What makes a physician prefer one supplier over another?

A study on physicians' supplier preference criteria.

Author: Farah Freij
University of Twente
P.O. Box 217, 7500AE Enschede
The Netherlands

ABSTRACT,
Various research has shown that clinical input has probably been the most important influence over expensive medical items choices for decades. However, what elements influence the physicians' criteria has been quite neglected in literature. Due to the unclarity of these criteria, inefficiencies within the procurement process and supply chain are likely to emerge. Therefore, this study is aimed at finding out which criteria determine the physicians' preferences over certain suppliers. For this study, the databases of Scopus, Web of Science and PubMed were used to review articles. Furthermore, case study research was conducted, containing three interviews held with experts that work in healthcare organizations. Based on the literature review and interviews, multiple physicians' criteria to prefer one supplier over another came to play. Moreover, the interviews revealed that distinction in criteria tends to be made when taking disposable and non-disposable products into account. For disposable items the physicians' base their supplier preference on the costs of the product that suppliers offer. Regarding non-disposable medical items, the physicians' supplier preference criteria are product innovation, sales/service, brands offered, instrumentation of the product, available supplies, price awareness of products, longevity of the product, ease of use of product, manufacturer reputation, sales representatives, training programs, existing relationships with other physicians, possibility to develop a close relationship with supplier, cost of the product, and quality of the product.

Graduation Committee members:
First supervisor – dr. Carolina Belotti Pedroso
Second supervisor – dr. Frederik Vos

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1. INTRODUCTION

The high scarcity of gravely needed medical supplies, caused by the sudden emergence of the COVID-19 pandemic, has put an emphasis on the importance of procurement within the healthcare context. To prevent the spread of the virus to and from health care workers and patients relied on effective use of personal protective equipment (PPE), such as gloves, face masks, air-purifying respirators, goggles, face shields, respirators, and gowns (Livingston et al, 2020, p. 1912). It is important to note that in times like these, physicians still have preference over certain items, the so-called physician's preference items (PPIs). The existence of physician's preference should not come as a surprise. Workers in many skilled occupations, as well as athletes in many professional sports, are known to have favorite tools - and vendors who supply them (Burns et al., 2018, p.40). Various research has shown that clinical input has probably been the most important influence over product choice for decades (DeJohn, 2005, p. 9-11), however the theoretical input, such as physicians' criteria has been quite neglected.

Due to the unclarity of these criteria, inefficiencies within the procurement process and supply chain are likely to emerge. As stated by Burns et al. (2018), physician's preference and influence over product – and therefore supplier – choice affect for instance the prices that hospitals pay, partially by reducing the hospital's ability to standardize on a small number of vendors and obtain bulk pricing (exchange high volume for lower unit cost). Rising health care costs, technological innovations introduced during the 1990s and early 2000s, the emergence of nationally organized group purchasing organizations (GPOs), the advent of bundled payment, and growing attention to the hospital supply chain have highlighted these issues regarding physicians' preferences (Burns et al., 2018, p.41). These arguments make the importance of acquiring the criteria physicians hold for their supplier preferences evident.

Therefore, the research question is: *which criteria determine the physicians' preferences over certain suppliers?* As there are various incentives to improve the knowledge on physician's supplier criteria, the importance of doing so is being emphasized. As Shbool et al. (2020) state, effective, and efficient selection of medical items and supplies can lead to the better management of inventory within a healthcare organization's supply chain and, consequently, a more sustainable system, as well as a reduced total cost. Physicians' supplier criteria can influence this, which increases the need for this topic to be explored further.

In this paper the theory will first be discussed. This includes the concept of purchasing in the healthcare sector, and the concept of the purchasing department within the healthcare sector. Subsequently, the research design and data collection will be presented. Additionally, the analysis of the data from the interviews and the results of these interviews will be evaluated. Furthermore, the findings from the research – literature and interviews – will be discussed. Next, a conclusion based on these findings will be presented. As last, limitations of this research and recommendations for further research will be discussed.

2. LITERATURE REVIEW

2.1 The Concept of Purchasing in the Healthcare Sector

2.1.1. The main characteristics of purchasing in the healthcare sector and its difference with other sectors

The main characteristics of purchasing in the healthcare sector have been discussed by various authors. According to Nachtmann and Pohl (2009), purchasing practices are crucial for an organization's success, yet in the healthcare industry, practices are immature and often overlooked within the strategic vision. Gorji et al. (2018, p. 6299) argue that strategic purchasing in healthcare services is a key component in improving health system performance, and it has been one of the most important issues in health system reform around the world. Van Raaij (2016, p.14) concludes that purchasing in the healthcare sector consists of two quite distinct areas of purchasing and supply management, namely purchasing of care and purchasing for care. According to van Raaij (2016, p.15) the purchasing of care refers to the process through which healthcare financers – e.g., health insurers – select, contract, and manage relationships with healthcare providers – such as hospitals and GPs. This type of purchasing in healthcare occurs in countries with a purchaser-provider split (Figueras et al., 2005, p.26). Purchasing for care refers to the process through which healthcare providers select, contract, and manage relationships with suppliers of clinical and non-clinical inputs. For instance, healthcare organizations purchasing hospital beds or cancer drugs are examples of purchasing for care (van Raaij, 2016, p.15).

