Barriers for capacity pooling in healthcare systems

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ABSTRACT

Background: In this paper, we examine how pooling – a theoretically based strategy for capacity planning – can be used to create a higher service level at a given total capacity in the healthcare sector.
Objective: The purpose of this study was to explore the perceived practical barriers for a capacity pooling strategy in healthcare systems.
Method: Based on a previous interview study with specialty department managers at Sahlgrenska University Hospital where 22 types of barriers for capacity pooling were found, grouped in six different categories, a questionnaire was developed and distributed among managers (N=1177; n = 473) in the Region Västra Götaland healthcare system. Data were analyzed with a confirmatory factor analysis (CFA), an explorative principal component analysis (PCA) and Analysis of Variance (ANOVA).
Results: The six barrier categories could not be confirmed by the CFA. Instead, the PCA identified four primary barriers for capacity pooling systems. These were; threshold heights, community view, recruitment difficulties and physical distance. A two-way mixed ANOVA showed that there were significant differences in perceived height among these barriers. However, there were only small differences among the different types of participating managers.
Conclusion: The four barriers need to be considered in order to introduce capacity pooling successfully in a healthcare system.

1. INTRODUCTION

Capacity planning is one of the major fields of operations management. Ensuring that operations can meet current and future demand effectively is a fundamental task of operations managers (see e.g. Slack et al. 2010). This task represents a significant challenge for the healthcare sector because of resource scarcity that makes it necessary to increase utilization and efficiency of existing resources by improving the system design and overcome inefficiencies in the present processes (Hulshof et al. 2012, Noon et al. 2003, Terwiesch et al. 2011). It is then fundamental to understand the impact of variations on the healthcare system (Walley 2007). The most significant source to variation in healthcare systems is variation in demand and capacity (Walley et al. 2007). According to Walley et al. (2007) the most variation is caused by the healthcare system itself and not by unplanned demand. Operations management can help to improve the system, for example by introducing tools that create volume flexibility to reduce or to better manage variations (e.g. Jack and Powers 2004, Noon et al. 2003, Terwiesch et al. 2011).

One example of such a tool for managing variations is capacity pools (e.g. Cattani and Schmidt 2005, Dziuba-Ellis 2006, Mahar et al. 2011, Kuntz et al. 2015, Terwiesch et al. 2011). A capacity pool is a general capacity that can be allocated to parts of the system where the existing workload and demand for capacity is unusually high (Hopp and Lovejoy 2013, Kuntz et al. 2015, Vanberkel et al. 2012). Therefore, capacity pools are a method to improve capacity utilization of current resources, which is particularly important for bottlenecks in the system (e.g. doctors and specialist nurses). The use of capacity pools is a well-known and extensively used method to improve capacity utilization and the service level in manufacturing firms and service organizations (see e.g. Cagliano et al. 2014, Kalleberg 2001, Qjn et al. 2015).

Capacity pools are also a method to effectively achieve the goal of matching current resources and the healthcare demand, resulting in gains in terms of shorter waiting times for patients, increased service level, and patient safety (Alvekrans et al. 2016, Lupien et al. 2007, Mahar et al. 2011, Kc and Terwiesch 2009, Kuntz 2015, SOU 2016:2). In addition, capacity pools can be a tool for creating a better working environment and a more attractive workplace. According to Hultberg (2007) a reasonable workload without large variations and overtime work with the possibility of recovery is one of the most important factors for a good psychosocial work environment. Improved production and capacity planning lead to reduced variations in workload and less overtime work (Brandt and Palmgren 2015). However, it requires that plans can be realized smoothly, even if short-term deviations occur, such as sick leave and occasions with unexpected high demand. Capacity pools are tools that create volume flexibility to manage such deviations, and thus as well tools for creating a better working environment (Hultberg 2007, Kuntz et al. 2015, Mahar et al. 2015, Noon et al. 2003).

From a theoretical perspective, there are several types of advantages that can be achieved with capacity pooling in healthcare systems (Ata and Van Mieghem 2009, Cattani and Schmidt 2005, Hopp and Lovejoy 2013, Vanberkel et al. 2012). Firstly, the average waiting times can be reduced, sometimes substantially, when a system is characterized by one single queue to all servers rather than individual queues for different servers. Secondly, when different parts of the system lack different types of basic capacity (for example, one unit needs more physicians, while another needs more specialist nurses), a better utilization can be achieved on an aggregate level through synergy. Thirdly, centralization of safety capacity can reduce, sometimes drastically, the need (and therefore the cost) for safety capacity without reducing the service level as some of the variations in actual demand among units will cancel out on an aggregate level.

