling resources to the individual, including preferences and beliefs, personal circumstances, working conditions, etc., that may differ depending on cultural, religious, educational, and social backgrounds (Andersen, 1995; Jeffers et al., 1971). Supply factors also influence demand, including competition and demand-induction (Labelle et al., 1994), financial incentives by compensation (Ozegowski, 2013a; Ozegowski & Sundmacher, 2014), and quality differences, all leading to outcome variation and repeatedly influencing objective need and demand (Ozegowski & Sundmacher, 2014).

Beyond individual and supply factors, the five dimensions of access depicted in Figure 1 mainly determine whether objective need ultimately leads to demand and utilization (Andersen et al., 1983; Penchansky & Thomas, 1981). Effective access refers to the capability of a health system “to secure a specified range of services, at a specified

level of quality, subject to a specified maximum level of personal inconvenience and cost, whilst in possession of a specified level of information.” (Goddard & Smith, 2001, S. 1151). Effective access implies, that an individual in need of medical services overcomes various potential barriers to health care (Aday & Andersen, 1974; Andersen, McCutcheon, Aday, Chiu, & Bell, 1983), such as accessibility, availability, accommodation, affordability and acceptability of providers and services (Penchansky & Thomas, 1981). Availability refers to the number and types of potential providers or services a patient can choose from, within a defined catchment area (Penchansky & Thomas, 1981). Accessibility refers to the spatial interaction between the patient and provider location taking into account travel distances and actual effort associated with travelling (Guagliardo, 2004; Haggerty et al., 2011). Accommodation refers to appropriate organisation of care, for example office hours, waiting times, appointment systems and telephone services (Penchansky & Thomas, 1981). Affordability is the absence of financial barriers, such as insufficient insurance coverage, co-payments, travel costs or lost earnings due to physician visits (Haggerty & Levesque, 2015; Penchansky & Thomas, 1981). For the patient, access to care is also characterized by the opportunity to visit an acceptable provider (Haggerty et al., 2011; Thomas & Penchansky, 1984). Depending on the health service, this acceptance can be influenced by age, gender, cultural background, and religious views of both patients and providers (Penchansky & Thomas, 1981).

The dimensions of access necessarily influence one another. For example, health care providers may be accessible, but not available in case of long waiting times, leading to increased travel time for patients travelling further for more available providers (Varkevisser & van der Geest, 2007). Similarly, accessible and available health care

providers might be unacceptable to a patient due to socioeconomic or cultural reasons, or even a perceived lack of quality, leading to an underutilization of services (Roh & Moon, 2005).

To define equitable access, value judgements about which main factors *should* explain variation in health care utilization are necessary (Andersen, 1995). Equitable access occurs, when most of the variation is explained by factors beyond individual control—demography and objective need in particular (Andersen, 1995; Andersen & Newman, 1973). Access and health care utilization are, however, means to other ends, like individual or public health outcomes and health care satisfaction, and must also be considered, especially for policies around equity (Andersen, 1995).

In Germany, ensuring access to health care provided by SHI-accredited physicians is mandated by the Associations of Statutory Health Insurance Physicians (KVen) and the Federal Association of Statutory Health Insurance Physicians (KBV) (Section 75 SGB V), together with health care providers and SHI funds (Section 72, para 1-2, SGB V). Health policy legislation of past years emphasized local access to health care, especially against the backdrop of perceived regional differences between urban and rural regions (cf. the SHI Care Structures Act (GKV-VStG 2011) and the SHI Care Strengthening Act (GKV-VSG 2015)). However, legislation does not provide a specific definition of equitable access and hardly defines binding access standards (Weinhold & Wende, 2018).

1.2. Regional variation as a contradiction to the equity principle

Systematic and unjustified discrimination in the quality and quantity of care among people with equal health care needs is counterproductive to health equity. Such

discrimination occurs in various forms; the relationship between income and widespread income-related health inequalities are documented in both developed (Mackenbach, Kunst, Cavelaars, Groenhof, & Geur, 1997; Mackenbach et al., 2008; Siegel, Vogt, & Sundmacher, 2014; van Doorslaer & Koolman, 2004; van Doorslaer et al., 1997) and developing countries (Goryakin, Suhrcke, Roberts, & McKee, 2015; Wagstaff, van Doorslaer, & Watanabe, 2003). Some research suggests that average health improvements often go along with an increase in health-related socioeconomic disparities; often, the higher income and higher educated members of society are predisposed to profit most from advancements in health care, leaving deprived population groups behind (Mackenbach et al., 2003; Wagstaff, Bredekamp, & Buisman, 2014).

Another form of inequity is regional differences in health care, unless it is justified by different needs (Ozegowski, 2013b). Due to the increasing possibilities in analysis and presentation, 'medical geography' has evolved as an area of research in the 19th century, and the number of studies on geographical factors that influence health differences has steadily increased ever since (Meade, 2014). In the 20th century, researchers expanded their focus and increasingly assessed not only variation in health, but also in health care, such as supply structures, services and utilization, and the relationship between these two aspects (Wennberg, 2014; Wennberg, Gittelsohn, & Gittelsohn, 1973).

An individual's health and need for health care is influenced through multiple regional conditions, ranging from the physical environment (e.g., air and water quality), material infrastructure (e.g., housing, recreation areas, access to social services), and the social environment within neighbourhoods and broader communities (Macintyre & Ellaway,

2000; Macintyre, Ellaway, & Cummins, 2002). The principle of equity in a regional context is therefore anchored in German legislation: the state must ensure equitable living conditions, (Section 72, para 2, GG) and balanced socioeconomical, infrastructural, ecological, and cultural living conditions, throughout the territory. In order to ensure equal opportunities for all individuals, an adequate and accessible supply of services and general infrastructure must be secured everywhere, even in sparsely populated regions (Section 2, para 2, no. 1, ROG). Primary care, which is usually the first point of contact in the health system, must particularly be based on this premise.

Despite this, regional variation in health and health care is well documented in many countries (Ellis & Fry, 2010; Reich, Weins, Schusterschitz, & Thöni, 2012; Skinner, 2011). In Germany, regional variation has been seen in health outcomes (obesity, hypertension and type 2 diabetes) (Maier et al., 2013; Siegel, Mielck, & Maier, 2015), health care expenditure (Göpffarth, Kopetsch, & Schmitz, 2016), hospital productivity and quality (Karman & Roesel, 2017), supply density in outpatient care (Sundmacher & Ozegowski, 2016), health service utilization (Kopetsch & Schmitz, 2014; Ozegowski & Sundmacher, 2014) and cancer screening uptake (Vogt, Siegel, & Sundmacher, 2014). Skinner (2011) discusses the reasons for regional variation in health care spending and utilization in detail. He distinguishes potential reasons into supply-side factors, such as provider density, practice patterns, financial incentives or price effects; and demand-side factors, such as patients' preferences, health conditions, socioeconomic status or access, that may differ among social groups, regions and even individuals (Skinner, 2011).

With regard to primary care, regional access differences that contradict the health equity principle are evident in many countries (Ozegowski 2013a, Weinhold & Gurtner, 2014). In Germany, there are recurring patterns in regional variation of access to primary care, which is of particular importance in rural and structurally deprived regions (SVR, 2014, Bauer, Maier, Müller, & Groneberg, 2018). This development has intensified in recent years: in 2013, one of the 883 primary care planning areas in Germany was classified as a shortage area, and 52 areas were considered threatened areas (SVR, 2014). In 2016, this number rose to 12 shortage- and 95 threatened planning areas (Sundmacher et al., 2018). Again, parts of eastern Germany and rural regions are particularly affected by these developments.

Regional differences like this occur even more pronounced when comparing regional health structures considers the different needs of that regions. Supply levels that come short of needs are particularly prevalent in eastern Germany and in some rural areas of Rhineland-Westphalia. In contrast, outpatient care supply seems to exceed regional needs in Bavaria (south-east Germany), and all larger cities, such as Hamburg, Munich, Berlin and Frankfurt. This can be explained largely by structural and regional factors that determine access to care (availability of outpatient physicians, urban or rural spatial structures) (Ozegowski & Sundmacher, 2014). Regional differences follow a comparable pattern to former German Democratic Republic (GDR) states (formerly East Germany), and are apparent in population health outcomes, for example of type 2 diabetes prevalence (Maier et al. 2013), or the years of life lost due to premature death (Sundmacher et al., 2018).

1.3. Reducing unwarranted regional variation in health care

Reorganisation or reallocation of resources could reduce unwarranted regional variation in the health care system, using regulation of health care supply—both in terms of quantity as well as regarding spatial distribution of health care providers (Ettelt, Nolte, Thomson & Mays, 2008; Ozegowski, 2013a; Weinhold & Wende, 2018, Karmann, Weinhold & Wende, 2019). Thus, many countries apply mechanisms of health care capacity and distribution planning (Ono, Lafortune, & Schoenstein, 2013) hereinafter referred to as *health care structure planning*. In most approaches target values are defined (region-specific or population-related quotas), to control the number and distribution of (future) providers, perhaps by limiting distribution of licenses to practice, selective contracting with providers, or by limiting medical program capacities and specialist training options (Ozegowski, 2013a; SVR, 2018). These mechanisms that restrict potential earnings or licenses to practice, may avoid concentration of regional supply, potentially resulting in a more equitable overall distribution of health care providers (such as GPs as shown by Ozegowski, 2013a). However, the distribution effect of regional ratios depends on the absolute supply quantity; they are unlikely to have redistributive effects if a nationwide provider shortage already exists (Ozegowski 2013a). However, as long as density target ratios are updated from historical supply structures, without adjustment to actual regional need and access conditions, a more equitable distribution cannot be achieved, and inequitable provider distribution—especially between urban and rural areas—is perpetuated (Fülöp, Kopetsch, & Schöpe, 2010; Ozegowski & Sundmacher, 2012).

Higher equity can only be achieved, if regional ratios are adjusted to well-grounded estimates of population health needs, and valid assessments of access to care (Oliver &

Mossialos, 2004; Ozegowski, 2013a). Needs estimation ranges from rather simple age- and-sex-adjusted per capita calculations to more sophisticated estimations, using indicators of morbidity, regional deprivation, socioeconomic status, environmental factors, subjective needs and health-related behaviour (Weinhold & Wende, 2018). Valid and reliable measures of access to health care is also essential to any effective distributional regulation approach (Andersen et al., 1983; Oliver & Mossialos, 2004).

Spatial target ratios of provider density are used to regulate provider quantity and distribution in many countries, but they also serve as simple measures of access, estimating the adequacy of regional health care supply (Guagliardo, 2004; Nüsken & Busse, 2011; Ozegowski, 2013a). Intuitive and easy to compute from readily available data, their use is particularly popular (Guagliardo, 2004). The ratios are computed for predefined areas, with a health capacity indicator (such as physicians, hospital beds) in the numerator, and a demand indicator (such as population size, number of insured, historical service utilization) in the denominator (Guagliardo, 2004). However, this approach has weaknesses, both in terms of validity and reliability: access has several interconnected dimensions, and supply ratios can only capture this to a small degree—potential availability of providers within a fixed spatial unit (Weinhold & Wende, 2018). However, they have too little informative value on the populations' actual, multidimensional access experience, such as travel distances, waiting times and provider acceptance. As a measure of access, supply ratios within fixed spatial units carry three erroneous assumptions: an equal supply distribution within the spatial unit, equal accessibility to all providers from all locations, and the irrelevance of health care providers outside the spatial unit's borders, which neglects actual interaction across spatial unit boundaries (Fotheringham, Densham, & Curtis, 1995). In reality, access to

care varies across spatial boundaries; it is influenced by both provider locations and patient residences, neither of which is equally distributed (Luo & Wang, 2003). Depending on the concentration of regional providers, the actual burden of traveling (the distance, transport, geographic barriers etc.), and the extent of cross-boundary patient flows, simplistic ratios can lead to considerably false assessments of actual access within spatial units (Luo & Wang, 2003).

In Germany, the main structural approach to foster equitable access to outpatient health care, health capacity and distribution planning (sections 99–105, SGB V), has for long been primarily based on historical physician-population ratios, computed within different administrative planning units (Weinhold & Wende, 2018). Essentially, supply ratios form the indicators to assess regional care access and potentially trigger regulatory action. Additionally, basic information on the current regional health care situation (Capacity planning directive of the Federal Joint Committee (BPRL) 2019, section 4 (1)) is presented in the official health care plans drawn up by the regional Associations of SHI Physicians in agreement with the Associations of SHI funds. Basic regional care information, which may include access assessments, is updated every three to five years, and the physician group-specific degrees of coverage¹ per planning unit are published every six months (BPRL 2019, section 4 (1)). These are determined using administrative spatial units of increasing size², referred to as planning areas, the

¹ The degree of coverage is calculated as percentage deviation between the physician group-specific target ratios (population per physician per planning area) and the actual relations of SHI-accredited physicians per population (including various correction factors, e.g., for employed and part-time physicians (Section 21, BPRL 2019)) in the respective regions (Section 17, BPRL 2019).