As argued by van Raaij (2016, p.14) purchasing and supply chain management (PSM) in the healthcare sector is in part very similar to PSM elsewhere, and in part very special. What makes the healthcare sector differ, according to Kannampallil et al. (2011), is that the healthcare sector is a highly complex sector, when compared to other industries sectors. First, healthcare sector cannot predict the demand, and therefore they cannot know for sure what specific types of services are needed (Knight et al., 2017). Besides that, logistics costs can be up to 20 times higher than other industries (Beaulieu, Roy, and Landry, 2018). All in all, the healthcare sector has its challenges opposed to other sectors.

2.1.2. The Main Challenges Within the Purchasing Field in the Healthcare Sector

A huge challenge in healthcare purchasing is the unpredictability of patient care; medical centers do not know which patients with which ailments will require treatment (Knight et al., 2017, p.102). Furthermore, Hanson et al. (2019, p. 501) state that within strategic purchasing for healthcare challenges of coordination and adaptation exist – and tend to arise. In addition, Preker et al. (2007, p. 68) state that another challenge in healthcare is that asymmetry in information is often great between patients and their healthcare provider about both the causes and likely effectiveness of treatment. The author adds that often a third party – the government or an insurer – pays the bill, which can result in individuals and households make irrational decisions they would not make when consuming other goods and services. Furthermore, patients usually need help from both a health care provider who can advise them what to do and from organizations that handle the dual complexities of financing and delivering high-level care (Preker et al., 2007, p.68).

2.2 The Purchasing Department in Healthcare Organizations

2.2.1. Purchasing Roles and Responsibilities in Healthcare Organizations

According to Kraljic (1983), strategic purchasing was introduced as a practice used to secure items crucial to an organization's daily operations where, due to the abundance of the items and the likelihood of a continued requirement, would benefit from the establishment of a centralized contract to purchase the item for an organization. In accordance with this, Sanderson et al. (2018, p. 4) state that strategic purchasing within healthcare

organizations is much more than the simple financing of healthcare services. The author argues that it involves an evaluation of population health needs, the planning and design of healthcare services, the qualification and selection of appropriate providers, and the incentivization and management of providers to ensure good performance. Regarding healthcare, the single largest cost after labour is materials, as stated by Gurger (2013, p. 1650). The author continues, stating that increasingly sophisticated and expensive medical devices are being introduced in the market every year. The number and variety of medical procedures performed have also risen together with more demand for such medical device and equipment (Gurger, 2013, p.1650). The increase of medical devices introduced, requires the purchasing department to have precise knowledge on all updates in the market, while simultaneously being able to procure the items for the healthcare organization. This can be a tricky process, especially given the quick rate where new medical devices and equipment are being introduced.

As Farmer (1981) states, an organization's strategic purchasing strategy will consider the total transactional costs as well as the total life-cycle costs of the product, to include efficiencies outside of the purchasing process that may be provided by the supplier. Therefore, the purchasing strategy of an organization is also crucial for the efficiency of an organization. Additionally, gaining control of the hospital's supply chain – the flow of products and associated services to meet the needs of the hospital and those who serve patients – is a key goal of the purchasing department, but does not come without special challenges (Montgomery et al., 2007, p.308).

2.2.2. The Importance of Purchasing Within Healthcare Organizations

As argued by McKone-Sweet et al. (2005, p.4) the strategic importance of hospital supply chain – including purchasing – is evident as it makes up as much as forty percent of the typical hospital's operating budget. Furthermore, Knight et al. (2017, p.94) state that purchasing practices are a crucial component of an organization's success.

Additionally, according to the World Health Organization (WHO) (2000, p.105) strategic purchasing is a process that goes beyond a passive and relatively unsystematic allocation of funds to healthcare providers to encompass a continuous search for the best interventions to purchase, the best providers to purchase from, and the best payment mechanisms and contracting arrangements to pay for such interventions. Therefore, it is safe to conclude that healthcare purchasing is more than just allocating products and services for healthcare organizations.

Sanderson et al. (2018, p.4) add on to this, stating that healthcare purchasing involves an evaluation of population health needs, the planning and design of healthcare services, the qualification and selection of appropriate providers, and the incentivization and management of providers to ensure good performance. As mentioned by Knight et al. (2017, p.94) one aspect of purchasing is strategic sourcing, where buyers form relationships with suppliers that result in cost savings through logistical and purchasing efficiencies.

The healthcare purchasing department is also crucial for physicians in specific. For instance, high-cost and high-quality devices frequently referred to as physician preference items (PPIs) – to distinguish them from more humble supplies purchased through bulk discounts – account for one-third of overall hospital supply costs and are rising as a percentage of the total (Financial Leadership Council, 2006). The purchasing department therefore has the role of 1) acquiring these items for physicians and 2) simultaneously keep the costs for the PPIs as low as possible.

2.2.3. Physicians' Influence over the Purchasing Department

Physicians are widely recognized as both professionals (Freidson, 1988; Sharma, 1997) and as surrogate buyers (Aggarwal et al., 1998; Bhakoo et al., 2012). According to Abdulsalam et al. (2018, p.13) the influence of physicians on supply selection decisions is substantial. Physicians are traditionally considered to be the primary selectors of medical supplies and bear the liabilities associated with the products they use or prescribe, for example, pharmaceuticals, surgical instruments, or medical implants (Abdusalam et al., 2018, p.13). Moreover, as stated by Schneller and Smeltzer (2006), most of the most expensive materials – up to 61 percent of the total supply expenditures – are for items about which physicians have strong preferences (PPIs). Furthermore, Burns et al. (2018, p.41) states that physicians' preferences and control on the purchasing department affect the prices that hospitals pay. In addition, the author explains that because of physician preferences the hospital's ability to standardize on a small number of vendors and obtain bulk pricing (buying higher volumes for lower unit costs) might be reduced.

