ASSESSING AVAILABILITY RISKS IN HEALTH CARE SERVICE SUPPLY CHAINS

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ABSTRACT
Purpose: In many countries the demand structure for health care services is changing due to ageing population. This has led to the need to re-assess the current designs of the current service models. This paper studies health care services as service supply chains which face an availability risk largely due to the re-organisation of the service supply.

Design/methodology/approach: This paper uses a survey methodology approach in the context of the Finnish health care system. The study is based on regional health care system statistics and vast questionnaire results.

Findings: Taking customer perspective into account in planning health care services increases customer perceived availability and social acceptance of services. Geographical distance might have a great influence on availability risk, but it is context dependent and rooted in routines and habits of customer groups.

Originality/value: The availability risk of health care services is still a focal subject under research and there are clear gaps in the current scientific discussion from several perspectives. This study addresses some new research perspectives to the availability of health care services. Our contribution to earlier scientific discussion is formed through the combination of geographical availability and customer perspective.

Keywords: Availability, risk, health care, service supply chain, assessment, geographical distance, Finland.

Paper type: Research paper

Introduction

The aging population poses challenges to the health care systems in industrialised countries (Christensen et al. 2009). Functional limitations amongst aging citizens are expected to be more common, creating risks involving the availability of primary health care particularly in sparsely populated areas (Beillon et al. 2008). A decrease in the customers' mobility can have a crucial impact on the availability of the services from the customer perspective. On the supply side, the changing age structure creates pressure to develop health care service supply chains to tackle this issue. Indeed, the patient perspective is currently rather under-researched and forms a clear gap in the current scientific discussion on health care supply chains (e.g, Baltacioglu et al., 2007; Giannakis, 2011).

Even though the development of health care supply chains has been a trend in many countries and many scholars have contributed to the field, the focus in these studies has traditionally been on the upstream supply chains (e.g. pharmaceutical companies) rather than on the patient perspective and experience (e.g. Pedroso and Nakano, 2009; Motiwala et al. 2008). As many countries are issuing changes to their health care systems to decrease costs and increase efficiency, taking into account the customer perspective can give a more holistic view of how the health care supply and demand meet. In Finland, for example, the centralisation of health care services and decreasing the amount of service sites has been the prevailing trend along with the consolidation of municipalities.

In order to address this gap in the current literature, we will provide a customer perspective on the availability of health care services. This paper studies health care services as service supply chains which face an availability risk largely due to the re-organisation of the service supply. More precisely, the availability risk is viewed as a situation where the health care service supply and demand do not meet in terms of geographical distance. The availability of health care services is measured through both the absolute and perceived distance of the customers.

Literature Review

Service supply chain management
Despite the extensive focus received by supply chain management the academic contributions to the service supply chains still remains less explored. The studies on service supply chains have so far focused mainly on applications of existing SCM models to the management of service supply chains (e.g. Arlbjørn et al., 2011; Baltacioglu et al., 2007; Ellram et al., 2007). Few researchers have developed service supply chain management frameworks and have defined it to include the management of information, processes, capacity, service performance and funds from the earliest supplier to the ultimate customer (e.g. Ellram et al., 2004 and Baltacioglu et al., 2007). The benefits that the service supply chain management provides can be for example better coordination of processes, improved performance through process integration and improving the customer interface (Giannakis, 2011).

According to Arlbjørn et al. (2011) it is important to differentiate the tasks in service supply chain management, which can be achieved through different types of relationships with customers, as well as suppliers (Cho et al., 2012). Indeed, as identified by Cook et al. (2002) in an application of healthcare industry the traditional supply chain management is not implicit to the service sector practitioners due to lack of a systematic integration of supply chain functions. Ellram et al. (2004), lists seven theoretical processes of service supply chains including: Information flow, capacity and skills management, demand management, customer relationship management, supplier relationship management, service delivery management, and cash flow. By developing the model presented by Ellram et al. with SCOR model Baltacioglu et al. (2007) proposed a service supply chain framework with an application to the healthcare industry to include the following activities: demand management; capacity and resources management; customer relationship management; supplier relationship management; order process management; service performance management; and information and technology management.