² spatial integration areas with a central location (in German: *Mittelbereich*), independent cities and districts (in German: *kreisfreie Städte und Landkreise*), supra-regional planning areas (in German: *Raumordnungsregion*) or the area covered by a regional SHI physician association (in German: *KV-Region*), largely corresponding to the federal states.

size of which increases with the level of medical specialization, accounting for increasing catchment areas. However, their shape and size are not derived from assessments of need and access, but mostly from administrative boundaries.

Since distribution of provider locations within planning units is not taken into account, the spatial target value of provider density is an indicator of potential availability that contains the assumption of equal potential accessibility³, depending on the size of the planning area (Weinhold & Wende, 2018). However, accessibility is not explicitly monitored, and there are no standard distance thresholds for accessing outpatient care. Apart from the fact that the approach fails to assess access in a valid way, it also leads to problems in reliability. Since administrative units at the same specialization level differ in size throughout the country, implicit accessibility standards vary between the federal states. Due to consistently larger planning areas, the implicit accessibility values are disproportionately high in the northeast of Germany, especially in the federal states of Brandenburg and Mecklenburg-Western Pomerania. This means, for example, that, even if there was an equal density and even physician distribution, GP planning areas in Mecklenburg-Western Pomerania have the same implicit potential accessibility as specialist planning areas⁴ in the rest of Germany (Sundmacher et al., 2018). Deviating from the nationwide planning guidelines by using regional considerations, (such as morbidity structures, socioeconomics, infrastructure, and geography) to improve accuracy of target density ratios or spatial planning units is possible in principle (section 2 BPRL, 2019), and applied in some federal states

³ Its extent can be estimated, for example, by measuring the implicit average potential distance to be travelled from any point within a planning area, to the centre of that area (Sundmacher et al., 2018).

⁴ General specialist care is mainly planned at district level (in German: *Landkreise und kreisfreie Städte*).

(Weinhold & Wende, 2018). Despite this, valid and reliable methods to evaluate access from the patient perspective (perceived access barriers, regional infrastructure, and outcomes like patient satisfaction with local care) are lacking. Unless ratios are adjusted to theoretically and empirically justified estimations of regional needs in a valid and reliable manner, they are not a suitable measure to ensure equal access to care for the same needs (Sundmacher et al., 2018).

1.4. Research objectives and thesis structure

Considering theoretical equity, access concepts, and regional health care variation, together with the shortcomings of current approaches to monitor access and carry out outpatient health care structure planning, the aim of this thesis is to:

- systematically identify and categorize the various forms and causes of regional health care shortages and access barriers, with a particular focus on rural areas (see chapter 2, based on Weinhold & Gurtner, 2014),
- develop a survey-based instrument to evaluate access to primary care in Germany, assess empirical differences in rural vs. urban regions and evaluate the importance of different access dimensions from the patient perspective (see chapter 3, based on Weinhold & Gurtner, 2018, and chapter 4).
- develop a model to measure different dimensions of area deprivation at small-area levels in Germany, and analyse their relation to regional health outcomes (see chapter 5), and finally
- derive implications for regional primary care planning and development, which aims to reduce geographic differences in access to care, while putting greater emphasis on the patient perspective (see chapter 6)

Figure 2 summarizes the content, based on four empirical studies, as well as the structure of the thesis.

Theoretical Background (chapter 1) Equity in health care Access to health care Regional variation		
General Content	Related article	Approach
Chapter 2 <ul style="list-style-type: none"> ▪ Access barriers and rural health care shortages ▪ Reasons for rural health care shortages 	Understanding shortages of sufficient health care in rural areas (Weinhold & Gurtner, 2014)	Qualitative Systematic literature review
Chapter 3 <ul style="list-style-type: none"> ▪ Survey-based measurement of access to primary care ▪ Rural-urban access variation and differences in patients' priorities 	Rural-urban differences in determinants of patient satisfaction with primary care (Weinhold & Gurtner, 2018)	Quantitative Structural equation modelling
Chapter 4 <ul style="list-style-type: none"> ▪ Relevance of primary care access und patient-physician relationship for outpatient care coordination quality 	The impact of structural and relational factors on care coordination problems (Weinhold, 2020)	Quantitative Regression model with mediation
Chapter 5 <ul style="list-style-type: none"> ▪ Regional deprivation measurement ▪ Correlation between area deprivation and health 	Area deprivation and its impact on population health: conceptual aspects, measurement and evidence from Germany (Karmann, Weinhold & Wende, 2019)	Quantitative Structural equation modelling
Implications for regional health care structure planning (chapter 6)		

Figure 2: Content and structure of the thesis

Chapter 2 lays the foundation by summarizing causes of regional variation; inadequate access and rural health care shortages are analysed in a systematic literature review. The main focus is on different kinds of inadequate access, examining the frequently used term “health care shortage”, followed by the various causes. I focused on rural areas, where different barriers to access tend to occur in combination and particularly pronounced. Especially in rural areas, these variations can be observed in both developing and industrialized nations alike. Nevertheless, I limit the focus of the analysis on developed countries, as defined by the United Nations (UN) grouping, to improve comparability of information from different countries (see Weinhold & Gurtner, 2014 for details).

Chapter 3 develops a survey-based measurement instrument to assess primary care access and satisfaction and determines variations between objectively well-served

urban and underserved rural areas. Based on a self-administered survey distributed in 2014 in nine different regions in Germany, I assess reliability and validity of the measurement approach by confirmatory factor analysis (CFA) and estimate primary care access from the patient's perspective. By means of a structural equation model (SEM) with multi-group comparison I assess the relationship between access and process attributes with satisfaction and identify regional differences in the importance of structural access (accessibility and affordability of primary care, availability of comprehensive primary care services), and process (physician-patient interpersonal quality, relational continuity), as determinants of patient satisfaction with local primary care.

Chapter 4 expands on the topics discussed above and evaluates the role GPs have in coordinating outpatient care, thereby improving quality and care integration in the broader health system. To investigate this, a subpopulation of patients with at least one GP and one specialist visit in the preceding year was assessed from the survey respondents as described in chapter 3. Regression-based mediation analyses was used to determine the quality of coordination in terms of patient-reported coordination failures and the extent to which these are influenced by organisational access, regular preventive visits as well as directly and indirectly by the quality of interaction between patients and their GPs.

Chapter 5 focuses on regional factors associated with variations in need, health, and utilization, beyond individual health determinants. In this research, regional health-determinants are covered by the concept of regional deprivation, defined as a relative lack of resources "to obtain the types of diet, participate in the activities and have the living conditions and amenities which are customary, or at least widely encouraged or

approved” within ones’ society (Townsend, 1979, p. 31). In this research, we first adapted an area deprivation measurement model and second developed a literature-based SEM of how regional deprivation as a predisposing factor relates to population health. We then empirically test the model and estimate different deprivation dimensions as latent variables and in relative relation to population health.

Finally, chapter 6 summarizes the different studies’ main implications for regional health care structure planning, especially in terms of equitable access in different regions, and a stronger influence of the patient and public perspective on planning and development.

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2. Rural health care shortages and access barriers

Chapter 2 has been published as a peer-reviewed article and is available at the following reference:

Weinhold, I., & Gurtner, S. (2014). Understanding shortages of sufficient health care in rural areas. *Health Policy*, *118*(2), 201-214.
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3. Regional access and satisfaction with primary care

Chapter 3 (with the exception of Appendix 3, which is only part of this dissertation) has been published as a peer-reviewed article and is available at the following reference:

Weinhold I., & Gurtner S. (2018). Rural - urban differences in determinants of patient satisfaction with primary care. *Social Science & Medicine*, 212, 76–85.
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Appendix 3

I. Notation and econometric specification of the SEM

The SEM (see also chapter 5) consists of a latent-construct measurement model, an outcome measurement model, and a structural model explaining the relationships between the latent attributes and the outcome. The measurement model of latent primary care access and process attributes estimates the first-order factor loadings $\Lambda_x \in \text{Mat}_{19,7}(\mathbb{R})$ of the indicators $x \in \mathbb{R}^{19}$ and is defined as:

$$(1) \quad x = \Lambda_x \xi + \delta$$

with the error term $\delta \in \mathbb{R}^{19}$. The factors loadings specify how large the common variance of the indicators with the respective latent variable is (Byrne, 2010). As described in Weinhold & Gurtner (2018) we measure the latent access and process attributes as:

$$(2) \quad \begin{pmatrix} x_1 \\ x_2 \\ x_3 \\ x_4 \\ x_5 \\ x_6 \\ x_7 \\ x_8 \\ x_9 \\ x_{10} \\ x_{11} \\ x_{12} \\ x_{13} \\ x_{14} \\ x_{15} \\ x_{16} \\ x_{17} \\ x_{18} \\ x_{19} \end{pmatrix} = \begin{pmatrix} \lambda_{1,1} & 0 & 0 & 0 & 0 & 0 & 0 \\ \lambda_{1,2} & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & \lambda_{2,3} & 0 & 0 & 0 & 0 & 0 \\ 0 & \lambda_{2,4} & 0 & 0 & 0 & 0 & 0 \\ 0 & \lambda_{2,5} & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & \lambda_{3,6} & 0 & 0 & 0 & 0 \\ 0 & 0 & \lambda_{3,7} & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & \lambda_{4,8} & 0 & 0 & 0 \\ 0 & 0 & 0 & \lambda_{4,9} & 0 & 0 & 0 \\ 0 & 0 & 0 & \lambda_{4,10} & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & \lambda_{5,11} & 0 & 0 \\ 0 & 0 & 0 & 0 & \lambda_{5,12} & 0 & 0 \\ 0 & 0 & 0 & 0 & \lambda_{5,13} & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & \lambda_{6,14} & 0 \\ 0 & 0 & 0 & 0 & 0 & \lambda_{6,15} & 0 \\ 0 & 0 & 0 & 0 & 0 & \lambda_{6,16} & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & \lambda_{7,17} \\ 0 & 0 & 0 & 0 & 0 & 0 & \lambda_{7,18} \\ 0 & 0 & 0 & 0 & 0 & 0 & \lambda_{7,19} \end{pmatrix} \times \begin{pmatrix} \text{Accessibility} \\ \text{Affordability} \\ \text{Comprehensiveness} \\ \text{Communication} \\ \text{Physician conduct} \\ \text{Care concentration} \\ \text{Knowledge} \end{pmatrix} + \begin{pmatrix} \delta_1 \\ \delta_2 \\ \delta_3 \\ \delta_4 \\ \delta_5 \\ \delta_6 \\ \delta_7 \\ \delta_8 \\ \delta_9 \\ \delta_{10} \\ \delta_{11} \\ \delta_{12} \\ \delta_{13} \\ \delta_{14} \\ \delta_{15} \\ \delta_{16} \\ \delta_{17} \\ \delta_{18} \\ \delta_{19} \end{pmatrix}$$

The measurement model for the second-order factors (interpersonal quality and relational continuity) is defined as:

$$(3) \quad \xi = \Lambda_{\xi} \alpha + \tau$$

with second-order factor loadings $\Lambda_{\xi} \in Mat_{4,2}(\mathbb{R})$ of the first-order factors $\xi \in \mathbb{R}^4$:

$$(4) \quad \begin{pmatrix} \xi_4 \\ \xi_5 \\ \xi_6 \\ \xi_7 \end{pmatrix} = \begin{pmatrix} \lambda_{1,23} & 0 \\ \lambda_{1,24} & 0 \\ 0 & \lambda_{1,25} \\ 0 & \lambda_{1,26} \end{pmatrix} \times \begin{pmatrix} \textit{Interpersonal quality} \\ \textit{Relational continuity} \end{pmatrix} + \begin{pmatrix} \tau_1 \\ \tau_2 \\ \tau_3 \\ \tau_4 \end{pmatrix}$$

The outcome measurement model links the survey-based indicators to the latent variable of general satisfaction with primary care:

$$(5) \quad y = \Lambda_y \eta + \zeta$$

Here, $y \in \mathbb{R}^3$ is a vector of indicators, $\Lambda_y \in Mat_{3,1}(\mathbb{R})$ is a vector of factor loadings and the error term is $\zeta \in \mathbb{R}^3$. The outcome measurement model is thus specified as:

$$(6) \quad \begin{pmatrix} y_1 \\ y_2 \\ y_3 \end{pmatrix} = \begin{pmatrix} \lambda_{23} \\ \lambda_{24} \\ \lambda_{25} \end{pmatrix} \times (\textit{Satisfaction}) + \begin{pmatrix} \zeta_1 \\ \zeta_2 \\ \zeta_3 \end{pmatrix}$$

Survey items are described in Weinhold & Gurtner (2018). Their scores represent the indicators $x \in \mathbb{R}^{19}$ and $y \in \mathbb{R}^3$. Figure 3 depicts the measurement model graphically with $i = 1$ for the urban and $i = 2$ for the rural sample.