An overly simple example may be used to illustrate the safety capacity issue. Assume that a healthcare division consists of four units that are similar in terms of competence requirements for nurses. Further, assume that the expected daily demand for nurses and its variation has been estimated for each unit as shown in table 1 below, and that demand is shown to be approximately normally distributed and independent across units. In order for each unit to reach a 90 % service level without a pooling approach, a safety capacity of 1.28 standard deviations is required at each unit. Thus, the total safety capacity required at the division is 19 nurses.

Table 1: Example of capacity pooling

	Unit			
	1	2	3	4
Mean	10	15	20	5
Standard deviation	3.1	3.9	5.5	2.4
Safety capacity required for a 90 % service level	4	5	7	3

Now, suppose that capacity planning with a pooling approach is used instead. The expected daily demand for nurses for the division as a whole is simply the sum of the expected demand for the units, that is, 50 nurses. However, the standard deviation for the division as a whole is the square root of the sum of the squared standard deviations for the units. This can be calculated to be 7.8 nurses. Hence, to reach a 90 % service level for the division as a whole, using capacity pooling, a total safety capacity of 10 nurses is required. In other words, a pooling approach can reduce the required safety capacity by almost 50 % without lowering the service level.

However, in practice, the theoretical analysis may for several reasons not be fully applicable in a real-life healthcare system such as the Swedish. One such reason, in the example above, is that the units in the pool should have similar competence requirements for their nurses. Theoretically, the pooling effect becomes stronger when the pool consists of more units, everything else being equal. On the other hand, the marginal effect of another unit in the pool diminishes, and it is in general more challenging to build pools with more units from a practical perspective as, for example, the required competence similarity, organizational issues, geographical issues, and other factors (Ata and Mieghem 2009, Cattani and Schmidt 2005, Creemers 2007). According to Utley and Worthington (2012) there is a trade-off in terms of capacity needs for a given service level between smaller pools dedicated to more homogeneous patient groups and larger pools dedicated to more heterogeneous patient or care mix.

Hence, we need to elaborately explore the practical potential to implement capacity pools in a healthcare system and study how many and which types of units in different contexts should be included in the same pool and at what level in the system the pools should be located. The literature in this area is mainly directed towards the so-called float pools (pools of nurses) and is almost exclusively anecdotal (e.g. Bates 2013, Lebanik and Britt 2015, Linzer et al. 2011, Ruby and Sions 2003). Hence, there is little knowledge about how they are organized and structured. This is particularly true in relation to pooling in multi-hospital systems. Thus, there is a lack of systematic research on support of the implementation of capacity pools in healthcare systems (Cattani and Schmidt 2005, Dziuba-Ellis 2006, Mahar et al. 2011, Mazurenko et al. 2015, Smith-Daniels et al. 1988).

Therefore, there is a significant need to systematically analyze the prerequisites for pooling capacity in a healthcare system. Hence, the aim of this paper is to explore the perceived practical barriers for capacity pooling in healthcare systems among middle- and top-level managers. Empirical knowledge is developed about perceived barriers for capacity pooling in different types of specialties and at different levels of the healthcare system.

2. THE HEALTHCARE SYSTEM IN SWEDEN

In the Swedish healthcare system, both basic capacity (capacity used to handle expected demand) and safety capacity (capacity used to handle the variations in actual demand) is, to a large extent, planned at the actual unit or clinic where the short-term need for capacity actually arises (Alvekrans et al. 2016). The advantage of this approach is that the control of capacity is directly linked to the current situation on a unit or clinic. The significant disadvantage with such an approach is that capacity in different parts of the system is managed independently. Hence, pooling can create a potential for synergy.

The use of temporary agency staff is widespread and increasing. The costs incurred by the Swedish regions for temporary agency staff have increased from SEK 1.9 billion in 2010 to SEK 5.2 billion in 2017. This development has caused a lively discussion in the media and profession about the effects of agency staff on patient safety, work environment, and finances (SvT.se 2016-12-27, SKL.se 2017-12-08, dagenssamhälle.se 2018-02-28).