Availability and availability risk
By definition, the availability of services denotes how quickly or fluently services are accessible to a citizen when a need for services occurs. More precisely, the availability of health care services is affected by supply and demand factors, which are interconnected (Lilrank et al. 2011, Lillrank and Venesmaa 2010). The supply factors include geographic availability (including such issues as location, distance, density, means and ways of transport) and timely availability (including such issues as opening hours, response times, queues, length of time to appointment) (Kuhlthau 2011, Lillrank and Venesmaa 2010). Respectively, economical factors (e.g. conditions for public/private service provision, social insurance system) and personal factors (e.g. motivation, educational (informational) level, language, culture, attitudes) are significant on the demand side (Lillrank and Venesmaa 2010).

In a broader scope, service availability is related to service quality measures (e.g. SERVQUAL and its simplified version RATER), which overall aim to measure gaps between customer expectations and experiences about the services. Following this logic, service availability concerns failures to match demand and supply, i.e. the gap between what is made available by the service provider and what is perceived accessible by the customer. If failures occur, an availability risk is confronted. The service quality framework puts customer perceptions clearly in focus. If geographic and timely availability were purely supply side factors decided by the service provider, a large part of the problem would be

solved. In the development of service supply chains through the quality logic, customers' personal perceptions on geographic and timely availability should be taken into account.

The availability risk is connected to inequalities in health and health service delivery. The availability risk occurs when the demand and supply are imbalanced due to changes in the factors presented above.

Empirical Research

Major trends on Finnish health and social care
Demographic change is a global challenge. In Europe, Finland is the first country to face steep ageing due to the great post-war (1945–1949) increase in the birth rate. The economic consequences of ageing are fundamental. Also demand for social and health services increases dramatically. This means a need for productivity improvement in public services. One of the major challenges of the future is how to support elderly people's welfare and ability to live at home. (SOTKAnet, 2012)

According to the Finnish constitution, public authorities must promote and take care of the health of the population. The provision of health care services in practice is the responsibility of municipalities and is financed primarily out of tax revenue. (The Constitution of Finland, 1999). Finnish municipalities are self-governing entities, which, under Finnish law, have the right to decide on their own matters. At the beginning of 2011, there were 336 municipalities in Finland. Municipalities control many community services, such as schools, health care, water supply, and local streets. (Ministry of Social Affairs and Health, 2008)

There is currently a heated political debate in Finland about reforming the municipality system. Essentially, a large number of small municipalities are seen as detrimental to the provision of public services. Recently, a large number of voluntary mergers have been agreed. In 2012, the government published an extensive plan aiming at merging municipalities to reach a minimum population of 20 000 per municipality. This would reduce the number of municipalities from 336 to approximately 70. However, the centralisation of services and political power also arouses opposition. A merger might immediately lead to the termination of municipal services in areas considered too remote by the majority in the new merged council. (Finnish Local and Regional Authorities, 2011a, 2011b)

Service provision in target area
The South Karelia Social and Health Care District (Eksote) provides health services, family and social welfare services, and services for senior citizens to the approximately 130 000 citizens of South Karelia in South-east Finland. Health and social services are closely integrated together in the South Karelia region. Eksote is working to deliver patient-oriented care by ensuring equal access to social and health care services to all citizens in the region, across the boundaries of municipalities. (South Karelia Social and Health Care District 2012) In South Karelia, a large number of aging people are living in sparsely populated areas from where it is often difficult to obtain transportation to urban areas where the social and health services are located. Eksote launched a Mobile Clinic in November 2010 to address these difficulties. The first duty of the Mobile Clinic (named "Mallu") was to deliver influenza vaccinations to sparsely populated areas. Since the beginning of the year 2011, the Mobile Clinic has stopped at different appointed villages in South Karelia, providing clients in sparsely populated or rural areas services closer to their home. The services offered have consisted of a nurse's consultation as well as social services in the form of service guidance for senior citizens. (South Karelia Social and Health Care District, 2012)

Sample
The empirical evidence was collected in a mail survey that was targeted to 60–90-year-old inhabitants in rural and suburban areas of South-east Finland. The target areas were defined by postal codes. The total target population was slightly over 79 000 persons. A stratified random sample of 3 000 people was drawn from the Finnish Population Register. The sample frame was based on the

population age distribution divided into five-year categories. A total of 1121 valid responses were received and the resulting age distribution was representative, indicating no statistical difference compared to the true age distribution in the population. The gender distribution was also in line with the target population; the share of female respondents was 53.8 percent (55.1 in the overall population). Due to incomplete responses, the effective sample used in the analysis was n=1006.