However, the importance that these physician preferences are being considered must still be emphasized. According to Montgomery et al. (2007, p.318) whenever it occurs that certain items are limited to physicians, a greater burden will be placed on physicians to adjust to a restricted set of products. Subsequently, this often requires that physicians change their practice decisions to comply with the product's availability established under the formulary or make frequent requests for exceptions (Montgomery et al., 2007, p.318). This can have negative consequences, thus should be avoided. As the author further states, hospitals must rigorously assess products' equivalency with the risk that a restricted product set could compromise patients' safety and outcomes. Furthermore, if physicians have alternative facilities at their disposal, hospitals also face the risk that physicians will take their patients elsewhere or even band together to develop specialty facilities outside the hospital – to minimize their dependence on the hospital's resources. (Montgomery et al., 2007, p.318). This can indicate that there might be a trade-off between cost advantages by buying in bulk or patient's safety.

Again, the importance of knowing the supplier criteria of physicians is being highlighted. By finding out these criteria and trying to align them as much as possible with those of the purchasing department of healthcare organizations, better teamwork will result. This cooperation between purchasing and the physicians then might also ensure that e.g., the trade-off between these cost advantages and patient's safety will diminish.

2.2.4. Possible Criteria That Determine Physicians' Preferences Over Certain Suppliers

To understand why physicians might have preference between suppliers, it is important to define what is meant with preference. As stated by Alekserov et al. (2007), preference is a rational individual choosing the best alternative to maximize utility or value. Kirkden and Pajor (2006, p. 31) argue that the term preference denotes a difference between the strength of motivation to obtain or avoid one resource or stimulus and the strength of motivation to obtain or avoid another. Therefore, the definition of preference used in this research is 'a rational individual's motivation to choose the best alternative to maximize utility and value opposed to any other option'.

Furthermore, it is of relevance to review in literature what criteria determine physicians' preferences over suppliers according to literature. According to Burns et al. (2018, p.40) the product and non-product strategies of medical device firms suggest that physician's preference may similarly rest on the dimensions of product innovation and sales/service. In addition, the author states that physicians also tend to have specific brand preferences for device product lines, instrumentation, and available supplies. Therefore, product innovation, sales/services, brand preferences, instrumentation and available supplies are seen as contributing criteria for physicians to prefer one supplier over the other. Additionally, Wasterlain et al. (2017), state that price awareness of products significantly influences physicians' choice of products – and therefore ultimately supplier choice. Thus, this is an indication that price/cost is likely to influence physicians' criteria over certain suppliers.

Physicians also prefer products that are easy to be managed according to Shbool (2016). Miksic et al. (2005), agree as they also state ease of use of a product as a criteria physicians base their supplier preference on. Furthermore, according to Miksic et al. (2005), longevity, instrumentation, product innovation, manufacturer reputation, the sales representatives, training programs, and existing relationships with other physicians in the practice determine physicians' preferences over certain suppliers. This is in accordance to Burns et al. (2017, p.42), who state that not all factors that influence physicians' criteria are tied to product cost but rather to personal experience with the product, assessment of a patient's interests, and relationships with the sales representative. These findings are in line with Abdusalam et al. (2018). According to Abdusalam et al. (2018, p.13), physicians value professional relationship strategies with their suppliers. The author states that traditionally within healthcare, physicians are regarded as the primary selectors of medical supplies and bear the liabilities associated with the products they use or prescribe. Physicians tend to appreciate and trust the expertise suppliers have over their own products, and therefore like to develop strong relationships with suppliers. Furthermore, physicians seek to develop strong relationships with suppliers who support physicians in post-sale product-related services and education (Schneller and Smeltzer, 2006; Thill, 2015).

In the table below, a list with the authors and their stated physician's criteria for supplier preferences can be viewed.

Author	Criteria
Abdulsalam et al. (2018)	Possibility to develop a close relationship with supplier
Burns et al. (2018)	Product innovation, sales/service, brand preferences, instrumentation of product, and availability of supplies
Miksic et al. (2005)	Longevity of product, instrumentation of product, ease of use of a product, product innovation, manufacturer reputation, sales representatives, training programs, and existing relationships with other physicians
Schneller and Smeltzer (2006)	Possibility to develop a close relationship with supplier
Shbool (2016)	Ease of use of a product
Thill (2015)	Possibility to develop a close relationship with supplier
Wasterlain et al. (2017)	Price awareness of products

Table 1. Physicians' supplier criteria

As can be seen in the table, the criteria that are mentioned multiple times in literature are product innovation, the ease of use of a product offered by a certain supplier, the possibility to develop a close relationship with supplier, and the instrumentation of products. Therefore, it can be stated that based on literature, these are the criteria the physicians keep an eye out for the most. However, all criteria should be treated as equally important, to avoid any kind of bias.