Since the beginning of 2017, all 21 regions in Sweden operate in accordance with an agreement within the umbrella organization Sveriges Kommuner och Landsting (SKL), with the goal to become independent of agency staff in the healthcare sector by 1 January 2019. SKL is an association for municipalities, county councils, and regions in Sweden. Each region decides on the basis of their prerequisites of what actions are to be taken to succeed and develop their own action plan to achieve the goal. However, a common measure for all regions is to increase permanent staff by creating more attractive workplaces (SKL.se 2017-12-08).

Increasing costs for temporary agency staff is not a unique Swedish phenomenon. For example, in the United States of America (the US), the cost of temporary agency staff has increased to such an extent that it created financial problems in the sector (see, e.g. Dziuba-Ellis 2006, Diaz et al. 2010, Roach et al. 2011). Approximately 75 % of US hospitals use staffing agencies as a short-term strategy to resolve staff shortages and to create flexibility in staffing planning (Adams et al. 2015). According to case studies that we found in our literature review, a measure to reduce the cost of temporary agency staff is to replace agency staff with less costly internal staffing agency in order to maintain the flexibility that such capacity pools create in staffing planning (see e.g. Adams et al. 2015, Lebanik and Britt 2015). The establishment of a region-wide internal staffing agency is also a measure that both Region Västra Götaland and Region Värmland decided to investigate in their action plans to be independent of agency staff. Other Swedish regions are investigating similar arrangements linked to specific parts of their healthcare system, such as primary care and individual hospitals.

3. METHOD

3.1. Setting

Region Västra Götaland consists of four multihospital groups with 12 individual hospitals, including 4 university hospitals and 8 rural hospitals, and 4 stand-alone hospitals. There are also 202 primary health centers and 28 emergency centers in the region. In addition, there are four private hospitals with contractual agreement with the healthcare provider in the region. There are capacity pools linked to specific parts of the healthcare system in the region, such as primary care and single hospitals.

The Sahlgrenska University Hospital is one of the four multihospital groups in the region and also the biggest university hospital in Sweden, with 50 specialty departments. It covers all the specialties in Region Västra Götaland and account for approximately 50 % of total healthcare costs in the region. The hospital has approximately 16,500 employees and 2,000 beds. It has 50 specialty departments such as Cardiology, Clinical Physiology, Children's medicine, and Psychiatry. A designated manager heads each specialty department. The specialty department managers have the overall responsibility for the departments' capacity planning. Section managers and care unit managers are responsible for staff scheduling within a specialty department. Sections managers are responsible for scheduling physicians, while care unit managers are responsible for scheduling nurses and assistant nurses. Sahlgrenska University Hospital has an internal staffing pool of mainly nurses and assistant nurses.

3.2. Design and data collection

A pre-study was conducted where interviews were held with specialty department managers at Sahlgrenska University Hospital (for the details and results of the pre-study, see Fagefors et al. 2019). The interviewees described, among other things, potential barriers to capacity pooling. Based on the results, six categories of barriers to capacity pools consisting of 22 items were identified; competence, geography, culture, system, planning and recruitment. A web-based questionnaire was developed and distributed to all managers in the Region Västra Götaland in order to validate the findings in the pre-study. A seven-point Likert scale was used to record answers for each item, where a lower value meant a lower level of agreement with the statement. The questionnaire was tested on the interviewees in the pre-study before distribution and after minor adjustments it was sent to 1,144 managers in Region Västra Götaland. The questionnaire had a response rate of 41.3 %. The distribution of respondents in terms of manager type and department type was representative for the population.

3.3. Data analysis

The questionnaire data was initially analyzed using a confirmatory factor analysis (CFA) to see if the factor structure revealed in the content analysis could be confirmed (Hair et al. 2014). It could not, so a more exploratory approach was used instead to analyze these data. A principal component analysis (PCA) was used to determine the underlying factors (ibid.). SPSS version 25.0 with the AMOS plugin was used for all analyses. Finally, a two-way mixed ANOVA was conducted to investigate how the different manager types perceived the heights of the barrier types.