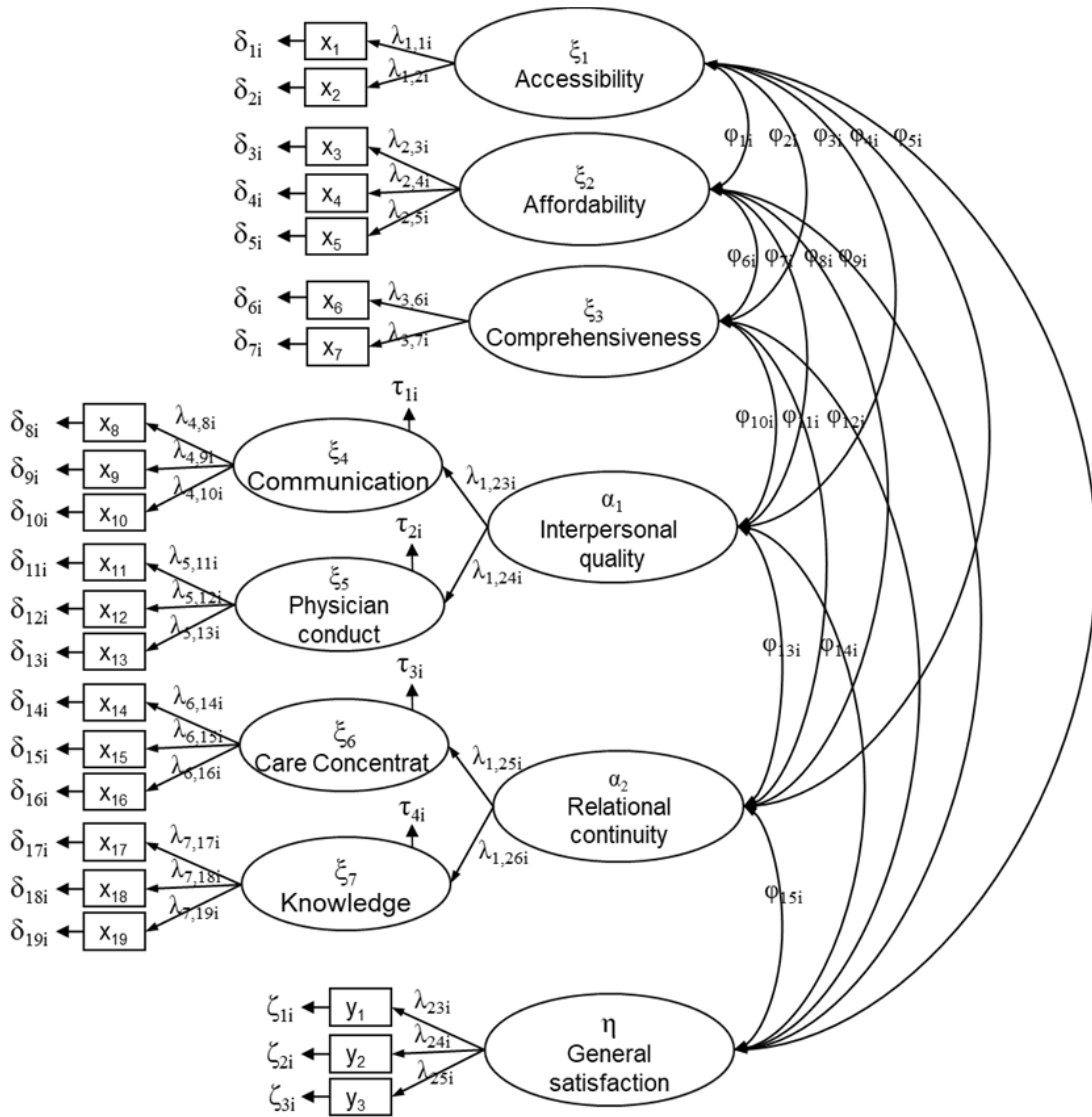


Figure 3: Configural measurement model of primary care access and process attributes

Finally, the structural model (Figure 4) is defined as:

$$(7) \quad \eta = \beta_{1i} \xi_{1i} + \beta_{2i} \xi_{2i} + \beta_{3i} \xi_{3i} + \gamma_{1i} \alpha_{1i} + \mu_{1i} + \gamma_{2i} \alpha_{2i} + \mu_{2i} + \varepsilon_i$$

with the outcome variable $\eta \in \mathbb{R}$ which is a latent variable of general satisfaction with primary care with error term ε and the vectors $\xi \in \mathbb{R}^3$ and $\alpha \in \mathbb{R}^2$ representing the first-order factors accessibility, affordability and service comprehensiveness and the second-order factors interpersonal qualities, and relational continuity with error terms μ . The matrix $\Phi \in Mat_{5,5}(\mathbb{R})$ defines the correlation of the latent attributes. Structural

relations between the latent attributes and satisfaction are estimated with respect to $\Gamma \in Mat_{1,2}(\mathbb{R})$ and $B \in Mat_{1,3}(\mathbb{R})$ as well as covariance $\phi_{\eta} \in \mathbb{R}$.

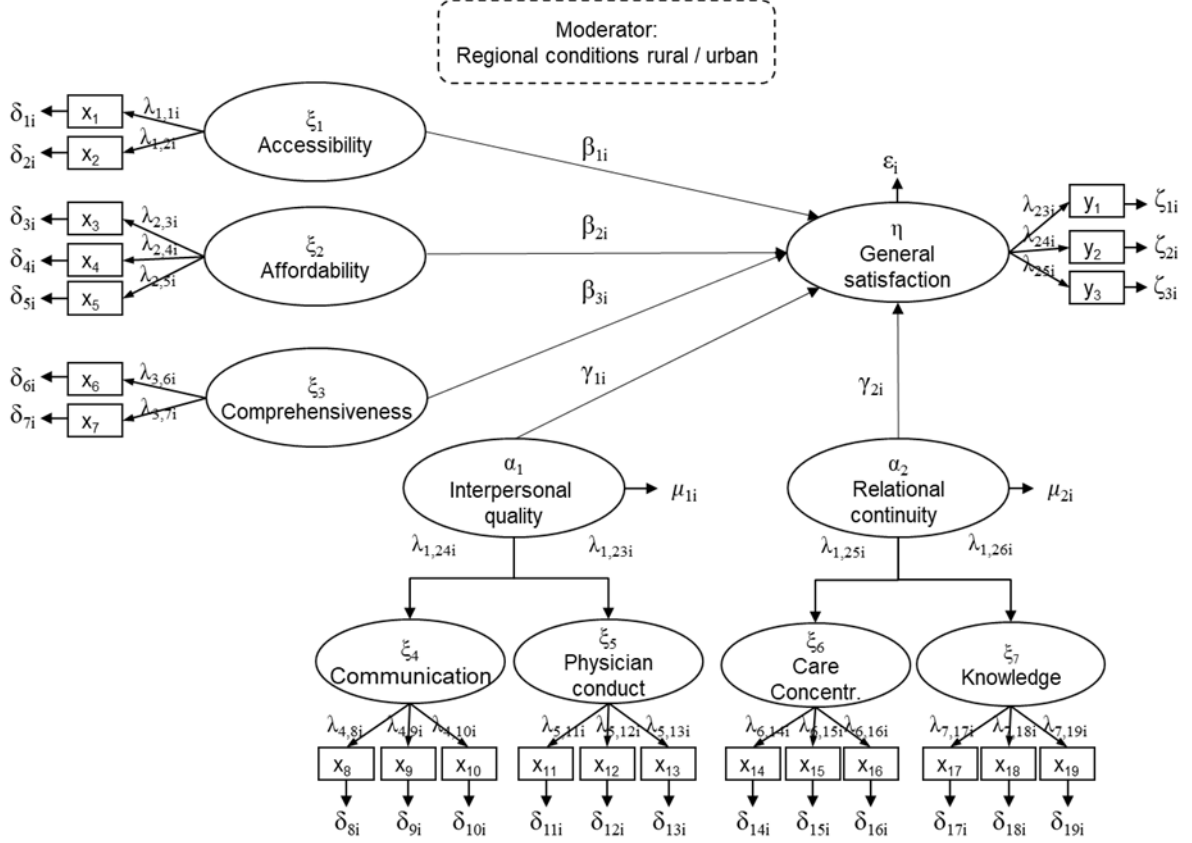


Figure 4: Structural path model of primary care access and process attributes predicting satisfaction

Prior to the scrutiny of the structural model (Section IV) and the testing of our five hypotheses (Section IV), we assess the measurement model. For this purpose, the following steps are carried out:

II. Test of equivalence of the measurement model for the different regional groups

First, we assess the measurement model's equivalence among the rural and urban group by testing for multigroup configural invariance (Byrne, 2010, Chen, Sousa & West, 2005). By assessing a two-group baseline model (with doubling of df in contrast to the single group model), we test, whether similar latent variables are present in both

groups, i.e., the same items are an indicator of the same latent factor (cf. equations 2, 4 and 5). Judgment is based on the adequacy of the goodness-of-fit statistics assessing how well the configural model fits in its representation of the rural-urban group data. Since these fit indices are used in the CFA (section III) as well as for the evaluation of the structural model (section IV), their derivation and discussion is bundled in section VI. Due to an adequate fit of the configural two-group measurement model (cf. the description of results in Weinhold & Gurtner, 2018), we can assume the same structure of latent constructs in both groups.

III. Scrutiny of the measurement model and assessment of internal model structure

In order to classify the respondents into the two groups they are characterized by the regional conditions of their hometown in terms of:

- their geographic classification in terms of settlement structure and proximity to urban centres, distinguishing between sparsely populated rural areas and urban areas (including big or mid-sized cities as defined in Weinhold & Gurtner, 2018)
- provider availability per primary care planning unit⁵ in which respondent's place of residence is located, operationalized as the percentage deviation of actual physician-to-population ratios from 100% target ratios indicating an adequate level of GP supply according to the German health care structure planning as of 2016 (cf. Weinhold & Gurtner, 2018).

The measurement model's appropriateness for the so classified under-supplied rural- and well-supplied urban sample is assessed by CFA, where the covariance between indicators is supposed to be explained by a higher order latent factor (Backhaus, Erichson, Plinke & Weiber, 2011). The configural measurement model (equations 1, 3,

⁵ spatial integration areas with a central location (in German: *Mittelbereich*)

5 and Figure 3) was specified by assigning each item a nonzero loading on the factor that it was designed to measure and a zero loading on the other factors; the items error terms are uncorrelated with three exceptions (see notes in Weinhold & Gurtner, 2018). For each factor, we fix one of the factors loadings to 1 to identify the model in the CFA estimation. Factor loadings λ of the exogenous and endogenous variables as well as a calculation of the respective factor values are estimated simultaneously by maximum likelihood estimation in AMOS 22 with the aim of reproducing the model-theoretical covariance matrix as well as possible by the empirical covariance matrix (Backhaus, Erichson, Plinke & Weiber, 2011).

We then stepwise evaluate the global fit of the measurement model as well as the dimensionality, reliability and validity of the latent constructs for both groups. For large samples $n > 250$ Hu & Bentler (1999) recommend to combinational use the Comparative Fit Index (CFI), the Root Mean Squared Error of Approximation (RMSEA) and the standardized root mean square residual (SRMR) for global model fit assessment. Our model evaluation strategy follows this recommendation, but we add the information on χ^2 -statistics and df to complete the reporting.

To evaluate how well the latent variables are measured by their empirical indicators we use local goodness-of-fit measures, i.e., indicator reliability, factor reliability and for the assessment of discriminant validity, the average variance extracted (AVE) in conjunction with the Fornell/Larcker criterion (cf. description of results in Weinhold & Gurtner, 2018).