2.3 Synthesis

As stated by Morrisey et al. (1990, p.586) physician integration strategies are attempts to bring physicians into hospital administration by giving them a role on the hospital board, employing them in administrative or clinical capacities, or expanding the administration issues dealt with by medical staff committees. By making use of physician integration strategies within purchasing, duplicity and unclarity between physicians and the purchasing department can be minimized. Moreover, this can enhance the clarity of physicians' criteria on items as well as on suppliers. Furthermore, the literature brings several criteria physicians might prefer when considering certain suppliers. Ultimately, knowing physician's supplier preference criteria enables healthcare organizations to make a more accurate selection on suppliers. Additionally, as stated by Corsten and Kumar (2005, p.80), collaborative relationships through joint efforts of the partners create unique value that neither partner create independently. This indicates thus that there is importance for the healthcare organization to focus on strategies to build on the collaborative relationship between the suppliers and physicians – as well as the purchasing department and physicians. There are thus multiple incentives to explore physicians' criteria for supplier preferences.

3. METHODS: RESEARCH DESIGN AND DATA COLLECTION

3.1 Research Design

The aim of the research presented in this report is to find answers and insights into the following research question: *which criteria determine the physicians' preferences over certain suppliers?*

The research presented is literature-based, meaning that all findings are based on previous (academic) literature and academic books. The databases of Scopus, Web of Science and PubMed were used to review articles. The keywords used were *healthcare purchasing, physicians' preferences, strategic purchasing*, and *healthcare sector*.

Furthermore, interviews with a strategic buyer. physician and a medical specialist in training were held. All interviewees were currently in employment at a hospital at the time of the interviews, as the subjects of this research are required to have experience within the healthcare sector. For the interview with the strategic buyer, the purchasing department of a hospital was contacted for information if anyone in that department was willing to be interviewed. Moreover, for the search for physicians and medical specialists (in training) to interview, flyers with information on the research, and contact details were handed out at various secretaries within the hospital. The secretary reached out in case there was any interest from physicians/similar occupations to cooperate with this research.

The data has been gathered between the months of April and June 2022. The orientation and literature search started in April; the research question was also developed within this time period. Throughout April and May the interview questions were devised and established. In June the interviews were held, and the obtained data was processed.

Two questionnaires were developed, one for the strategic buyer and one for the physicians and medical specialist in training. The questions developed for the strategic buyer are the following:

1. What types of medical supplies does your organization purchase?

2. Could you describe the procurement process?

3. Who is involved in the acquisition of medical supplies?

These questions are related to understanding the purchasing process within the organization itself. The next questions are related to the physician's involvement within the purchasing process:

4. Are there situations where physicians are involved with the procurement process? If so, how are physicians involved?

5. Are possible preferences that physicians might have for brands/products communicated? If so, how do you become aware of these preferences?

6. Do you think physicians should be more involved with the procurement process? Why do you think so?

7. What do you think physicians would deem as criteria for suppliers?

The questions developed for the physicians focused on the involvement and awareness of physicians of the purchasing process. The questions are as follows:

1. Do you participate in the purchasing process for expensive items (such as prothesis, cardiac stents, etc.)?

2. Are you aware of the prices of these items, and of items you use in general?

3. Do you think you could collaborate with cost containment efforts in the purchasing department?

4. Do you prefer certain suppliers? If so, how are your preferences over certain suppliers determined?

5. Are you aware of differences between brands when you use products, and do you prefer certain brands? What kind of criteria would influence this preference?

6. What would be possible reasons for you to switch supplier(s)?

7. When taking supply into account, can you already feel the repercussions of the current global crises? In what way can the impact be felt the most?

The interviews were held as well as directly – thus an actual conversation – as indirectly through Microsoft Teams. The interviews took approximately half an hour. Subsequently, respondents were required to give consent to the interview – and the recording of it – throughout a form. Subsequently, the interview was transcribed with help of the recordings to have all the information that was discussed. It is important to note that the interviews were held in Dutch, as that is the language the interviewees are most familiar with.

3.2 Data Collection

The transcriptions and recordings do not contain any names of the interviewees, as well as the organization they work for, to preserve anonymity. What can be said is that all interviewees are employed at the same healthcare organization. The interviewed strategic buyer received the code name 'SB#1' when processing the data. In addition, the physicians/medical specialist in training received the codes 'WP#1' and 'WT#1'. The codes with explanation can be viewed in the table below. Furthermore, in the table the gender and the years the interviewees have been working within their stated profession in this healthcare organization can be seen.

Code	Explanation of code	Occupation	Gender	Years active
SB#1	Strategic buyer no. 1	Strategic buyer	M	4
WP#1	Worker – physician	Physician	M	17
WT#1	Worker – in training	Medical specialist in training	F	2

Table 2. Overview of the interviewees

After completion of this report, these transcriptions and recordings have been deleted. This is to guarantee the data is handled carefully, and to prevent leaks from happening. The interviews were transcribed as quickly as possible, to ensure that the interpretation and context of the transcription were completely accurate. After transcription the interviews were coded with help of the software Atlas.ti. The interviews were inductively coded, meaning the codes were derived from the data, thus not predetermined. The codes can be viewed in the appendix.