4. RESULTS

The results from the pre-study formed six categories of barriers for capacity pooling: *competence, geography, culture, system, planning, and recruitment.* The results from the interview study was used to develop 22 items that are presented in table 2.

Table 2: The 22 items used in the questionnaire

Factor	*Item*	*Questionnaire statement*
Competence	Komp1	A longer training is necessary before new staff can work well on my unit
	Komp2	Nurses without specialist training can work well on my unit

	Komp3	Physicians that are not yet specialists can work well on my unit
	Komp4	The practical day-to-day work on my unit reminds to a large extent on the work in other units
	Komp5	The work on my unit is characterized by a high degree of standardization
Geography	Geo1	I would have confidence in a regional capacity pool
	Geo2	I would have greater confidence in a local than a regional capacity pool
	Geo3	Larger geographical distances would obstruct the possibilities to create capacity pools in my type of unit
Culture	Kul1	There are no differences in culture between my unit and other similar units that would obstruct capacity pooling
	Kul2	There is a community view between my unit and other similar units that would facilitate capacity pooling
	Kul3	Traditionally my unit and other similar units have not been cooperating with capacity
	Kul4	Other similar units have different IT solutions than us
	Kul5	I believe that my staff in general would be positive to be part of a capacity pool
System	Sys1	The daily availability of staff is varying to a large extent on my unit
	Sys2	Our patients are often transported to other units when my unit is full
Planning	Plan1	The variation of healthcare demand over time is to a large extent predictable at my unit
	Plan2	In general, we do not have a shortage of staff at my unit
Recruitment	Rekr1	Poor local agreements mean difficulties when recruiting staff to my unit
	Rekr2	Competition regarding salary at other healthcare providers mean difficulties when recruiting staff to my unit
	Rekr3	Other factors besides salary are important aspects when recruiting staff to my unit
	Rekr4	There is a general shortage of nurses, which is a problem when recruiting staff to my unit
	Rekr5	I believe that there are mainly economic incentives that would be effective to recruit staff to a capacity pool

Table 3 presents descriptive statistics for the 22 questionnaire items. The distribution of specialties represented by the participating respondents was in line with the distribution of specialties in the Region Västra Götaland. Hence, we proceeded under the assumption that the data were not characterized by nonresponse bias.

Table 3: Descriptive statistics

Item	*N*	*Mean*	*S.D.*	*Skewness*	*Kurtosis*
Komp1	99	5.55	1.52	-0.84	-0.11
Komp2	91	5.08	1.99	-0.82	-0.49
Komp3	90	4.52	1.84	-0.39	-0.78
Komp4	91	4.62	2.04	-0.46	-1.06

Komp5	95	4.12	1.63	-0.24	-0.75
Geo1	88	4.01	1.68	-0.18	-0.80
Geo2	95	4.95	1.98	-0.83	-0.46
Geo3	84	5.08	1.96	-0.78	-0.64
Kul1	87	4.09	1.88	-0.05	-1.03
Kul2	84	4.49	1.57	-0.47	-0.05
Kul3	93	4.26	2.01	-0.19	-1.17
Kul4	82	2.82	2.27	0.92	-0.78
Kul5	89	2.06	1.29	1.22	0.82
Sys1	99	3.40	1.75	0.34	-0.87
Sys2	70	1.94	1.51	1.73	2.22
Plan1	95	4.24	1.69	-0.34	-0.83
Plan2	99	3.52	2.18	0.41	-1.25
Rekr1	88	3.45	2.02	0.24	-1.29
Rekr2	97	5.54	1.68	-1.27	0.83
Rekr3	98	5.78	1.20	-0.99	0.84
Rekr4	89	4.64	2.17	-0.50	-1.28
Rekr5	85	5.28	1.74	-0.78	-0.33

Tables 4-5 display the Pearson's correlations between item ratings. Many pairs of item ratings exhibited substantial correlations, indicating that there might be a smaller number of common underlying factors. Hence, a CFA indicated by the factor structure indicted by the content analysis was run.