As summarized in Weinhold & Gurtner (2018), all factor loadings of the final model turned out significant ($p < .001$) and scored higher than 0.68 (minimum of rural sample)

and 0.76 (minimum of urban sample) and therefore excel the threshold of loadings $\lambda \geq 0.5$ (Cronbach, 1951). We continue by assessing the reliability of single indicators as:

$$(8) \quad rel(xi) = \frac{\lambda_i^2 \phi_{\xi_n}}{\lambda_i^2 \phi_{\xi_n} + \theta_{ii}^\sigma}$$

with the residual covariance matrix θ_δ and ϕ_{ξ_n} = the variance of the latent attributes⁶ (cf. equation 1). Likewise, indicator reliability for the outcome scale is calculated as:

$$(9) \quad rel(yi) = \frac{\lambda_i^2 \phi_\eta}{\lambda_i^2 \phi_\eta + \theta_{ii}^\zeta}$$

with variance of the errors = θ_ζ and variance of the latent outcome = ϕ_η (cf. equation 6). Indicator reliabilities are directly computed by AMOS 22.0 as squared multiple correlations. Their value indicates the proportion of variance that is explained by the indicators of the respective factor. Next, we calculate factor reliabilities for the latent constructs as:

$$(10) \quad p_{\xi_i} = \frac{(\sum_{i=1}^k \lambda_{ij})^2 \phi_{\xi_n}}{(\sum_{i=1}^k \lambda_{ij})^2 \phi_{\xi_n} + \sum_{i=1}^k \theta_{ii}^\sigma}$$

and for the outcome:

$$(11) \quad p_\eta = \frac{(\sum_{i=1}^k \lambda_{ij})^2 \phi_\eta}{(\sum_{i=1}^k \lambda_{ij})^2 \phi_\eta + \sum_{i=1}^k \theta_{ii}^\zeta}$$

Both, the indicator reliabilities as well as the factor reliabilities for all our hypothesized latent variables surpass the cut-off values of .40 and .50 respectively (Homburg & Baumgartner, 1995, Bagozzi & Yi, 1988; Fornell & Larcker, 1981) as depicted in Weinhold & Gurtner (2018).

⁶ Note, that $\phi_{\xi_n} = \phi_\eta = 1$ for standardised variables.

Next, the average variance extracted for each factor is calculated as:

$$(12) \quad AVE(\xi_i) = \frac{\sum_{j=1}^k \lambda_{ij}^2 \phi_{jj}}{\sum_{j=1}^k \lambda_{ij}^2 \phi_{jj} + \sum_{i=1}^k \theta_{ii}^{\sigma}}$$

and respectively:

$$(13) \quad AVE(\eta) = \frac{\sum_{j=1}^k \lambda_{ij}^2 \phi_{jj}}{\sum_{j=1}^k \lambda_{ij}^2 \phi_{jj} + \sum_{i=1}^k \theta_{ii}^{\zeta}}$$

The AVE indicates what proportion of the dispersion of a latent variable is explained on average by the indicators. Adequate validity is assumed for a threshold value $AVE \geq 0.5$ which is exceeded by all latent variables without exception (see Weinhold & Gurtner, 2018). If the value was lower, it could not be assumed that the validity of the items and factors is sufficiently high, because the variance due to measurement error exceeds the variance captured by the latent variable (Fornell & Larcker, 1988). Finally, discriminant validity is achieved if the factors' common variance, i.e., squared factor correlations φ_{ij}^2 (correlations are depicted in Weinhold & Gurtner, 2018) is below the AVE for each factor. Since this requirement is consistently true, the scales effectively discriminate in both groups (Fornell & Larcker, 1981).

The CFA for both groups is likewise accomplished with AMOS 22.0; the described reliability and validity indicators were calculated using the AMOS outputs and implementing the formulas in Microsoft Excel. The measurement model is well fitted in both groups (cf. the description of results in Weinhold & Gurtner, 2018). Due to the very good performance of the reliability and validity indicators compared to the outlined cut-off criteria from scale-development research, we conclude, that our measurement model is adequate to further analyse the structural relations of interest.

IV. Assessment of structural model paths and testing of regional moderation effect

The parameters of the hypothesized structural model are estimated for each group by minimizing the difference, i.e., the residual matrix, between the covariance matrix implied by the theoretical model $\Sigma(\theta)$ and the empirical covariance matrix $S \in \text{Mat}_{22,22}(\mathbb{R})$ by maximum likelihood estimation performed with AMOS 22.0 (Byrne, 2010). Prior to the fit assessment of the structural model, we derive the regression-based factor scores $\widehat{\xi}_i$, $\widehat{\alpha}_i$ and $\widehat{\eta}_i$ per respondent from the estimated CFA parameters, i.e., the estimated factor loading matrix $\widehat{\Lambda}_{xy}$, the covariance matrix $\widehat{\varphi}_{\xi\eta}$, the residual covariance matrix $\widehat{\theta}_{\delta\zeta}$ and regression weights \widehat{B}_{ξ} and \widehat{I}_{α} . We then transfer the estimated scores to the initial dataset, calculate means and standard deviations for both groups and apply one-way Analysis of Variance (ANOVA) in SPSS 22 to test for mean differences between the rural and urban sample. After the estimation of the parameters, it is again assessed how well the model structure fits the empirical data as described in section III and VI. The hypothesized relationships in the structural model are represented by the regression coefficients \widehat{B}_{ξ} and \widehat{I}_{α} for both groups (as reported in Weinhold & Gurtner, 2018). Despite one group-specific deviation and the supposedly less relevant affordability dimension, model fit and regression results indicate that the primary care access and process attributes serve as an adequate framework for predicting general satisfaction with primary care across different regions.

V. Test of moderation effect by multi-group structural equation analysis

As derived in Weinhold & Gurtner (2018), we hypothesize that regional conditions (i.e., densely supplied urban versus sparsely supplied rural) influence the strength of the relationships between the primacy care access attributes and patient's general satisfaction (cf. hypotheses H1 to H5). We test the hypotheses by a multi-group

structural equation analysis (Byrne, 2007 & 2010). This procedure requires the additional estimation of five separate models for any B_{ξ} and Γ_{α} that was hypothesized to be different or equal. In each of the separately estimated models, the relation of interest is constrained, i.e., the parameter is not freely estimable in the different groups. Finally, any of these constrained models is compared the configural structural model. Invariance of the constrained and free models is tested by differences in the χ^2 - goodness-of-fit statistic $\Delta \chi^2$ (df). Significant χ^2 difference values indicate that the relationships tested are not equivalently existent or equivalently strong across the groups (Byrne, 2010). Estimates are derived from maximum likelihood in AMOS 22; the results are summarized in Weinhold & Gurtner (2018).

VI. Global and incremental indices of model fit

Model performance is first assessed by the χ^2 -goodness-of-fit statistic, i.e., the Likelihood Ratio Test statistic to determine the discrepancy between the empirical covariance matrix S , and the restricted covariance matrix $\Sigma(\theta)$ (Hu & Bentler, 1999):

$$(14) \quad T = (N - 1)F_{min}$$

with N = sample size and F_{min} = minimum fitting function. The T-statistic has an χ^2 distribution with degrees of freedom:

$$(15) \quad df = \frac{1}{2}(p)(p + 1) - t$$

with p = number of observed variables and t = number of parameters to be estimated (Bollen, 1989). By means of χ^2 , the null hypothesis (H_0) of validly specified factor loadings, factor variances, covariances and error variances for the model, with all residuals in $\Sigma - \Sigma(\theta) = 0$, is tested (Byrne, 2010). We derive χ^2 from maximum likelihood. The χ^2 probability indicates at which level a departure of the data from the

model is significant. Because χ^2 is highly sensitive to sample size and a hypothesized models will never be able to fit empirical data exactly (Bentler, 2004), there is now consensus among researchers to better assess the magnitude of χ^2 relative to df (Byrne, 2010). Due to the weaknesses of χ^2 , it is moreover advisable to perform the model evaluation based on a combination of other fit indices less sensitive to sample size but sensitive to model misspecifications (Byrne, 2010).

For this purpose, additional fit measures should be used to assess the goodness of fit along a continuum; among them absolute fit indices such as the SRMR and the RMSEA. The indices are calculated as:

$$(16) \quad RMSEA = \sqrt{\frac{\hat{F}_0}{df_T}} \text{ with } \hat{F}_0 = \max\left[\frac{(T_t - df_T)}{(N-1)}, 0\right]$$

$$(17) \quad SRMR = \sqrt{\left\{ \frac{2 \sum_{i=1}^p \sum_{j=1}^i \left[\frac{(s_{ij} - \widehat{\sigma}_{ij})^2}{(s_{ii}s_{jj})} \right]}{p(p+1)} \right\}}$$

with T_T = T statistic of the target model, df_T = target model's degrees of freedom, p = number of observed variables, s_{ij} = observed covariances, $\widehat{\sigma}_{ij}$ = reproduced covariances as well as s_{ii} and s_{jj} = observed standard deviations. Cut-off values ≤ 0.06 for the RMSEA and ≤ 0.09 for the SRMR indicate a well fitted model (Hu & Bentler, 1999).

Incremental fit indices, such as the CFI, measure the proportionate improvement in fit by comparing the T-statistics of the hypothesized target model T with df_T against an independent baseline model B with df_B , in which all observed variables are uncorrelated (Hu & Bentler, 1999). The CFI is calculated as:

$$(18) \quad CFI = 1 - \frac{\max[(T_T - df_T), 0]}{\max[(T_T - df_T), (T_B - df_B), 0]}$$

Values range from zero to 1; whereas $CFI = 1$ implies the hypothesized model to perfectly describe the empirical data (Byrne, 2010). A cut-off value close to 0.95 indicates superior model fit (Hu & Bentler, 1999).

4. Access to primary care and outpatient care coordination⁷

In this study, I look at care coordination problems perceived by the patient as an outcome of care utilization, and examine how coordination mechanisms (facilitating access, routines, and relational coordination), work in primary care. Individual-level data were obtained from a self-administered survey in nine German regions, from patients who received treatment from multiple doctors in the previous year. Self-reported coordination problems were measured by the VANOCSS overall coordination scale. Coordination facilitating structures are operationalized by access to primary care, preventive routine visits and relational coordination between patients and their GPs. Various channels were used to distribute the survey throughout the communities. Multivariate linear regression was used to estimate the direct effects of coordination mechanisms on self-reported coordination problems. Mediation analysis tests the degree to which facilitating structures of access operate through interaction quality between patients and their physicians (referred to as relational coordination). On average, respondents reported three out of six coordination problems. Patients that routinely used preventive services, those with good access and who had experienced good relational coordination, reported fewer problems. Apart from directly enhancing care coordination, access works indirectly by influencing interaction quality, i.e. the degree of relational coordination. To improve coordination, easy access and the structural role of primary care providers should be strengthened, and more incentives for GPs' efforts to establish knowledgeable and effective relationships with their patients should be provided.

⁷ This chapter follows Weinhold (2020), a single-authored working paper.

4.1. Introduction

An ageing population, increasingly specialised health care providers, and fragmented services, make health care coordination increasingly challenging (Schoen et al., 2011). In Germany, patients go through an annual average of 9.2 medical consultations (Rattay et al., 2013), and an average of 79.4% consulted a GP at least once within in the past 12 months. Specialized services are used by about 10-70% within a 12-month timeframe, depending on the medical profession (Rattay et al., 2013). Patients' experience of care coordination therefore provides feedback for the continuous efforts of health systems to improve quality and integration of providers and services. Coordination activities target time and quality of acute care, while stabilizing patient health and avoiding costly deterioration of chronic conditions (Hofmarcher, Oxley, & Rusticelli, 2007). To control costs and cope with the increasing complexity of interprofessional care delivery, improving care coordination is one of the main initiatives of health system reforms (Hofmarcher et al., 2007; Schoen et al., 2011).

Care coordination is comparatively poor in the German health system, especially the exchange of information between health sectors and doctors. Coordination gaps, such as poor knowledge of medical history, bad planning of hospital transfers, and unavailability of timely test results or records, are reported frequently (Schoen et al., 2011). These drawbacks correspond largely to a disconnection in health care delivery, a result of long-standing and strict separation of remuneration and planning of different health care sectors in Germany (Busse & Stahl, 2014; Büyükdurmus, Kopetsch, Schmitz, & Tauchmann, 2017). Usually, different health care providers are paid separately in Germany, leaving insufficient incentives for effective care coordination with other providers (Struckmann, Quentin, Busse, & van Ginneken, 2017). Outpatient,

inpatient, and long-term care are financed from separate budgets, which fosters fragmentation instead of collaboration along the care pathway. This lack of economic incentive for an inter-disciplinary care process conserves other barriers, such as separate administrative and documentation systems, and differing standards of practice and quality control. Instead of an integrated care process that is responsive to patients' needs, care is provided vertically from each profession, resulting in lost information and inefficient repetition of activities (Schoen et al., 2005, 2011).