Measured concepts
Organisational mergers at municipality level often concern, in practice, the re-organisation of the geographic availability of services (e.g. in search of effectiveness, service sites in remote locations might be shut down), meanwhile preserving the availability of health care to the customer health. For this reason, the following customer related and perceived measures are proposed to help tackle the availability risk. The following measured concepts are developed based on the previous scientific literature (e.g. Kuhlthau, 2011, Lillrank et al., 2011, Lillrank and Venesmaa, 2010).

Demanded availability – the acceptable distance in kilometres to service points targeted for daily activities (e.g. groceries, pharmacies, banks and regular health care). The demanded availability is measured by group-wise means and the distribution of respondents' answers about acceptable distances to the point of service. The distance in this case describes the natural area where individuals act and carry out daily activities. The respondents were grouped by the municipalities in which they lived.

Actual availability – the distance between homes and city centres which is expected to represent the current state of Finnish service locations. Actual availability was defined by respondents' declared distances, measured in kilometres.

Perceived availability – evaluates experiences of individuals regarding actual service availability in their residential areas. The measurement consists of two scale items for the availability and acceptability of distances to services in the respondents' residential areas.

Research process
The research process of this study consists of two parts. In the first part of the empirical study, we aim to define the centralisation allowance of the local health care service supply and the customer demand for service as a geographical distance to service sites. The second part of the empirical analysis targets to test the perceived availability of regular health care services in the residential areas. The SPSS Statistics 20 was applied in the analysis.

Results

Assessing centralisation allowance of service networks
We have measured the actual service supply (i.e. locations of the service points) by the actual distance from the respondent's home to the local city centre. The mean value of the municipal specific distances (Table 1, actual dist.) is then applied as a rough estimate of the locations of service sites at present. The respondents were also asked to define the highest acceptable distance to service sites from their homes (Table 1, demanded dist.). In this aspect, respondents' entries are expected to represent the appropriate location of service sites with regard to their needs, capabilities and available logistics. Respondents were asked to consider acceptable distances from the perspective of services that are used regularly, daily or several times a week.

		Actual dist. [km]	Demanded dist. [km]			
	N	**Mean**	**Mean**	**Quartile 25% upper bound**	**Median**	**Quartile 75% lower bound**
Municipality 1	238	3.8	3.4	1.4	2.5	5
Municipality 2	40	5.3	4.8	0.6	2	6.3
Municipality 3	81	8.5	6.9	1	3	10
Municipality 4	79	8.7	6.6	1	3	10
Municipality 5	122	8.8	6.5	1	3	10
Municipality 6	15	8.9	7.8	1	10	18
Municipality 7	55	8.9	8.6	3	10	15
Municipality 8	214	10.5	6.1	2	4	10
Municipality 9	70	11.1	9.5	2	10	20
Municipality 10	92	12.3	10.1	2	6	15

Table 1: Actual and demanded distances to service sites

Findings support several conclusions about the centralisation allowance of the service sites. In an urban environment, the density of service site networks should be higher because customers are not willing to use distant service sites. Municipality 1 represents the demand of suburban inhabitants. There the mean values in actual and demanded distances are low and the 75% quartile of demanded distance is below the actual means of others. Findings from sparsely populated municipalities 6, 7 and 10 indicate that centralisation is less critical from the perspective of the demanded location of service sites. In these cases, the median of demanded distance is near the actual distances. The growing demanded distance is likely to be explained through the inhabitants' adjusted circle of living. The following observations from static areas support the assumption because a significant difference in the mean values of the actual and demanded distances cannot be seen in the static municipalities (3 to 7). In these cases, the service supply can be expected to fit well with the demand. The most interesting findings regard transitional areas (Municipality 8). We assume that the centralisation allowance is not available there because the 75% quartile of demanded distance is below the mean value of the actual distance to service sites. The centralisation of health and social care services during municipal mergers seems to have moved service sites outside of the inhabitants' natural circle of living in that particular area.