4. RESULTS

4.1 Company Introduction

The strategic buyer, physician, and medical specialist in training – thus all interviewees – work at the same hospital. This hospital is one of the biggest in the east of the Netherlands and has been busy with commercializing its business in the last few years. Furthermore, the healthcare organization is a member of a hospital alliance, that strives to enhance healthcare in the Netherlands. More cannot be stated, to preserve the anonymity of the hospital.

4.2 Findings

4.2.1 The Organizations' Purchasing Process

Based on the interviews held with the actors stated above, various insights of the purchasing process within the organization have been gained. To understand the perspectives of the purchasing department and the physicians (and similar occupations) towards the purchasing process, it is required to understand the purchasing process within the stated organization.

Interviewee SB#1 has revealed that within this healthcare organization, the purchasing department has the responsibility for the facilitation of products and services. The distinction is made between disposable products and non-disposable products. Examples that SB#1 has given of disposable products that are being procured by the purchasing department are items such as PPEs, plasters, needles, and cymbals. The examples of non-disposable products that the same interviewee has given are (durable) medical equipment, services, investments, and devices (e.g., for ultrasounds, or examination tables).

As previously stated by SB#1, the purchasing department is thus responsible for the facilitation of products and services for the hospital. The same interviewee stated that the six stages of the purchasing process developed by van Weele (1997) – popularised in Dutch organizations by NEVI – has been explicitly mentioned as the purchasing model that is used as guidance with this facilitation of goods and services within this organization. The model suggests purchasing as a linear flow of six steps, divided into a tactical part (specification, selection, and contracting) and an operational part (ordering, monitoring, and evaluation). This is in line with the statement of interviewee SB#1, who revealed that the strategic/tactical buyers are responsible for the first three stages of this model within the

organization, and the last three stages are the responsibility of the operational buyers. The model can be seen in the figure below.

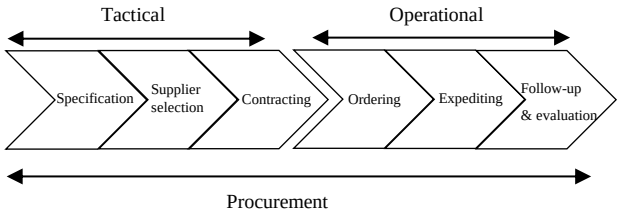

Figure 1. Process model of purchasing (van Weele, 1997)

The first stage of this model is the specification stage. In this stage (purchasing) managers specify which products and/or services are needed – and what the exact specifications of this desired product/service is. The next stage, supplier selection, is about discovering which supplier offers the best suitable product/service on the market based on before thought of criteria. As stated by SB#1 and WP#1, in the case of medical devices such as ultrasound machines, the physicians have a trial period with the product, to ensure it really is in line with all the criteria. After the product is approved, the next stage follows. In the third stage – contracting – the supplier is thus decided, and any negotiations on the product/service as well as the role of the supplier will take place.

Now, the tactical buyers hand the responsibility over to the operational buyers, as confirmed by SB#1. The fourth step is ordering. As the name indicates the product/service will be ordered now, based on the way the product/service were specified and negotiated in the previous steps. After ordering the product/service the expediting stage takes place. In this stage, the operational buyers focus on securing the quality and timely delivery of the products/services. The last step is the follow-up and evaluation. Here, the operational buyers will have to make sure that the products/service are delivered at the right department (internal of the organization thus), and the delivery will be administrated. Lastly, the procurement process of the product/service will be evaluated in its entirety.

In addition, the interviewee revealed that every department within the hospital is seen as its own little business, with its own budget and has its own head of the department. The departments can acquire materials (the vast majority being disposables) throughout an ERP-system – therefore it is required that these departments take the responsibility of their own stock. This is confirmed by interviewee WP#1 and WT#1.

For all kinds of products – but medical devices such as ultrasound and x-ray machines in particular, as they are extremely costly – the purchasing process is divided in four dimensions of product acquirement within this hospital, according to SB#1. First, the product must be approved commercially. This is the responsibility of the purchasing department. In this process the cost and quality of products are evaluated and compared with one another. Also, possible criteria physicians have are considered. The next dimension is the legal dimension. The buyers then view the legal aspects of a selected product with a jurist. For instance, it will be evaluated if a product is allowed to be used in the EU/The Netherlands according to the law. Subsequently, the next dimension is the technical dimension. This is the stage where a technician or various technicians that are employed at the same hospital must approve the product. Furthermore, with their technical expertise they must determine if the chosen product is (technically) safe to use within the hospital – and will not e.g., short-circuit. Lastly, the functionality dimension of product acquirement will take place according to interviewee SB#1. The functionality of the product is evaluated and approved by the users of the product – in this case the physicians. The physicians generally are allowed to test the product for a week/few weeks according to SB#1 and WP#1. During these weeks the physicians will then evaluate the product based on their criteria and will discover if they can actually manage to work with this product properly. This is thus where the involvement of physicians comes to play in the purchasing process – which is confirmed by WP#1. Medical specialists in training are not considered with this matter, as their contracts are temporary, and it would make the purchasing process nearly impossible according to WT#1.

4.2.2 The Involvement of Physicians Within the Purchasing Process

As stated above and confirmed by SB#1, WP#1 and WT#1, physicians are involved within the purchasing process of this organization. According to SB#1 and WP#1, the physicians are seen as the experts that are required to be able to work with the material provided by the purchasing department. Therefore, their involvement within the purchasing process is crucial – for medical devices (ultrasound machines, examination tables, etc.) and medicine particularly. This is also seen as part of the functional dimension that was discussed before, as the physicians are the end users and should be able to function with the products.