Many strategies to improve care coordination focus on standardization, documentation, and education. At the core of well-established German disease management programs are clinical guidelines, quality assurance measures, and training and information for providers and patients, among other things (Busse, 2004). Professionals that take responsibility of patient care are central to care coordination improvement in most settings (Hofmarcher et al., 2007), making primary care of particular importance. International experience suggests that many coordination problems might be best addressed at the first point of contact in the health system; in primary care (Boerma, 2006). Continuous interdisciplinary management throughout the care process, reflecting patient health and social needs, is a key dimension of primary care (Boerma, 2006); there is ample evidence on the benefits of well-developed primary care systems on population health and health expenditures (Starfield & Shi, 2002; Starfield, Shi, & Macinko, 2005).

This paper examines the patients' perception of coordination problems, clarifies how coordination mechanisms originating from organisational theory might work in primary care, and derives strategies to improve care coordination at system and service-delivery levels. Providing a background, section 4.1 defines care coordination from the

patient perspective and outlines three theoretical mechanisms to improve it. Applying them to primary care, I develop a theoretical and measurement model to demonstrate the direct and indirect impact of the mechanisms on coordination problems. The econometric methods and data used are described in section 4.3, followed by the results in section 4.4. In section 4.5 the findings and limitations are discussed, and section 4.6 concludes by pointing out measures and policies to foster well-coordinated care.

4.2. Background

4.2.1. The patient perspective of care coordination

Coordination is the management of dependencies between activities. Sharing limited resources gives rise to common dependencies, when goods or information are exchanged and complex tasks are involved (Malone & Crowston, 1994). Health care systems and processes are characterized by dependencies, and coordinating them involves coherence across settings and over time (Haggerty et al., 2011). Good coordination is often unrecognized until it is missing (Malone & Crowston, 1994). Coordinating activities are usually invisible to patients, with supportive information technology operating in the background; the value of care coordination to the patient lies in the results, rather than in the collaborating activities themselves (Haggerty et al., 2011). Coordination activities include several domains, such as interprofessional communication, information transfer, facilitation of transitions, multi-dimensional needs assessments, monitoring, linkage to other resources, and patient education (Schultz, Pineda, Lonhart, Davies, & McDonald, 2013). To the patient, coordination failures result in provider knowledge gaps, insufficient information transfer, inconsistent messages or advice from different providers, and a lack in health literacy,

care competence or poor self-management skills of the patient (Schoen et al., 2011; Schultz et al., 2013).

4.2.2. Coordinating mechanisms

Coordination can be enhanced by mechanisms that *facilitate* interactions between participants or *reduce* their need to interact, for example by establishing routines (Hoffer Gittell, 2002a). Effective coordination also depends on the interaction quality, which is based on the *relationship* of people interacting with each other (Hoffer Gittell, 2002a).

Interaction facilitating structures

Task-appropriate structures and processes to facilitate interactions are the predominant drivers of well-coordinated work (Malone & Crowston, 1994). As a result of facilitated interactions, the patient experiences easier access to health care (Schoen et al., 2011). Access captures multiple dimensions of spatial, temporal, and financial availability of health care, as well as convenience and acceptance of health service utilization (Andersen, McCutcheon, Aday, Chiu, & Bell, 1983; Penchansky & Thomas, 1981). The organisational dimension of access in particular, determines the effectiveness and efficiency of care interactions (Kullgren, McLaughlin, Mitra, & Armstrong, 2012). This includes organisation of health care resources, in a way that allows patients to contact and reach providers including phone services, appointments and operation hours (Beaulieu et al., 2011; Haggerty, Burge, Gass, Pineault, & Beaulieu, 2007). I therefore propose that access to primary care is related to better perceived outpatient care coordination (*hypothesis 1*).

Routines

Routines are recurring patterns of collective activities (Becker, 2004), that reduce the need for interaction between participants in work processes. Routines enhance coordination by establishing regular, systematic, consistent and unified processes (Becker, 2004). Repeated activities enable actors to capture the lessons learned from prior experiences, enhancing learning and development (Levitt & March, 1988). Moreover, routine processes are easier to monitor and control (Becker, 2004). Clinical pathways describing responsibilities and task orders are routines that enhance coordination in health care (Hoffer Gittell, 2002a), as well as regular check-ups or routine medical examinations, especially for chronically ill patients (Bodenheimer, Wagner, & Grumbach, 2002). Accordingly, I suggest that regular preventive (not acute) primary care visits are related to better perceived outpatient care coordination (*hypothesis 2*).

Coordination facilitating relationships

Patient-physician interactions imply a reciprocal work relationship, to which both participants contribute actively by sharing knowledge, values, and decisions (Weinhold & Gastaldi, 2015). Patient-physician interactions therefore share commonalities with joint work processes, where two or more participants interact, sharing knowledge and resources to achieve a common goal (McDonald et al., 2007). Coordination can therefore be described as a process of interaction among participants, conceptually denoted as *relational coordination* (Hoffer Gittell, 2006). Relational coordination is based on an increasing interaction quality by “a mutually reinforcing process of interaction between communication and relationships carried out for the purpose of task integration.” (Hoffer Gittell, 2002b, S.301). In contrast to the previously described

mechanisms, relational coordination refers to the interaction itself, instead of supporting or replacing it. It captures the role of frequent, precise, and problem-solving communication in high-quality relationships, all accomplished through mutual respect, and shared goals and knowledge (Hoffer Gittell, 2002a), in turn affecting communication quality and reducing coordination problems. Several studies, most of them in hospital-settings, have investigated the relational aspects of coordination and found it positively related to quality of care (Havens, Vasey, Hoffer Gittell, & Lin, 2010; Hoffer Gittell et al., 2000; Shortel et al., 1994).

In primary care, GPs play a major role in health care delivery and often serve as care coordinators. A notable part of their work is characterized by relational, non-medical attributes, like communication and patient-centeredness (consideration of the whole person and their broader context) (Cheraghi-Sohi, Bower, Mead, McDonald, Whalley, & Roland, 2006). I therefore hypothesize that relational coordination between patients and their GP is related to better perceived outpatient care coordination, when based on a continuous relationship with accumulated knowledge of the patient's medical history, context and personal views (Burge et al., 2011) (*hypothesis 3*).

Mediating effects of relational coordination

Different coordination mechanisms operate dependently on one another. As previously described, good access should facilitate interaction between GPs and patients. Good access should therefore also improve relational coordination, reducing coordination problems both directly and indirectly (*hypothesis 4*).

In summary, access to primary care, routines, and relational coordination are expected to reduce perceived problems with care coordination (*hypotheses 1, 2 & 3*). Relational coordination is expected to mediate the positive effects of access (*hypothesis 4*).

4.3. Methods

4.3.1. Data collection and sample

I tested the hypotheses using a self-administered survey distributed in January and April 2014, to patients in six rural communities and three urban towns in Germany (cf. Weinhold & Gurtner, 2018). To increase response numbers and avoid situational biases, online and offline questionnaires were used as survey channels. Online responses were encouraged through announcements, emails, and notifications on social networks. The hardcopy survey version was distributed by local administration, clubs and associations, and public facilities. I obtained 633 questionnaires from respondents who saw at least one GP and one specialist in the preceding year.

4.3.2. Measures

Variables and mediator

To analyse coordination problems from a patient perspective, I used the *overall coordination* scale of the Veterans Affairs National Outpatient Customer Satisfaction Survey (VANOCSS) (Borowsky, Nelson, Fortney, Hedeem, Bradley & Chapko, 2002) to capture coordination failures detected by patients (Haggerty et al., 2011). The subscale uses a benchmark approach, with the implicit performance aim of a minimal number of patients that experienced the coordination problems in question (Haggerty et al., 2011). I counted problem frequencies from the dichotomized responses, and then added up the number of problems.

I used the following measures to analyse the direct and indirect effects of coordination mechanisms on the frequency of patient-reported coordination failures. I used an index of access to primary care to evaluate interaction facilitation. Due to its adequate

psychometric properties (Beaulieu et al., 2011), I adopted the PCAS Organizational Access subscale (Safran et al., 1998) which captures spatial accessibility, ease of contact, office hours, waiting times, and availability by phone for patients in need of primary care. The index was calculated for each respondent using their average score of the eight items depicted in Table 1.

Patient reports of regular preventive visits serves as a proxy to recurring routines.

Relational coordination was measured by the PCAS Contextual knowledge subscale (Safran et al., 1998). The scale covers the main dimensions of relational coordination, i.e. relationships of shared goals and knowledge, and mutual respect. The level on the scale of relational coordination is derived from factor analysis. The four items loaded very well (>0.8) onto a single factor, and fit indices indicating a high reliability of the scale and adequacy of the sample (Cronbachs $\alpha=0.916$, overall Kaiser-Meyer-Olkin measure= 0.85). Table 1 summarizes the content of the subscales used to measure the different constructs.

Table 1: Measures of care coordination and content of measurement scales

Dimension	Measurement
Outcome	
Outpatient care coordination problems	<ul style="list-style-type: none"> - Providers not familiar with most recent medical history - Providers lacking knowledge about previous tests and results - Providers lacking knowledge in patient's treatment as recommended by other provider - Inconsistent communication among different providers - Patients' knowledge of next steps in their care - Patients' knowledge of whom to ask about care <p>Items derived from <i>VANOCCS scale</i> (Borowsky et al., 2002)</p>
Coordination mechanisms	
Access to primary care	<p>Items derived from <i>PCAS, Organizational access</i> subscale (Safran et al., 1998):</p> <ul style="list-style-type: none"> - Convenience of regular GP's office location - Rating of GP's office hours for medical appointments - Usual wait for an appointment in case of sickness - Waiting time at the doctors office - Ability to get through to the doctor's office by phone - Ability to speak to the doctor by phone in case of questions or need for advise
Routines	Regular visits at GP's office for preventive services (yes/no)
Relational coordination	<p>Items derived from <i>PCAS Contextual knowledge</i> subscale (Safran et al., 1998):</p> <ul style="list-style-type: none"> - GP's knowledge on patient's entire medical history - GP's knowledge on patient's responsibilities at work or home - GP's knowledge of what worries patient most about her health - GP's knowledge of patient as a person (values and beliefs)

Control variables

As done in previous research (Maeng, Martsof, Scanlon, & Christianson, 2012; McDonald et al., 2007), I adjusted for predisposing characteristics that indicate a need for coordination, and enabling factors that might influence whether patients' needs are met. With the increasing complexity of care that comes with more chronic conditions, care coordination problems also increase (Maeng et al., 2012). Increasing age of patients was inversely associated with perceived coordination problems, perhaps a result of more experience with the health system, a health condition, or an adjustment of physicians' behaviour (Maeng et al., 2012). I also adjusted for sociodemographic

characteristics, (like sex, education and income level, and residential area), although there is no consistent evidence of a relation to coordination problems (Hoffer Gittell, 2002a; Maeng et al., 2012; McDonald et al., 2007).

4.3.3. Data analysis

I applied regression-based mediation analysis (Hicks & Tingley, 2011, Imai, Keele, & Yamamoto, 2010) to estimate the effects of coordination mechanisms *access*, *routines* and *relational coordination*, on reported coordination problems. I then analysed to which degree *access* plays an indirect role by improving *relational coordination*, by estimating its indirect effect. To estimate the mediator (relational coordination, RC_i) and the outcome (coordination problems, CP_i), I specify two linear regression models

$$(1) \quad RC_i = c_{RC} + \alpha_{AP}AP_i + \alpha_R R_i + \alpha_{X_n} X_i + \mu_{iRC}$$

$$(2) \quad CP_i = c_{CP} + \beta_{AP}AP_i + \gamma_{RC}RC_i + \beta_R R_i + \beta_{X_n} X_i + \mu_{iCP}$$

where AP is the access to primary care index; R is the regular use of preventive services at the GP's office, c is a constant, α , β and γ denote the coefficients to be predicted and X_i is the vector of confounders, with A and SM/SF controlling for age and sex, EA and EO controlling for education in terms of academic versus other degrees; the variables W_W , W_N and W_R referring to respondents' work status (differentiating working, not working and retired), In_L , In_M and In_H reflecting low, medium or high levels of net monthly income, PR_C , PR_M and PR_R referring to the area type (city, midsized town or rural) of respondents' place of residence and C controlling for morbidity in terms of one or more chronic conditions. Finally, μ_i is an error term.