Table 4: Correlations part 1

	Komp2	Komp3	Komp4	Komp5	Geo1	Geo2	Geo3	Kul1	Kul2	Kul3	Kul4	Kul5
Komp1	-0.35	-0.17	-0.18	-0.06	-0.21	0.02	0.10	-0.04	0.04	-0.06	0.36	-0.16
Komp2		0.51	0.32	0.18	0.26	-0.03	-0.08	0.12	0.03	-0.05	-0.60	0.00
Komp3			0.42	0.25	0.08	0.04	0.08	0.00	-0.04	0.01	-0.39	-0.17
Komp4				0.61	0.34	0.10	-0.02	0.25	0.23	0.00	-0.43	-0.07
Komp5					0.28	0.09	0.14	0.25	0.45	0.11	-0.25	-0.02
Geo1						0.04	-0.36	0.37	0.39	0.21	-0.27	0.29
Geo2							0.45	0.03	0.01	-0.09	-0.16	0.10
Geo3								0.07	0.06	-0.08	-0.08	-0.19
Kul1									0.52	0.16	-0.33	0.00
Kul2										0.03	-0.16	0.01
Kul3											0.14	0.02
Kul4												-0.03

Table 5: Correlations part 2

	Sys1	Sys2	Plan1	Plan2	Rekr1	Rekr2	Rekr3	Rekr4	Rekr5
Komp1	-0.08	0.14	-0.10	0.03	0.03	0.09	0.02	0.07	0.29
Komp2	0.15	-0.21	0.18	0.17	0.00	-0.07	0.24	-0.06	-0.22
Komp3	0.12	-0.10	0.04	0.07	0.07	-0.03	0.21	-0.09	-0.10
Komp4	0.07	-0.12	0.22	0.04	-0.11	-0.08	-0.01	0.08	0.08
Komp5	-0.08	-0.18	0.20	0.04	-0.10	-0.09	0.18	0.05	0.06

Geo1	0.10	-0.07	0.20	0.01	-0.12	-0.08	-0.10	0.20	-0.03
Geo2	-0.04	0.10	-0.05	0.09	0.03	0.02	-0.02	0.16	0.04
Geo3	-0.12	-0.08	-0.01	-0.13	0.02	0.06	0.07	-0.01	0.02
Kul1	-0.06	-0.15	0.15	0.06	-0.12	0.00	-0.12	0.06	0.09
Kul2	-0.26	-0.22	0.18	0.07	-0.12	0.03	-0.04	0.01	0.12
Kul3	0.08	-0.03	-0.17	-0.02	-0.07	-0.01	0.06	-0.03	0.11
Kul4	0.02	0.13	-0.11	-0.10	0.12	0.16	-0.12	0.10	0.20
Kul5	0.16	0.17	0.10	-0.17	0.16	0.00	-0.09	0.22	-0.12
Sys1		-0.03	0.08	-0.13	0.17	-0.25	0.13	0.18	-0.03
Sys2			-0.20	-0.25	0.36	0.20	-0.06	0.12	0.00
Plan1				-0.13	-0.09	-0.12	0.03	0.01	0.03
Plan2					-0.28	-0.15	-0.01	-0.35	-0.18
Rekr1						0.53	0.17	0.38	0.28
Rekr2							0.09	0.27	0.29
Rekr3								0.05	-0.01
Rekr4									0.17

The CFA showed that the data fitted the hypothesized factor structure poorly. A closer investigation of the data indicated that the bad reliability of the hypothetical constructs SYS and PLAN, which include only two items each, were the main reason of this result. Hence, these four items were dropped and an explorative principal component analysis (PCA) was conducted on the remaining 18 items, using Varimax rotation and Kaiser Normalization, to detect the common underlying factors. Barlett's test of sphericity was significant ($p < 0.001$) and the Kaiser-Meyer-Olkin measure of sampling adequacy was 0.561, indicating that the data were acceptable for a PCA. A solution where six factors had eigenvalues over Kaiser's criterion of 1 was found, which in combination explained 69.5 % of the variance. Table 6 shows the results in terms of factor loadings after rotation.

Table 6: The 18 items from the questionnaire and their rotated factor loadings.