However, the participation is limited to ensure that all other dimensions (commercial, legal, technical) can represent themselves, according to interviewee SB#1. Furthermore, the interviewee states that this enables rational decision-making between all dimensions to take place.

Moreover, according to the same interviewee, for non-disposable products – medical devices (such as ultrasound machines and examination tables) and medicine in particular – physicians are involved more intensively. This is because they are the main users, and thus therefore specifications of these products must suit their needs. Interviewee WP#1 confirms this, by stating that physicians/users of the products have influence on non-disposable products such as medical devices and medicine. In addition, the interviewee adds that these products are being procured based on the specifications they communicate with the purchasing department. The knowledge the user has – in this case the physicians – determines the choice of the product according to interviewee WP#1. Interviewee WP#1 also revealed that there is a formal and informal circuit for the procurement of medical devices. Firm representatives of medical devices sometimes pay a visit to the hospital, or physicians encounter them at congresses, according to the interviewee. At congresses these firms sometimes have demonstration rooms and will try to persuade physicians/medical workers this way according to WP#1. Additionally, interviewee WP#1 and WT#1 state that suppliers do lobby a lot by e.g., sending advertising brochures, and quite actively try to be on the physicians' good side by doing nice things such as offering them coffee.

Furthermore, the interviewee continues that the formal circuit is defined as when this occurs throughout the purchasing department. Within this circuit, the purchasing department will consult firms with the needs they have, and negotiations for products will take place. According to SB#1 and WP#1 the purchasing department together with other departments within the hospital will try to combine every department's needs – in the context of medical equipment and devices. By doing so, they could as an example buy multiple (different) devices at one company and negotiate a better deal, because they are buying multiple products.

4.2.3 Physicians' Criteria for Suppliers

For disposable products, the main criteria according to SB#1 as well as for WP#1 is cost, as the quality for e.g., gloves rarely differ. Therefore, disposable products are standardized within the healthcare organization according to interviewee SB#1.

As the procurement process for non-disposable products is more complicated, various criteria come to play. Apart from the most obvious two ones – cost and quality – the interviewees SB#1 and PH#1 also both named availability as an important criterion regarding preference of one supplier over another. As WP#1 stated, in the last few years product availability – again, medicine in particular – can be limited. If a certain supplier does have e.g., the network that provides this supplier with any product desired by physicians, then naturally a preference for this supplier over other suppliers will emerge. Furthermore, interviewee WP#1 stated that when taking medicine into consideration, brand differences are considered the most, as prices per brand can differ a lot. Therefore, supplier preference in the case of medicine depends on what brand the suppliers have available, and for what cost these brands are being supplied. In addition, interviewee WP#1 stated that more important criteria are the ease of use and functionality of the product supplied – for instance, when talking about machinery for e.g., ultrasounds, the product should be able to be connected to the hospital's software systems to save patient files etc. Furthermore, the interviewee stated that the service that is provided from the supplier when e.g., the product has a defect plays a major role within physician supplier preferences. Interviewee SB#1 adds that soft skills of a supplier might influence the supplier preference of physicians as well.

5. DISCUSSION

5.1 Criteria for Disposable Products

In accordance with the revelations of the interviews above, the main criteria the supplier preference of physicians for disposable products consists of is their cost. As SB#1, WP#1, and WT#1 state, the items will be disposed of after use, and the use of these items does not tend to be lengthy – resulting in all other possible factors apart from thus price to be irrelevant. SB#1 concludes that disposable items are standardized within the healthcare organization. This means that an item such as gloves are all bought from the same supplier. Also, the purchasing department aims to buy multiple different products (e.g., gloves, masks, needles) all at the same supplier, if possible, as then products might be offered at a discount. The interviewee adds on that with help of an ERP-system, all departments can order these standardized products from the organization's catalogue – which is confirmed by interviewees WP#1 and WT#1. Furthermore, SB#1 includes that soft skills of the supplier (e.g., emotional intelligence, compassion, etc.) might influence physicians' preference for a supplier over another. This might be the case in general, thus as well as for disposable products as non-disposable products.

As explained by Burns et al. (2018, p.41) physician's preference and influence over product choice affect the prices that hospitals pay, in part by reducing the latter's ability to standardize on a small number of vendors and obtain bulk pricing (exchange high volume for lower unit cost). In the healthcare organization of which the interviewees are employed, disposable products such as sheets for examination tables, needles, and PPEs, are thus standardized. As previously stated by interviewee SB#1, the influence of physicians in the purchasing process is limited as much as possible, to ensure rational decision-making on the four mentioned dimensions (commercial, legal, technical, and functional). In addition, by containing this influence, the purchasing department can standardize on the disposable products, which thus enables the possibility for buying products in bulk. Moreover, as stated by Krol et al. (2013, p.537) standardization can increase the comparability and credibility of economic evaluations and as a means of decreasing costs and increasing productivity. If a supplier can offer a variety of different disposable products, the healthcare organization might consider using all those products to standardize their catalogue with – as this means there are bulk advantages. As physician WP#1 stated, for disposable products cost is the leading criteria, thus a supplier that can offer the same disposable products at the lowest cost – and can enable the hospital to buy various disposables in bulk – will be preferred over any other supplier.