The indirect effect was derived by multiplying the coefficients $\alpha_{AP\gamma_{RC}}$, the direct effect of access equals β_{AP} and their sum yields the total effect $\beta_{AP} + \alpha_{AP\gamma_{RC}}$. The relation $\frac{\alpha_{AP\gamma_{RC}}}{(\beta_{AP} + \alpha_{AP\gamma_{RC}})}$ indicates the proportion of the total access effect, that is mediated through relational coordination. A detailed notation of the quantities of interest as well as the econometric specification are summarized in the appendix.

This analysis was conducted by implementing the *mediation* package in STATA version 13.0, using complete case analysis in the mediation analysis. By simulating predicted values of the mediator and outcome variables from their sampling distribution, the average direct and indirect effects are estimated, and point estimates and confidence intervals are calculated (Hicks & Tingley, 2011).

4.4. Results

Respondents reported an average of three out of six outpatient care coordination problems (see Table 2). Most patients experienced poor information exchange between providers in communication around medical tests (66.61%) or changes in treatment (65.76%). A considerable proportion of patients lacked knowledge about the course of their treatment (44.76%), or did not know whom to contact for advice (22.03%). The mean age of the respondents was 47, and a majority of 70.11% were females. 55.77% of the respondents reported having at least one chronic condition. Most of the respondents have an academic degree and are either employed or self-employed, and 18.33% were retired. Income levels were mostly medium (59.40%). 41.71% of patients lived in large urban cities, while the rest lived in midsized towns or rural areas. Some variables have missing values, as each question provided the option to give no response.

Table 2: Reported coordination problems and descriptive statistics

Variable	Obs.	Freq. / Mean	SD [min; max]
Outcome			
Reported coordination problems			
Providers not familiar with most recent medical history	630	42.54%	
Providers lacking knowledge about previous tests and results	626	66.61%	
Providers lacking knowledge in patient's treatment as recommended by other provider	625	65.76%	
Inconsistent communication among different providers	627	54.70%	
Patient lacks knowledge of next steps in their care	630	44.76%	
Patients lacks knowledge of whom to ask about care	631	22.03%	
Sum of reported coordination problems	624	2.97	1.85 [0; 6]
Coordination mechanisms			
Regular visits at GPs office for preventive services (yes)	633	39.34%	
Access to primary care (index)	601	4.82	1.01 [1.63; 7]
Relational coordination (factor)	633	0	0.95 [-2.46; 1.23]
Controls			
Sex			
<i>Female</i>	629	70.11%	
Age	629	47	16.5 [18; 93]
Education			
<i>Academic</i>	633	67.14%	
<i>Other</i>	633	32.86%	
Work status			
<i>Working</i>	633	73.93%	
<i>Not working</i>	633	7.74%	
<i>Retired</i>	633	18.33%	
Net income per month			
<i>Low level (0 – <1000€)</i>	633	18.01%	
<i>Medium level (1000 €– <3000€)</i>	633	59.40%	
<i>High level (>3000€)</i>	633	9.32%	
Place of residence (Ref.=City)			
<i>City (>50.000 inhabitants)</i>	633	41.71%	
<i>Midsized town (5.000 – 20.000 inhabitants)</i>	633	25.28%	
<i>Rural (<5000 inhabitants)</i>	633	31.75%	
Chronic conditions(s)	633	55.77%	

Note: SD = standard deviation; Obs. = number of observations

Hypothesis testing required a stepwise approach of estimating the effects of coordinating mechanisms on relational coordination (model specification 1, Table 3), estimating combined effects of relational coordination and the other hypothesized mechanisms on care coordination (model specification 2, Table 3), and estimating the indirect effects. Table 3 and Table 4 contain the results of the regression and mediation analyses.

Table 3: Regression results (standardized coefficients)

Model specification	1 (relational coordination)		2 (coordination problems)	
	α	SD	β	SD
Cons	-2.586***		6.107	.535
Coordination mechanisms				
Relational coordination	--	--	-.346***	.093
Access to primary care	.295***	.031	-.525***	.075
Regular visits at GPs office for preventive services	.180**	.064	-.518***	.144
Controls				
Sex (Ref.=male)				
Female	-.058	.067	.180	.151
Age	.019***	.003	-.010	.007
Education (Ref.=not academic)				
Academic	-.134	.072	-.123	.164
Work status (Ref.=working)				
Not working	-.119	.135	-.369	.304
Retired	-.329**	.120	-.212	.272
Income (Ref.=medium level income)				
Low level income	-.003	.098	.331	.221
High level income	.078	.105	-.421	.237
Place of residence (Ref.=City)				
Midsized town	.435***	.080	.055	.185
Rural	.348***	.080	.150	.183
Need for coordination				
Chronic condition(s)	.318***	.065	-.024	.150
R²	.408		.224	
Note: Standard deviation in parenthesis; *, **, *** indicate significance at 5%, 1% and 0.1% level				

The results confirm positive effects of the proposed coordination mechanisms, while adjusting for sociodemographic and health-related factors (model specification 2, Table 3). Ease of access to primary care was strongly related to a low perception of coordination problems ($\beta_{AP}=-.525$, $p<.001$, hypothesis 1 accepted) and patients that routinely used preventive services reported significantly fewer coordination problems ($\beta_R=-.518$, $p<.001$, hypothesis 2 accepted). Also, higher relational coordination is associated with fewer coordination problems reported ($\gamma_{RC}=-.346$, $p<.001$, hypothesis 3 accepted). To test the mediation hypothesis, the impact of access on relational coordination must be demonstrated, while controlling for other variables (model specification 1, Table 3). Both good access and regular preventive visits are related to relational coordination ($\alpha_{AP}=.295$, $p<.001$; $\alpha_R=.180$, $p<.01$). Among the control

variables, age ($\alpha_A=.019$, $p<.001$), chronic conditions ($\alpha_C=.318$, $p<.001$), and a mid-sized ($\alpha_{PRM}=.435$, $p<.001$) or rural place of residence ($\alpha_{PRR}=.348$, $p<.001$), were significantly associated with relational coordination. The results also suggest that age, retirement status, having chronic conditions, and the place of residence are no longer significantly associated with the perception of care coordination problems, once relational coordination is included in the model (model specification 2, Table 3).

Aside from directly enhancing outpatient care coordination, access to primary care works indirectly by influencing the degree of relational coordination among patients and their GP (Table 4). The mediation analysis revealed an indirect effect on the relationship between access and coordination problems, attributable to the level of relational coordination (-0.102, CI 95% [-.162;-0.43], hypothesis 4 accepted). In other words, the positive influence of access on coordination passes in a relevant amount throughout increases of relational coordination developed between the patients and their GPs (16.3% of total effect).

Table 4: Results of mediation analysis

Effects	Mean	[95% Conf. Interval]
Indirect effect of access to primary care	-.102	[-.162; -.043]
Direct effect of access to primary care	-.524	[-.665; -.376]
Total effect of access to primary care	-.626	[-.762; -.489]
% of total effect mediated	.163	[.134; .209]

4.5. Discussion and limitations

This research assessed the perception of care coordination problems as perceived by the patient, and tested the effects of different theoretically-based coordination mechanisms in primary care. The findings of this study support previous evidence on care coordination problems experienced by the patient, suggesting that over half of

patients participating in surveys report coordination flaws, stemming either from a lack of information exchange among providers, or from care that lacks patient-centeredness and engagement (O'Malley & Cunningham, 2009; Schoen et al., 2011).

The results clarify the structural role of primary care in reducing outpatient care coordination problems perceived by the patient, in terms of access, relational coordination, and regular routine visits. O'Malley & Cunningham (2009) examined determinants of coordination quality from a patient perspective in a US sample, and found that visiting a regular primary care provider and receiving referrals to specialist care from this same provider, was associated with a more positive assessment of the informed visits element of coordination. Haggerty et al., (2008) found that the organisational structure of primary care practices affects coordination, with pronounced attributes of enhanced access and relational continuity. In international comparison, patients who receive care from primary care practices with attributes of enhanced access, well-established relationships, and team-based care management, experienced less coordination failures (Schoen et al., 2011).

A growing body of research demonstrates positive associations of relational coordination to different outcomes; relational coordination among staff in a rural community hospital was related to fewer adverse events, medication errors, and complaints (Havens et al., 2010). In long-term care facilities, relational coordination among nurses was associated with improved quality of life of the patient and also job satisfaction of the staff (Hoffer Gittel, Weinberg, Pfefferle, & Bishop, 2008).

Relational coordination is also an important mediator in other health care settings. Hoffer Gittel (2002a) showed that routines and structural measures (such as case managers) in hospital joint replacement surgical care effectively improve care

coordination, because relational coordination among participants of the work process is strengthened. The results of this study suggest that the interplay of structural and relational mechanisms is generally valid, and can be transferred to primary care; appropriate structural conditions for access reduce care coordination problems for patients, and at the same time enable relational coordination between the patient and GP, which in turn reduces coordination flaws.

Several patient characteristics seem to predict care coordination problems. Particularly patients with chronic conditions are more likely to report problems (Maeng et al., 2012), whereas patients with advanced age and high activation (the ability to organize and lobby for one's own health), were less likely to report problems (Maeng et al., 2012; O'Malley & Cunningham, 2009). In this study, chronic conditions and age were not significantly related to perceived coordination problems, after adjusting for different coordination mechanisms. Other studies arrive at similar conclusions: O'Malley & Cunningham (2009) found that coordination-enhancing effects of regular primary care were especially pronounced for people with chronic conditions. Hoffer Gittel (2002a) demonstrates increased quality and efficiency of coordination mechanisms for patients with chronic conditions in hospital. In primary care, relational coordination may be what underlies the associations of patient characteristics and coordination experience; age and chronic conditions are significant determinants of relational coordination, likely due to longer relationships with one provider and more intense utilization. In turn, this strengthens relational coordination, and enables a physician to act and communicate in a way that is most responsive to the patients' needs. Relational coordination is more pronounced among patients from mid-sized towns or rural regions, possibly the result of a lack of local alternatives, care provided

mostly by one GP, (Boerma, Groenewegen, & van der Zee, 1998), a higher personal attachment to local physicians in rural areas, and more relationship-based care (Farmer, Hinds, Richards, & Godden, 2005; Haggerty, Roberge, Lévesque, Gauthier, & Loignon, 2014). Both aspects are supportive for building a knowledge-based and responsive relationship between patients and their GP.

This study has some limitations. Recruiting participants via various channels was necessary to achieve a reasonable and broad sample size, however it does not allow a response rate calculation and some groups might be overrepresented (e.g. women) as well as underrepresented (e.g. critically ill patients). Although the mediation analysis has implications with a causal direction, my results represent only one point in time and a longitudinal analysis would be needed to test causality.

Although most coordination measurement instruments are conducted from the patient perspective, several measurement scales applied in different studies (Schultz et al., 2013) complicates the comparison of results. Despite occurrence of similar patterns of coordination flaws in international comparison, results need to be interpreted against the background of different national conditions and varying health system characteristics, such as binding gatekeeping roles of GPs (Schoen et al., 2011).

4.6. Implications

Despite being central to health system performance, primary care does not play a corresponding central role in the distribution of health care services in Germany. Patients may seek out and access both general and specialized care at their discretion without primary care providers acting as gatekeepers (Busse & Blümel, 2014), which disrupts coordination and cooperation among providers (Schlette, Lisac, & Blum,

2009). While there is no doubt regarding the relevance of formal and explicit coordination mechanisms such as standardization, documentation and education, the findings of this study emphasize that very fundamental aspects are also very important, such as ease of access to primary care and indirect mechanisms operating through the patient-provider relationship. Therefore, easy access to primary care and the structural role of GPs as care coordinators must be strengthened further, to improve coordination quality along the care pathway. To achieve this, approaches at different levels should be considered.