	Factors					
Items	1	2	3	4	5	6
Komp4	0.81					
Komp3	0.74					
Komp2	0.63					
Komp5	0.52					
Kul1		0.86				
Kul2		0.85				
Geo1		0.52				
Rekr1			0.86			
Rekr2			0.79			
Rekr4			0.59			
Rekr3			0.47			
Geo3				0.86		
Geo2				0.85		
Kul3					0.73	
Rekr5					0.65	
Kul4					0.49	

Komp1					0.42	
Kul5						0.86
Cronbach's α	0.70	0.71	0.60	0.62	0.46	n/a

The items that cluster on the same factor in table 6 suggest that factor 1 represents *threshold height*, factor 2 *community view*, factor 3 *recruitment difficulties*, and factor 4 *physical distance*. Note that these factor names are arbitrarily chosen by the authors, based partly on what the items in each factor signify, but also to show divergence from the factors that emerged from the pre-study. These four factors exhibit tolerable values on Cronbach's α, indicating an acceptable reliability (Hair et al. 2014). Factors 5 and 6 comprise the remaining five items that did not cluster on any of the first four factors. Thus, they do not necessarily represent meaningful underlying factors. As can be seen, the fifth factor had an intolerable value on Cronbach's α and the sixth factor consisted of only one item, hence, these items were dropped. Hence, in summary, the results from the pre-study did certainly not coincide perfectly with the results from the qualitative content analysis, but several major factors – conceptual barriers for capacity pooling in healthcare systems – were common.

Next, a two-way mixed ANOVA was conducted to investigate how the different manager types, 1) care unit managers, 2) section managers and 3) department managers, perceived the heights of the four barrier types. Note that the barrier type is the within-subject factor (each respondent estimated the height of each barrier type) while the manager type is the between-subject factor (each respondent belongs to one of the three manager types) in this design.

The assumptions of the mixed ANOVA were met—the error variance of the dependent variable was not significantly unequal across groups (Levene's test, $p > 0.05$ for all barrier types), and the covariance matrices of the dependent variables were not significantly unequal across groups (Box's test, $p = 0.569$).

The descriptive results are displayed in table 7. The mixed ANOVA showed no significant between-subjects effect ($F = 1.09$, $p = 0.339$), hence, the different manager types did not perceive barrier heights in a significantly different way. On the other hand, there was a significant within-subjects effect ($F = 14.94$, $p < 0.001$), hence, the perceived heights of the four barriers were significantly different. A post hoc-analysis conducted with Bonferroni correction revealed that barrier types 3 and 4 both were perceived as significantly higher (average heights 5.11 and 4.92, respectively) than barrier types 1 and 2 (average heights 4.42 and 4.16, respectively). Finally, there was no significant interaction between barrier type and manager type ($F = 0.51$, $p = 0.602$).

Table 7: Descriptive results

Barrier type	Manager type	Mean	S.D.	N
F1	1	4.26	1.33	91
	2	4.17	1.03	13
	3	4.73	1.36	58
	Total	4.42	1.33	162
F2	1	4.21	1.28	91
	2	3.77	0.75	13
	3	4.16	1.39	58
	Total	4.16	1.29	162

F3	1	5.03	1.41	91
	2	5.62	0.98	13
	3	5.13	1.14	58
	Total	5.11	1.29	162
F4	1	4.82	1.62	91
	2	4.88	1.19	13
	3	5.09	1.59	58
	Total	4.92	1.58	162

5. DISCUSSION

Four barriers for capacity pools could be identified in the PCA; threshold heights, community view, recruitment difficulties, and physical distance. The factors and items that were excluded after the analysis might still be relevant in different parts of the healthcare system, although correlation with other items could not be proved. The literature that addresses the barriers for staff pools in healthcare system concerns solely pool of nurses or float pools and is mainly focused on three of our categories, namely threshold height, community view and recruitment difficulties.

An interesting finding was that we could not confirm any difference in perceived barriers between different manager types. Since the different manager types are managing various professions at different levels in the organization, we expected to find that the manager types would perceive the barriers to capacity pooling differently from each other. Our results might instead indicate that the identified barriers largely are relevant to all manager types regardless of organizational belonging and which profession that constitute their workforce, and that it is of importance for all manager types to address these barriers.

5.1. Barriers related to threshold heights

A crucial barrier to capacity pooling is the category of threshold heights in terms of inadequate professional competence and knowledge regarding practical differences between units. This barrier was similar to the barrier that was identified as “competence” in the interview study, with the difference that the item “A longer training is necessary before new staff can work well on my unit” was excluded. This could be an effect of that the questionnaire was sent to department managers in both primary care centers and specialty units, whereas the interview study mainly focused on specialty department managers at a university hospital.