5.2 Criteria for Non-Disposable Products

For non-disposable products various criteria are being considered, as this product group concerns mainly machinery and medicine – which tend to be extremely expensive. As stated in the interview with WP#1, physicians view suppliers' product quality, availability, service, ease of use and functionality as important criteria that determine the preference on a supplier over another. Price and costs also play a role but are seen as more inferior in comparison to the abovementioned criteria. In the case of medicine, the brands that suppliers offer can play a role when preferring a supplier over others. Research has shown that physicians not only have specific brand preferences for device product lines, instrumentation, and supplies but also desire high levels of service (Burns et al. 2018, p.40; Schneller and Smeltzer, 2006). This is in line with the interviews, as the literature also concludes brand preferences, ease of use and functionality (instrumentation), product availability of supplies and high service levels as determinants of physician's preference of suppliers.

Because of the high cost of non-disposable products, it is ideal to have a product to fit most of the criteria, desirably all of them. The fourth dimension, functionality, comes more to play here. With non-disposable products such as machinery, it is crucial the physician has the last say, as they are the users of the product. Moreover, the product therefore should be easy to use – otherwise a different supplier will be considered. The machinery should be able to connect to the hospital's software for e.g., registering patient data, therefore customization of these products might be an option. Miksic et al. (2005) touch on this subject as well, stating that physicians regard the instrumentation and ease of use of products as an important criterion to base their supplier preferences on. Interviewees SB#1 and WP#1 also stated that companies allow physicians to test products for a period of time. Therefore, physicians have the opportunity to evaluate these criteria. If the physician is pleased with the product, the product is bought. This is a known phenomenon within the industry, as it is common for physicians to work directly with companies, testing new items, and then to eventually adopt the item, according to Shbool (2016).

According to various researchers, product innovation and the relationship physicians have with the sales representative are criteria physicians make a supplier distinction on as well (Burns et al., 2018, p.40; Miksic, 2005). Moreover, Wasterlain et al. (2017), argue that price awareness of products significantly influences physicians' choice of products. This also influences the physicians' choice on supplier. Furthermore, according to Miksic et al. (2005), longevity, manufacturer reputation, training programs, and existing relationships with other physicians in the practice are criteria physicians base their supplier preferences on. Burns et al. (2017, p.42) states similar findings, as the author argues that not all factors that influence physicians' criteria are tied to product cost but rather to personal experience with the product, assessment of a patient's interests, and relationships

with the sales representative. This is in line with Abdusalam et al. (2018, p.13), who states that physicians value professional relationship strategies with their suppliers. The author states furthermore that traditionally within healthcare, physicians are regarded as the primary selectors of medical supplies and bear the liabilities associated with the products they use or prescribe. Therefore, physicians tend to appreciate and trust the expertise suppliers have over their own products, which leads to the preference to develop strong relationships with suppliers. In addition, physicians seek to develop strong relationships with suppliers who support physicians in post-sale product-related services and education (Schneller and Smeltzer, 2006; Thill, 2015). These findings have not been revealed within the interviews with the healthcare workers, however, are proven to be criteria physicians base their supplier preference on – thus should be considered. It is important to note that this does not necessarily mean that the interviews regard these criteria as less important, as more variables other than this could have influenced the interview outcomes.

5.3 Main Insights

As can be concluded from the interviews, distinction is made within the procurement of disposable and non-disposable materials. This distinction manifests itself in the way these materials are procured, and the criteria of these products – and therefore their suppliers as well. The literature concludes that physicians also tend to have specific brand preferences for device product lines, instrumentation, and supplies (Burns et al., 2017, p.40). The author adds on that the product and non-product strategies of medical device firms suggest that physician's preference may similarly rest on the dimensions of product innovation and sales/service. Wasterlain et al. (2017), state that price awareness of products significantly influences physicians' choice. In addition, physicians prefer products that are ease in usage, and select their suppliers based on this as well (Miksic et al., 2005; Shbool, 2016). Moreover, according to Miksic et al. (2005), longevity, instrumentation, product innovation, and manufacturer reputation, the sales representatives, training programs, and existing relationships with other surgeons in the practice determine physicians' preferences over certain suppliers. This is in line with the statement of Burns et al. (2017, p.42), that not all factors that influence physicians' criteria are tied to product cost – but rather to personal experience with the product, assessment of a patient's interests, and relationships with the sales representative. It is important to note that in the literature, no explicit distinction is made between disposable and non-disposable products, but a general approach to medical equipment and devices is taken. Furthermore, research has shown that physicians view the possibility to develop a close relationship with a supplier as of importance when selecting suppliers (Abdulsalem et al., 2018; Schneller and Smeltzer, 2006; Thill, 2005).

In the table below the physicians' criteria based on the interviews and literature are compared side to side.

Literature	Interviews
- product innovation - sales/service - brand preferences - instrumentation - availability of supplies - price awareness of products - longevity of products - ease of use of product - manufacturer reputation - sales representatives - training programs - existing relationships with other physicians - possibility to develop a close relationship with supplier	- cost of products - quality of products - brand preferences - ease of use of products - functionality of product (including instrumentation) - availability of supplies - service - soft skills of the supplier

Table 3. Comparison of physicians' criteria for suppliers based on the literature and interviews

Based on this comparison, it can be seen that the revelations of the literature and interviews have some criteria in common. The criteria in common are brand preferences, functionality of products (including instrumentation) offered, ease of use of products offered, availability of supplies, and service. As some criteria have not been mentioned in the interviews and vice versa, it does not mean that these criteria are less relevant. All the presented criteria that have been stated to be relevant to physicians and should therefore be considered.