At the system level, framework conditions must be created by political decisionmakers and the actors of self-administration, that ensure prompt and timely access to primary care in the first place. German health care planning strives to provide access to primary care for patients throughout the country, by setting target values of provider density within administrative regions. Equitable access is not achieved everywhere with this method, leading to disparities between rural and urban regions in particular (Bauer, Maier, Müller & Groneberg, 2018). Current debates consider reforms taking greater account of accessibility and availability of primary care providers and adjust target values of provider density to the morbidity-based need for health care (Sundmacher et al., 2018). Reforms should be accompanied by a continuous monitoring of access indicators and quality control. For example, the UK uses performance-based payment incentives; quality frameworks, with an emphasis on care plans; teams to facilitate access, and finally patient surveys to incorporate their feedback (Thomson, Osborn, Squires, & Reed, 2011). Austria is pursuing an approach of regional integrated health care planning with strong and interdisciplinary primary care structures, facilitated by regional centres and networks. Providers must guarantee appropriate opening hours and

are motivated to ensure easy access with mobile and web-based services (Eglau, Fülöp, Mildschuh, & Paretta, 2017).

Parallel, incentives to enhance relational coordination should be provided to GPs for their efforts to establish knowledgeable and effective relationships with their patients. This could come in the form of stronger incorporating efforts for medical-psychological and social assessments, information exchange, and coordination of care, in the estimation of GP capacity needs in regional health care structure planning. Second, efforts to provide well-managed care should be reimbursed sufficiently, i.e., by the relative upgrading of these services in the outpatient care uniform value scale⁸, which is used as a basis for reimbursement for outpatient services. This fosters care for the complete patient profile and improves relational coordination.

If several providers are involved, well-coordinated care is incentivised by financing mechanisms, that increase accountability for the care pathway as a whole and rewards for coordination and management. Possible approaches include additional payments or provider reimbursement for coordination tasks, bundled payments for care processes or defined populations, models of shared savings between providers and payers to incentivize efficiency in care delivery, or pay for performance agreements linked to achieving quality targets (Struckmann et al., 2017).

Establishing well-informed relationships can be paramount to health service quality, responsiveness of care to patient's needs and their self-managements skills, particularly for patients with chronic illnesses managing medication, diet and exercise. International evidence suggests considerable room for improvement in these

⁸ In German: *Einheitlicher Bewertungsmaßstab*

interpersonal aspects (Schoen et al., 2011). However, reforms to improve care coordination must be aligned with national health system conditions; changes in traditional reimbursement and planning mechanisms cannot be implemented short term. Considering conditions and incentives requires continuous monitoring and research of coordination quality and its determinants from the perspectives of patients, health care providers, and payers.

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Appendix 4

Notation and econometric specification

For the estimations of the direct, indirect and total effects of access, I specify two linear regressions on the outcome variable coordination problems (CP_i) and on the mediator (relational coordination, RC_i), where:

- AP_i = access to primary care index
- R_i = regular use of preventive services at the GPs office (binary, yes or no)
- A_i = respondent's age
- S_M/S_F = respondent's sex (binary, male or female)
- E_A/E_O = education (binary, academic versus other degrees)
- $W_W/W_N/W_R$ = respondent's work status (differentiating working, not working and retired)
- $In_L/In_M/In_H$ = low, medium or high levels of net monthly income
- $PR_C/PR_M/PR_R$ = area type (city, midsized town or rural) of respondent's place of residence
- C_i = morbidity (one or more chronic conditions)

I consider a sample of respondents that are either in the condition of experiencing above average quality of primary care access $AP_i = 1$ or in the control condition, i.e., below average access $AP_i = 0$. Thus, the outcome of coordination problems of respondent i in the good access condition can generally be denoted $CP_i(AP_i)$. Since I only observe each respondent in one condition, the respondent-level condition effect is unobservable. Researchers then typically focus on estimation of the average effect over a population (Hicks & Tingley, 2011), i.e., $E(CP_i(1) - (CP_i(0)))$. In contrast to calculating an average effect, mediation analysis aims to quantify the effect of primary care access that operates through a particular mechanism, i.e., the establishment of relational coordination between patients and GPs.

Let $RC_i(AP)$ denote the potential value of the mediator "relational coordination" in the condition of experiencing good primary care access $AP_i = 1$.

Similarly, let $CP_i(AP_i, RC_i)$ denote the potential outcome “coordination problems” if the condition and mediating variables equal AP and RC . The observed outcome CP_i is then $CP_i(AP_i, RC_i(AP_i))$, which depends upon both the primary care access status and the level of relational coordination (the mediator) under the observed access status. The amount of the access variable transmitted by the mediating variable, i.e., the indirect effect (mediation effect) for each respondent i is defined as:

$$(1) \quad \delta_i(AP) = CP_i(AP, RC_i(1)) - CP_i(AP, RC_i(0))$$

for each condition of primary care access $AP_i = 0,1$.

The quantity of interest is the change in the outcome corresponding to a change in the mediator from the value that would be realized under the condition of below average access, i.e., $RC_i(0)$ to the value that would be observed under a good access condition, i.e., $RC_i(1)$ while holding the access condition constant. For example, if $RC_i(1) = RC_i(0)$ primary care access has no effect on relational coordination and the mediation effect would be zero. As the access status is fixed and only the mediator changes, I isolate the hypothesized mediation mechanism.

The direct effect of primary care access on coordination problems for each respondent i and each status of access is defined as:

$$(2) \quad \zeta_i(AP) = CP_i(1, RC_i(AP)) - CP_i(0, RC_i(AP))$$

The total effect of primary care access on the outcome CP_i is defined as

$$(3) \quad \tau_i = CP_i(1, RC_i(1)) - CP_i(0, RC_i(0))$$

The effect of interest, the average mediation effect is denoted $\bar{\delta}(AP)$ and formally defined as

$$(4) \quad \bar{\delta}(AP) = E(CP_i(AP, RC_i(1)) - CP_i(AP, RC_i(0)))$$

Similarly, the average direct effect is defined as

$$(5) \quad \bar{\zeta} = E(CP_i(1, RC_i(AP)) - CP_i(0, RC_i(AP)))$$

Since both the mediator and outcome variable are estimated with a linear regression, the mediation effect is derived by estimating two regressions, where c is a constant, α , β and γ denote the coefficients to be predicted, X_i is the vector of confounders and μ_i is an error term:

$$(6) \quad RC_i = c_{RC} + \alpha_{AP}AP_i + \alpha_R R_i + \alpha_{X_n} X_i + \mu_{iRC}$$

$$(7) \quad CP_i = c_{CP} + \beta_{AP}AP_i + \gamma_{RC}RC_i + \beta_R R_i + \beta_{X_n} X_i + \mu_{iCP}$$

In a second step, the coefficient on the condition variable α_{AP} of the first regression (6) is multiplied with the coefficient on the mediator variable γ_{RC} of the second regression (7): $\alpha_{AP}\gamma_{RC}$. The model is identified under the assumption of sequential ignorability (for the mathematical derivation see Imai, Keele & Yamamoto, 2010).

The direct effect of primary care access on the outcome CP_i is identified as

$$(8) \quad \bar{\zeta}(0) = \bar{\zeta}(1) = \beta_{AP}$$

and the estimated average total effect:

$$(9) \quad \bar{\tau} = E(CP_i(1, RC_i(1)) - CP_i(0, RC_i(0))) = \beta_{AP} + \alpha_{AP}\gamma_{RC}$$

which is equal to the sum of the mediation effect and the direct effect. Finally, the

relation $\frac{\alpha_{AP}\gamma_{RC}}{(\beta_{AP} + \alpha_{AP}\gamma_{RC})}$ indicates the proportion of the total access effect, that is mediated

trough relational coordination.

5. Area deprivation and its impact on health

Chapter 5 has been published as a peer-reviewed article and is available at the following reference:

Karmann, A., Weinhold, I. & Wende, D. (2019). Area Deprivation and its Impact on Population Health: Conceptual Aspects, Measurement and Evidence from Germany. *Review of Economics*, 70(1), 69-98. <https://doi.org/10.1515/roe-2019-0001>

6. Summary of implications

Health equity-related goals of access to care and reducing avoidable regional variation (chapters 1 and 2), are ultimately means for other purposes, such as population satisfaction with health care (chapter 3); quality of health care, determined partly by coordination of outpatient care (chapter 4); and particularly, population health, e.g., in terms of morbidity and mortality (chapter 5).

For a more patient-oriented health care planning, with equitable access and without unjustified regional differences, the methodological approaches and the results of these analyses can be implemented and further developed at different points. In the final chapter, the most important implications from the first five chapters are brought together, supplemented by current developments in the topic areas discussed that go beyond this thesis.

6.1. Establishing a framework to assess primary care access and performance

In order to reduce regional differences in access to primary care, it is an essential first step to assess regional care structures in a valid, reliable and continuous way and then to align the planning of the care structure with the results. In Germany, there is currently no systematic and cross-regionally comparable assessment that could provide the basis for deriving targeted measures to ensure access to care. Presently, regional provider-to-population ratios are the decisive indicators that estimate access and trigger countermeasures in order to avoid local physician shortages. The insufficient validity and reliability of this approach have already been discussed in chapter 1.3.

To ensure economic, equitable and accessible health care according to current medical standards as outlined in chapter 1.1 (sections 70, 72, 75 and 99–105, SGB V), the

regionally accountable committee of SHI physicians and SHI funds⁹ which is responsible for reviewing the regional supply situation and determining specific, local care needs requiring particular medical qualifications (sections 35 & 36, BPRL 2019) as well as impending or existing health care shortages (sections 30 & 33, BPRL 2019) should instead assess primary care structures in their region, taking into account the various potential forms of inadequate health care and access barriers. The comprehensive framework of shortage aspects, as systematically elaborated in chapter 2, can provide the conceptual basis for this task. The identified focus areas (quantitative physician capacities, spatial distribution, quality aspects, access barriers as well as utilization inefficiencies) should be included as relevant dimensions in a comprehensive health care structure and performance assessment and would have to be operationalised via suitable indicators, such as¹⁰:

- *Assessments of capacity*, e.g., locally available GP capacity relative to estimated regional need for primary care (Sundmacher et al., 2018) to identify quantitative shortages,
- *Assessments of spatial provider allocation*, e.g., distance to the nearest GP for small-area population locations (Fortney, Rost & Warren, 2000), outreach of catchment areas (Weinhold et al., 2021) to identify potential maldistributions,
- *Assessments of primary care quality at the regional level*, e.g., rate of avoidable hospitalisations due to ambulatory care sensitive conditions (Kurte & Blankart, 2019), coordination deficits (cf. chapter 4), patient reported physician-patient-

⁹ In German: *Landesausschuss der Ärzte und Krankenkassen*

¹⁰ The following compilation of indicators does not claim to be exhaustive.

relationship, continuity of care and comprehensiveness of services (Weinhold & Gurtner, 2018) to identify structural quality deficits,

- *Assessments of different access dimensions* (e.g., realised travel times accounting for minimum distance standards (Schang, Weinhold, Wende & Sundmacher, 2019), patient-reported accessibility and affordability (Weinhold & Gurtner, 2018), organisational aspects such as waiting times, practice hours, ease of appointment scheduling (chapter 4) to identify regional barriers to care,
- *Assessments of health service utilization* (e.g., proportion of patient flows between different regions and bypassing behaviour (Sundmacher et al., 2018), rates of omitted preventive health services (Nutti & Seghieri, 2014) to identify inefficiencies of care in terms of over- under- and misutilization.

The framework requirement to implement such an assessment on a voluntary¹¹ or even mandatory basis can be made by including additional requirements in the Federal Joint Committee's health care structure planning guidelines. To make sure that the structural and access assessment is valid, reliable and comparable for different regions, suitable indicators must be derived using the same methodology, comparable time references and data representative for the regions of interest derived from unbiased databases.

To support the aim that conclusions derived from the data indeed reflect the truth about the phenomena of interest, different approaches to measurement and different data sources should be combined; these include administrative SHI data for an almost complete and reliable picture of health service provision; census population data from statistical offices, geostatistical area and distance measures, representative patient,

¹¹ to justify adjustments of the regular planning approach due to regional conditions (section 2, BPRL 2019)

population or health care provider surveys for a valid assessment of different access and quality indicators (Schang, Weinhold, Wende & Sundmacher, 2019, Guagliardo, 2004; Joseph & Bantock, 1982; Sundmacher et al., 2018; Wang & Luo, 2005). An initial set of indicators was implemented outside the scope of this dissertation in further research collaborations (Schang, Weinhold, Wende & Sundmacher, 2019).