The literature in this area is mainly directed towards practical issues. Concerning the professional competence, pool staffs can either be acting as temporary assistance to unit-based staff or as replacement staff with full patient assessments (Dziuba-Ellis 2006). In the first case, no specialist competence is required, which facilitates pooling because more clinical units can be considered together. In the second case, specialist competence is required to ensure patient safety and a good working environment, which obviously limits the potential of pooling. Adams et al (2015) has addressed the problem of temporary agency nurses lack of familiarity of organizational policies and procedures. The authors also note that the lack of standardization of, for example, nursing practice, unit routines, documentation and patient equipment makes it more difficult for pool staff (i.e., nurses) to rotate between different clinical units in a healthcare system. Bates (2013) and Rudy and Sions (2003) describe situations where staff spend a lot of time searching for supplies, asking for codes to locked rooms, and requesting assistance with unit-specific procedures. To avoid such barriers, it is important to train pool staff to work on multiple units in the healthcare system (so-called orientation programs) and to standardize practice, routines, equipment et cetera within the clinical units in the healthcare system (see e.g. Adams et al. 2015 and Roach et al. 2011). According to Agosto et al. (2017), it is crucial to shift from a unit-based to system-based model of education and practice. In that process, the float pool unit may be an important participant when standardize practice and routines due to their experience from multiple units (Straw 2018). In addition, developing unit-specific pocket guides or tip sheets and adequate pool staff support on the receiving unit are useful tools to reduce these practical barriers (Bates 2013, Roach et al. 2011). However, implementing appropriate orientation programs and pool staff support may in many cases be difficult due to resource shortages (Roach et al. 2011).

5.2. Barriers related to community view

In the category barriers related to culture, the informants claimed that there is a low willingness to be part of a capacity pool. Moreover, they claimed that different IT solutions is a barrier to use capacity pools. However, it could not be confirmed in the factor analysis that this correlates with the other items related to culture, which was no surprise, and a new barrier was identified as "community view". A new item was added to the barrier, namely "I would have confidence in a regional capacity pool", which is logical considering that capacity pools that are further away in the organizational structure more likely will be more different regarding culture.

The interviewees claimed that there is a lack of sense of community between the own unit and a capacity pool. Several studies indicate a higher job satisfaction and organizational loyalty among permanent nurses compared to temporary agency staff. Temporary agency staff typically experience a higher level of frustration, anxiety, occupational stress and burnout due to, for example, inadequate orientation, lack of trust from unit-based staff and insufficient support from clinical unit management. In clinical unit that use temporary agency staff to a greater extent, there are also more permanent employees who are considering leaving the unit (see e.g. Bates 2013, Mazurenko et al. 2015, Rudy and Sions 2003). According to Diaz et al (2010), many staffing pool solutions have even worsened the staff shortages. According to Bates (2013), one can avoid this by staffing the pool with independent and flexible individuals that enjoy the independence and the variety of challenge and experiences that rotating between multiple clinical units entails. As mentioned above, another important way of making rotation a positive experience is appropriate unit orientation and dedicated pool staff support on the receiving units (see e.g. Roach et al. 2011, Rudy and Sions 2003).

5.3. Barriers related to recruitment difficulties

One item from the interview study was excluded from the barrier related to recruitment after the analysis, namely "I believe that there are mainly economic incentives that would be effective to recruit staff to a capacity pool". This statement differs from the other items regarding recruitment, since it focuses on staffing the capacity pool, and not staffing the own unit. This might be an explanation to why it could not be confirmed to be correlating with recruitment difficulties. Barriers related to recruitment difficulties were found to be significantly higher than barriers related to threshold heights and barriers related to community view.

According to the specialty department managers, the lack of nurses is one of the main barriers related to recruitment. This is no new phenomenon, in the early 2000s the use of internal staffing pools was declining in American hospitals due to difficulties in recruiting qualified staff to the pools or by the fact that pool staff leaving for permanent work in clinical units (Cavouras 2002). The inability to staff the pool leads to inadequate service levels, that is, inability to fill in gaps in staff schedule due to sick leaves, temporary leaves and vacancies et cetera. Therefore, recruitment and retention of qualified staff are main challenges for staff pool managers in order for the pool to be a reliable facility in the healthcare system. Pay supplements, scheduling flexibility, independence, skill development and networking are widely used incentives for attracting staff to work in staffing pools (Bates 2013, Cavouras 2002, Dziuba-Ellis 2006, Larson et al. 2012, Lebanik and Britt 2015).