Analysing perceived availability

The two item measurement for perceived availability (see Table 2) describes the perceived obstacles to reaching local services. We applied the Likert scale, in which the respondent's opinion on statements varies between 1 (completely agree) to 7 (completely disagree). Thus, the higher the value is that the measurements reach, the lower the perceived availability is, and vice versa. The reliability of the measurement construct is good α=0.824 (limit for sufficient Cronbach's alpha >0.6) and inter-item correlation was measured at 0.714, indicating no collinearity. The distribution of scale variables was visually interpreted to be normal.

Measure	**Mean**	**SD**	**Alpha**
Perceived availability	2.51	1.72	.824
Services are available near my home			
Distance to services is acceptable			

Table 2: Measure and scale items

We divided the municipalities into four general areas for analysing the perceived availability of services. The analysed areas were defined by their geographical locations, population density and whether the area is under transition or not. The following grouping was then formed:

- Area 1: Densely populated suburban area where geographical distances are short.
- Area 2: Sparsely populated areas of recent municipal mergers and service provision reform.
- Area 3: Static sparsely populated rural areas.
- Area 4: Distant rural areas of static structures.

The perceived availability of services was tested using ANOVA to find out the differences in mean values between the areas. The test statistics (F-value) illustrates the confidence level related to the existence of a difference between mean values. The statistical tests indicate that statistically significant differences in mean values (Table 3) between residential areas can be found (F=6.087; p<.000). A post hoc test was then carried out to determine which areas manifest statistically significant differences in the perceived availability of services.

			Measure		**Post hoc[a]**	
Group	**Municipalities**	**N**	**Mean**	**SD**	**Difference to**	**p[b]**
Area 1	1	238	2.21	1.44	2	.000
Area 2	8	214	2.85	1.76	1	.000
Area 3	2, 3, 6, 7, 9	261	2.38	1.67	2	.017
Area 4	4, 5, 10	293	2.61	1.90	1	.043

[a])Tamhane's test, equal variances between groups not assumed
[b]) The difference between groups is statistically significant at p<.05

Table 3: Differences in perceived availability between municipalities

We did not find significantly decreased perceived availability from any analysed areas, but some indications of environmental characteristics in the availability risk were recognised. Overall, the perceived availability measured varies between good and moderately decreased. The analysis yielded several key findings that are worth discussing. Suburban areas indicate the lowest barriers to the use of services because of short distances, making the risk of unreasonably distant service locations low. Areas such as these are, however, sensitive to changes in the service provision networks due to the demand of a short distance to service sites. The transition area (Area 2) indicates a slightly lower perceived availability compared to other areas (Areas 1 and 3). The difference is a result of two major changes in the local government system of health and social care. First, large mergers of local municipalities have recently been accomplished in that particular area. Second, the health service provision responsibility has moved from municipalities to a federation of municipalities (i.e. the South Karelia Social and Health Care District) which operates as an external provider. As a sum of these trends, the centralisation of service sites from sparsely populated areas to the city centre has gained ground. Such development seems to increase the availability risks in Area 2 where three municipalities were merged a few years ago. Sparsely populated areas (Areas 3 and 4) do not differ from each other. A statistically significant difference to suburban areas and transitional areas can, however, be identified and the mean values of perceived availability in Areas 3 and 4 are between that of groups 1 and 2. The differences would indicate that geographical distance is an evident reason for the availability risk, but perceived availability seems to be strongly interlinked with the scope and speed of changes in the residential areas.

Discussion and Conclusion

Geographic distance to health care services is a pivotal issue in assessing availability risk from the customer point of view. Within the scope of this research availability risk is affected by demographic changes in population, structural changes in the municipal service system, and changes in customer needs and habits. A combined influence of these issues is likely to create imbalance between service demand and supply.

Demographic changes and availability risk

The challenge of ageing population needs to be resolved by increasing service capacity, either by increasing the capacity and effectiveness of existing modes of services or creating new service modes

and supply chains (e.g. by a stronger application of e-services). Ageing itself increases availability risk if nothing is done.. There are great differences in population dependency ratios between municipalities and regions. None of the municipalities are expected to report improved situation in the future. Smaller municipalities have the biggest challenges (The Association of Finnish Local and Regional Authorities, 2012). Remarkable net increase in service capacity (through capacity developments and efficiency gains) would be needed to balance the increasing demand. As it comes to geographic availability within our research, people would like to have services available within their circle of living in sparsely populated rural areas. For the elderly people, the circles of living become more restricted due to decreasing operational functionality by age. Further, due to constant population migration the circles of living in average are moving towards cities. Hence, at present the geographic service capacity need to be tailored to elderly, preserved in rural areas, while preparing for relatively stronger capacity increases in cities in the further future. It appears that while demographic changes occur, more flexible service supply chains are called for, like the Mobile Clinic mentioned earlier in the paper.