5.4 Practical Implications

Based on the findings analysed before, physicians thus make a distinction within their supplier criteria. when knowing the physicians' supplier criteria for disposable products as well as non-disposable products such as medical equipment and devices, (strategic) benefits might emerge. Broadly speaking, by knowing physician's criteria for suppliers, more specific product strategies such as product standardization and customization strategies can be developed. However, these topics are beyond the scope of this research, thus will not be elaborated on further.

6. CONCLUSION

This research has answered the following research question: *which criteria determine the physicians' preferences over certain suppliers?* The question was answered by reviewing literature and executing a case study containing three interviews held with experts that work in healthcare organizations. The case study has revealed that physicians' criteria differ between disposable products such as gloves, masks and needles, and non-disposable products such as medicine, medical devices, and equipment (PPIs).

To conclude, physicians view cost as the main criteria to switch suppliers in the context of disposable products, according to the interviews. Physicians do take bulk advantages into account, which naturally plays a part with this criterion. If the supplier can offer different volumes of various (disposable) products, with a discount, the likelihood of this supplier being preferred over other suppliers by physicians is high. As the main criterion for disposable products is cost, suppliers might only be switched if the same products can be bought for a lower price at a different supplier – thus creating a preference for the other supplier. If a certain supplier offers multiple sorts of disposable products (e.g., gloves, masks, needles) then the hospital can choose to e.g., 1) standardize on one of these items – i.e., gloves – and supply the entire hospital with these and/or 2) make all disposable products of this supplier the standard. This can have multiple benefits for the hospital, as standardization can increase the comparability and credibility of economic evaluations and as a means of decreasing costs and increasing productivity (Krol et al.,2013, p.537). Disposable items are therefore seen as items where the purchasing department can make cost containment efforts.

For non-disposable products the following criteria were stated in the interviews: cost of products, quality of products, brand preferences, ease of use of products, functionality of product

(including instrumentation), and availability of supplies. The cost and quality of a product are always compared with one another as stated by interviewee WP#1. The ratio should be equal; thus, the cost of a product and its quality should be equivalent to each other. In the case of medicine, the interviewee stated that brand preference plays an important role. The physician tends to prefer a certain brand and selects a supplier based on this. Furthermore, the ease of use and functionality of a product are criteria that are being evaluated by physicians, according to interviewee WP#1. The functioning of any product that physicians use should be easy to understand and work around with, as it otherwise can create a deterioration of the patientcare. In addition, in case of medical devices, the device should be able to save e.g., sonograms in patient files, thus should be compatible with the hospital's software. This also is related to the functionality of a product. Lastly, physicians' supplier preferences are also based on the availability of products suppliers offer according to WP#1. For instance, if a supplier tends to have shortages of products, the supplier is less attractive to physicians than a supplier that does (regularly) have desired products in stock.

Within literature, no clear distinction between disposable and non-disposables were made. The literature review revealed that physicians' supplier preference is based on the following criteria: product innovation, sales/service, brand preferences, instrumentation, availability of supplies, price awareness of products, longevity of products, ease of use of product, manufacturer reputation, sales representatives, training programs, existing relationships with other physicians, and the possibility to develop a close relationship with supplier.

7. LIMITATIONS AND FURTHER RESEARCH

7.1 Limitations

A big limitation of the research was the number of physicians available to participate with the interviews. Unfortunately, the physicians were extremely busy and therefore a limited number of physicians were available for an interview. As a solution, medical specialists in training were interviewed as well, to ensure that there was more data to be collected for this research. However, unfortunately they are not involved within the purchasing process which diminished the effectiveness. Another limitation was the fact that all interviewees work at the same hospital, therefore there was not really a contrast between answers. Moreover, it might have been interesting to compare the purchasing process of different healthcare organizations and see if these differences resulted in different answers in relation to physicians' supplier preferences.

7.2 Further Research

As a recommendation for further research, it would be interesting to know if physicians' criteria differ per department within the same organization – and where the big differences lie. Furthermore, it is curious to know if culture differences play a role in influencing physicians' supplier preference criteria. Furthermore, for further research it can be interesting to discover if physicians' supplier preference criteria differ between suppliers that offer disposable products and suppliers that offer non-disposable products. This element has been touched within this research; however, it is much more complicated in practice. All of these complexities unfortunately could not be uncovered in this thesis, as it is beyond the scope of this research.

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APPENDIX

Appendix A – Codes Atlas.ti

Code	Groundedness
○ budget	1
○ collaboration cost containment	1
○ communication with purchasing department	2
○ criteria: availability	2
○ criteria: brand preferences	1
○ criteria: ease of use	6
○ criteria: functionality of product	2
○ criteria: price/costs	3
○ criteria: quality	2
○ criteria: service	1
○ criteria: soft skills	1
○ influence physician	2
○ involvement for disposables	1
○ involvement for non-disposables	2
○ knowledge of user	1
○ participation of physician	3
○ procurement process	5
○ types of procured products	1