5.4. Barriers related to physical distance

Department managers expressed a lack of trust in a capacity pool that is supposed to cover a large geographical area. Trust is generally an important factor when integrating staffing pools in healthcare systems. According to Mazurenko et al. (2015), trust must be built from top to bottom through, for example, effective communication between the staffing pools and the units where the pool staff will be working, and by complete orientation program to the units on which the pool staff are assigned to work. Barriers related to physical distance was also found to be significantly higher compared to barriers related to threshold heights and barriers related to community view. This indicates that capacity pools preferably should be organized close to the clinics, and that a region wide capacity pool is not requested by the managers.

5.5. Barriers that could not be confirmed

The items related to the barriers “system” and “planning” are to a large extent varying depending on the characteristics of the specific unit. Since the questionnaire was sent to managers in both primary care centers and specialty departments, it is not surprising that these factors could not be confirmed in the CFA. However, they could still be relevant for defined parts of the system, for example specialty department managers at larger hospitals.

The category barriers related to the system is expressed by specialty department managers in terms of high locally variations of the availability of certain categories of staff, resulting in overstaffing during some periods and understaffing at other times. According to Dziuba-Ellis (2006), internal staff pools on an appropriate level in the healthcare system can be a useful approach to balancing understaffed and overstaffed clinical units. Today, a widely used approach when clinical units are understaffed is instead to hire costly staff from external staffing pools (Larson et al. 2012).

The category barriers related to planning is emphasized by specialty department managers through the fact that excess capacity is more or less non-existent while excess capacity at the same time theoretically is required at an aggregate level in order to plan a capacity pool. In the literature, on the contrary, internal staffing pools are emphasized as an approach to balance the effect of insufficient staffing levels (i.e., lack of basic capacity) and budget constraints (Dziuba-Ellis 2006, Linzer et al. 2011, Roach et al. 2011). According to Roach et al. (2011) staffing pools is a short-term measure to ensure adequate staffing on the clinical units on an “as-needed basis” to fill gaps in staff schedule due to sick leaves, temporary leaves and vacancies et cetera. Staffing pools can also be a tool for reduce overtime and the cost of external agency staff, to maintain minimum nurse-to-patient staffing requirements, to improve work environment and to create flexibility in staffing planning (Hultberg 2007, Kuntz et al. 2015, Larson et al. 2012, Lebanik and Britt 2015, Mahar et al. 2015, Noon et al. 2003).

6. CONCLUSION AND FUTURE RESEARCH

This study has identified four different categories of potential barriers for capacity pooling in a healthcare system; barriers related to threshold heights, barriers related to community view, barriers related to recruitment difficulties and barriers related to physical distance. In order to introduce capacity pooling successfully in a healthcare system, these barriers need to be addressed by both managers of the units that utilize the capacity pool as well as managers of that specific pool. For example, proper introduction programs and suitable tasks for the capacity pool employees can be identified to overcome some of these barriers. However, there is a need for future research to fully understand these barriers, and further studies are required to determine their optimal size, which competences that should be included, where these capacity pools should be located in the organization, and how they should be controlled for the most efficient use of resources.

Ideally, all identified barriers can be overcome and managed sufficiently when implementing capacity pools in healthcare systems. However, if not all four barriers can be addressed for various reasons, focus should primarily be laid upon the two barriers that were found in this study to be significantly higher, namely barriers related to recruitment difficulties and barriers related to physical distance. For example, the results indicate that capacity pools should be formed within a close proximity to the departments if possible. Moreover, incentives to work in a capacity pool must be identified so that the capacity pools can be sufficiently staffed.

In order to provide more general guidelines on capacity pooling, future research should explore more generally how the characteristics of different specialty departments or other organizational units are related to different barriers. A possible way to accomplish this could be to use multiple regression with the perceived weights of the different barriers as dependent variables, and unit characteristics as explanatory variables. That way, measures of the different barriers' significance in different system contexts could be obtained.

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