Structural changes in the municipal service system

Increasing size of municipalities is likely to create sparse network of service points covering large population. In such situations, the service supply would be centralized to the densely populated areas, where location of service sites does not fit to the demand of residents of rural areas. Our research showed that the centralization allowance limits have been reached in some municipalities in the sample region – a further centralization of services would conflict with the anticipated circle of living of people. Structural changes together with demographic changes might create a self-reinforcing cycle, where centralization decreases service site coverage, which in turn boosts population mitigation. As it is not self-evident that centralized service supply chains would be more cost-effective than distributed service provision, pure centralization in the cost of customer perceived availability seems to be merely increasing imbalance between service demand and supply. Actually, as mentioned earlier, one of the major challenges of the future is how to support elderly people's welfare and ability to live at home. Behind this aim is a strong economic logic that a prolonged period of independent life at home would save costs at system level. As the centralization strategy and home-centered approach exist at the same time, it inevitably shakes the demand-supply balance. More emphasis should be paid on integrated and seamless care paths, where the focus is in services, not in structural issues as such. Structural changes in the form of broader health care districts over single municipality borders might help overcome some factitious restrictions in municipality level services system. A municipality could for instance restrict the use of services from members from other municipalities, even if the underlying service site is within the circle of living of a customer. Further, some new forms of care would not be economically or operationally valid for a single municipality, but a health care district can organize the supply chain. A health care district might have a better opportunity to manage availability risk – at least in case it manages to avoid the centralization trap.

Customer perceived availability of health care services

Customer perceptions beyond actual service distances uncover deeper understanding about the geographical availability. Our findings show that suburban and transitional areas are somewhat more sensitive to the changes in the service system than the sparsely populated areas. A part of this phenomenon is explained through geographical distance, but a broader explanation is grounded in perceived availability. In static conditions, without major changes in the living conditions in residential areas, customers tend to become accustomed to the service availability within their circle of living. While the habituated balance is shaken by changes (e.g. centralization of services), it has always an effect on the perceived availability. This is, after a service site disappears from the circle of living, geographical distance might become an issue. As changes occur, it takes some time to get used to the new situation. People in sparsely populated areas accept longer distances to services, and more importantly they might not perceive longer distances a problem as much as people in suburban areas.

Scientific, managerial and social implications

The availability risk of health care services is still a focal subject under research and there are clear gaps in the current scientific discussion from several perspectives. This study addresses some new perspectives on the availability of health care services. Our contribution is formed through the combination of geographical availability and customer perspective. In earlier research geographical availability is often seen as a supply side factor, which easily limits the scope of analysis to service providers view only. Our approach enables an extension towards customer perceived availability. The implications of this research for future planning of health care services and managing availability risk can be summarized as follows:

- Customer perceptions of availability risk are a focal issue: Taking customer perspective into account in planning health care services increases customer perceived availability and social acceptance of services. Customers' perceptions and habits are important aspects in planning both volume critical services (e.g. hospital) and non-volume critical flexible services (e.g. a mobile health unit).
- There appears to be a 'habit' dimension in the availability risk: Suburban areas tend to be more sensitive to changes in the absolute distance to services than sparsely populated rural areas. Distance might have a great influence on availability risk, but it is context dependent and rooted in routines and habits of customer groups.
- The applied customer perceived availability measure indirectly accounts for both geographical and timely availability. Hence, it can be easily generalized. Actual distance and perceived availability should both be measured, but as separate items.

Limitations and further research directions

The implications of perceived availability and absolute distance are focal in reflecting the research in other contexts. The applied measure for perceived availability is technically valid, but its content should be elaborated to increase practical relevance. The results do not enable direct comparison between service availability between cities and sparsely populated rural areas. Further research should take into account a broader variety of residential areas in researching availability risk.

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