After the groundwork has been laid and the systematic regional assessments have been completed, the second step is to compare the results to predefined targets (Sundmacher et. al, 2018). This, in turn, requires the definition of standards against which the regional status quo is compared, including different dimensions of access: accessibility thresholds that are not exceeded when visiting a GP, thresholds for waiting times, and required local availability of physicians and services (consultation hours, personnel capacities, scope of activity, for example). Setting standards is not straightforward and should be evidence-based in terms of the impact of distance on utilization and health outcomes (Sundmacher et al., 2018) and should also consider the patient perspective to take account of the equity claim. An approach to derive critical accessibility thresholds from an empirical analyses of health-related travel distances based on administrative data covering 88% of the German population and supplementary representative patient surveys to determine acceptable distances depending on age, health, socioeconomic status and geographical location, was implemented outside the scope of this dissertation and is described in Weinhold et al. (2021)¹². The variation of thresholds, depending on socio-demographic and health variables and the proportion of the population to which

¹² paper under review in *Health Policy* (Elsevier Ireland Ltd.)

an acceptable limit is to apply illustrates the need to move beyond averages to realise equity – i.e., equal access for equal need.

In the most recent health care planning reform of 2019, the approach of defining minimum accessibilities has been implemented and distance thresholds can now be used for regional assessments of special health care needs. For primary care (from a GP, for example), these thresholds should apply to 95% of the residents in a region, and should not exceed a travel time of 20 minutes by car (G-BA, 2019a). Comparable standards can also be found in international comparisons (Voigtländer & Deiters, 2015); in Austria, for example, accessibility guidelines are used for site planning, whereby at least 90% of the residents of a federal state should be able to reach the nearest GP in 10 minutes by car (Eglau, Fülöp, Mildschuh & Paretta, 2017).

6.2. Strengthening patient involvement in health care structure planning

As per the defined equity framework (chapter 1.1) health care structure and performance assessments must include the experience of different social groups and potential reasons for under-/over and mis-utilization of health care (Whitehead, 1991). For the purpose of validity (chapter 6.1), assessments should be supplemented with ‘patient-reported outcomes’ for selected indicators from the outlined framework (chapter 6.1). Moreover, access standards should be derived evidence-based but should also reflect a societal consensus as much as possible; preferences and needs of the population should therefore be included in access discussions. Despite its important role in these contexts, health policy and authorities in some western health systems only occasionally integrated the patient and public perspective into health care planning and development over the last decades (Crawford et al., 2002; Mockford, Staniszewska, Griffiths, & Herron-Marx, 2012; Ocloo & Matthews, 2016).

Some attempts are made to assess health care access in Germany from the patient perspective by regular nationwide patient and population surveys. Examples are the *Bertelsmann Health Monitor* (Böcken et al. 2015) and the regular surveys of insured patients by the National Association of Statutory Health Insurance Physicians (KBV, 2020), that ask questions about utilization, satisfaction, travel and waiting times. However, the results are spatially highly aggregated and allow neither small-area access assessments nor a comparison of different regions. Moreover, the results are predominantly informative and not linked to actual measures (section 105 SGB V) to reduce inequitable regional access variation. Also, survey results reflect the status quo from the patient's perspective, but mostly do not contain a subjective assessment of the appropriateness of access or the relevance of the different access dimensions to patients.

To address these weaknesses, I developed a survey instrument that integrates psychometrically appropriate subscales of internationally established primary care assessment questionnaires used to evaluate access and care process attributes from a patient perspective (chapter 3). I have shown that the questionnaire is a valid and reliable instrument in different types of regions and can thus be used for access monitoring and small-area comparisons. Regularly and representatively implemented, this tool could directly feed the patient perspective into structural planning by identifying regional discrepancies and prioritising measures to improve access responsive to local population's needs and preferences.

As shown in chapter 3, people's priorities with regard to different access and primary care attributes, such as accessibility of care, concentration of services on single providers, and a personal relationship with locally available GPs, can vary between

densely supplied urban and sparsely supplied rural regions. The results indicate that a local physician who is acceptable in interpersonal terms and provides comprehensive services for locally prevalent health problems is more important for the rural patients in our sample than the mere accessibility of the practice.

Against the background of the policy requirement to create equivalent – not necessarily *equal* – living conditions throughout the federal territory (chapter 1.1), an assessment of differences in societal expectations for example, in primary care accessibility, could be a starting point to inform and guide political decision-making. The derivation of critical GP distance thresholds from empirical analyses of actual health care utilization depending on distances travelled coupled with willingness-to-travel patient surveys (Weinhold et al., 2021, chapter 6.1) can be used to determine corridors of acceptable distances to GPs practices, depending on the regional socio-demographic structure of the population (age, health status, mobility), or regional-infrastructure conditions (regional deprivation, degree of rurality/urbanization, local public transport density). By this approach, the societal perspective can feed a more patient-oriented determination of the outreach of catchment areas in health care structure planning. Further research should examine how different relevance of satisfaction determinants emerge, and which other factors, experiences and beliefs can shape patients' access priorities.

As attempts aim to innovate traditional outpatient care service delivery for the purpose of more equitable access, especially for vulnerable and rural population groups (chapter 2), this becomes increasingly relevant. Some efforts include concepts of health care centralization (Mungall, 2005) and outreach, such as mobile service delivery or telemedicine (Kuhn, Kleij, Liersch, Steinhäuser, & Amelung, 2017; OECD, 2010).

More patient and public involvement is important to innovate outpatient care in such ways, especially in deprived rural regions. Policy and innovative care model effectiveness depend not only on the concepts themselves, but also on their acceptance, the implementation process, the key stakeholders, and the context in which it is implemented (Walt & Gilson, 1994). Patient and public involvement also legitimises the decisions made by health policymakers, and increases accountability (Mockford, Staniszewska, Griffiths & Herron-Marx, 2012).

Public needs and preferences can be derived from various methods that focus on local communities, such as consultation meetings and forums, community health councils, interviews, focus groups, and surveys – as developed in chapters 3 and 4 of this thesis – (Crawford et al., 2002, Florin & Dixon, 2004). Regional stakeholders can then use targeted measures to improve access to care, by increasing accessibility (examples include improving transport to health care facilities or service relocation); increasing availability (e.g., by expanding services or implementing ICT-supported services such as video consultations); or improving accommodation (e.g., by ICT-supported appointment scheduling, extending opening hours or offering support for people with disabilities) (Crawford et al., 2002; Mockford et al., 2012; Nimegeer et al., 2011). The end goal being to contribute to health system equity goals, by better matching health care with the needs and preferences of population groups (Farmer, Nimegeer, Farrington & Rodger, 2012; Farmer & Nimegeer, 2014) and improve outcomes of care; patients' health, satisfaction, and quality of life (as depicted in Figure 1, chapter 1.1).

6.3. Strengthening access to GPs as outpatient care coordinators

Accessibility, convenient office hours, short waiting times, and accessibility by phone in primary health care is related to fewer coordination and information problems, both

directly and indirectly. Relational coordination is strengthened, a result of mutual knowledge and communication between patient and GP, giving rise to better coordination as an indirect effect. This demonstrates the relevance of an easily accessible GP, especially for patients with multiple health conditions and regular visits to multiple outpatient physicians (chapter 4).

In addition to financial incentives for coordination activities (as described in chapter 4), the GP's role as coordinators in the outpatient sector can be strengthened by the relative upgrading of the underlying services, i.e., coordination and establishment of a knowledge-based physician-patient interaction, in the outpatient care uniform value scale¹³, which is the basis for outpatient service reimbursement. Part of the current remuneration reform, strengthening of 'speaking medicine' is a step in this direction, as it includes a substantial increase in remuneration for conversations between GPs and patients (KBV, 2020).

Moreover, adequate organisational resources (e.g., time and personnel resources) must be available to ensure good access; this can also be supported by adjustments in health care structure planning. Next to the assessment of regional access as a basis (as described in chapter 6.1), an adjustment of the regional target quotas for GP capacity requirement is of special importance in this context. In the past, target quotas were derived from population counts adjusted by a descriptive age factor which was calculated from the relation of health care utilization between two age groups (<65 years and ≥ 65 years). The approach did not take into account changes in required GP capacities associated with the additional time needed for coordinating and relationship

¹³ In German: *Einheitlicher Bewertungsmaßstab*

building in primary care. Current scientific studies assess additional needs for primary care capacities based on indicators such as morbidity, multimorbidity, and differentiated age groups, which are associated with increased coordination activities (Sundmacher et al., 2018). Again, the recently reformed health care structure planning guidelines partially meet these requirements (G-BA, 2019a) and the reformed approach creates 1.446 new GP practice options, especially located in rural and deprived areas (G-BA, 2019b). Provided that these SHI-accredited practice options can be staffed, primary care can be improved, especially in these regions.

In addition to the distribution of practice locations, a GPs scope of activities also differs considerably between regions, with above-average case numbers concentrated in the eastern part of Germany (Ozegowski 2013b). This actual scope of GP activity is part of the availability dimension of regional access assessments, outlined in chapter 6.1. A more valid evaluation, for example using full-time equivalents (FTE) instead of per capita workforce calculations (i.e., health care service mandates (section 95 para 3, SGB V) including a minimum of a 25-hour weekly consultation time (section 17a, Ärzte-VZ), would also yield a more valid and reliable assessment of the regional access situation. In capacity assessments, GPs FTE can be supplemented by other service providers or primary care models, (such as mobile practices, telemedicine, or other medical professionals), who relieve GPs of some of their activities (van den Berg et al. 2009 & 2012), thereby creating incentives for access-fostering innovations, especially in rural and deprived regions (Kuhn, Kleij, Liersch, Steinhäuser & Amelung, 2017).

6.4. Including regional deprivation factors in health care structure planning

For more patient- and regional needs-oriented health care structure planning, a deprivation measure as developed in chapter 5 is another potential starting point. From

a normative point of view, the negative health effects from regional influences can be regarded as avoidable, since they are not of a genetic or biological nature; but they can also be regarded as unfair, since individuals mostly neither self-inflict nor do they voluntarily expose themselves to regional influences of harm to them (see the explanations on fairness in chapter 1.1). From a conceptual and methodological perspective, deprivation measures are potentially suitable indicators of health care need, since their relationship to morbidity and mortality (see chapter 5) and with regionally aggregated health service utilization (Kopetsch & Maier, 2018) has been empirically demonstrated. Moreover, regional deprivation factors can broadly be considered exogenous need indicators, since they can be measured independently of actual health care supply and utilization, which is particularly important in health care structure planning. Measures of deprivation can capture part of the unmet need that arises when an objective need for care does not lead to use of services, due to individual factors or access barriers (see Figure 1, chapter 1.1). In models that are based on diagnosis-related morbidity and service utilization, this uncovered morbidity remains invisible (Ozegowski, 2013b).

In 2015, the GKV-VSG commissioned the actors of self-administration to examine the consideration of social factors in addition to demographic developments and morbidity in health care structure planning (Section 101, para 2, SGB V). The suitability of deprivation measures – including the approach developed in chapter 5 – for needs assessment and planning at the national level was scientifically examined in a recently published report on further development of health care structure planning, according to sections 99-105 SGB V (Sundmacher et al., 2018), which implements the legal mandate of the GKV-VSG. Consistent with implications in chapter 5, experts conclude

that the extrinsic nature of supply to deprivation measures results in a high degree of robustness for a health care needs assessment (Sundmacher et al., 2018). As recommended in chapter 5, the usage of an index that combines multiple dimensions into a single factor was discarded due to the blurred influence of the separate deprivation dimensions and its validity depending too much on their weightings and calculation method. As also demonstrated in chapter 5, the social dimension of deprivation plays an essential role in the health context. The models primarily examined to estimate regional health care need preferably included measures of regional social deprivation, operationalized via community level unemployment. The main disadvantage of the approach, however, is possible ecological fallacies of the regional social deprivation and individual health service utilization connection. The assessed relations between regional deprivation indicators and physician group-specific estimates of health care need¹⁴ partly show differences that are not in line with other individual-level research findings (Sundmacher et al., 2018). Including them would lead to insufficiently evidence-based unequal treatment in the structural planning of different medical disciplines. It is therefore finally recommended to first adapting the data basis for regional needs assessments, by enriching it with geo-referenced diagnostic data of the patient's place of residence, and information on socioeconomic status of the insured (Sundmacher et al., 2018).

In the context of all the recommendations of this chapter the fact remains; planning, alone, does not ensure availability of capacities and services where they are needed most. Strategies and measures for recruiting and retaining physicians in rural and/or

¹⁴ determined from administrative data from the Associations of SHI Physicians; see Sundmacher et al. (2018)

deprived areas can be found in animated discussions in both national and international literature (for an overview see SVR (2018)). A comprehensive review is outside the focus of this work. Nevertheless, a valid assessment of regional access and performance giving more importance to the patient's perspective while considering regional need differences provide a crucial basis in more patient-oriented, equitable planning of health care structures.

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