Realizing the Value Potential of AI in Service Needs Assessment: Cases in Child Welfare and Mental Health Services

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Abstract

In social and health care the use of technology that utilizes data has great potential from the point of view of value creation. This case study examines the factors that impact the value potential realization of AI prediction models as part of the customer/patient service need assessment process. The research focuses on a pilot project of a Finnish case organization, in which prediction models were tested in child welfare and mental health services. Both positive and negative value-realizing factors were found in the research. The information produced by artificial intelligence has great value potential. Regulation and transparency of data need to be addressed, but at the same time, more flexible use of social and health register data needs to be considered to ensure that resources are allocated in a value-added way.

Keywords: Artificial intelligence, value potential, service needs assessment, child welfare, mental health

1. Introduction

Digitalization aims to change the business model in social and health care and to provide opportunities related to value creation by utilizing digital technologies (Gartner, 2022). Technology and the utilization of social and health care data have been seen as one of the key factors in resolving customer flow management and improving the way services are provided in social and health care. Machine learning and artificial intelligence have been used in healthcare for some time, especially for clinical needs (Sunarti et al., 2021; Jiang et al., 2017), and for health information management (Stanfill & Marc, 2019), but only a few applications have been deployed in clinical practice in healthcare (Yin et al., 2021). Artificial intelligence algorithms may be associated with technical problems, algorithm bias, challenges in generalization, and human barriers to adoption (Kelly et al., 2019), which limits the safe transformation of artificial intelligence research into clinical practice. In addition, the practical implementation of artificial intelligence applications can be challenging, for example due to data sharing and privacy issues or due to the lack of transparency of algorithms. The enormous potential of healthcare artificial intelligence applications can be realized when they are integrated into workflow routines (Yin et al., 2021; Expert Panel on effective ways of investing in Health [EXPH], 2019; Shaw et al., 2019; Kaasalainen & Neittaanmäki, 2018). This study examined the value potential of two artificial intelligence (AI) -based prediction model applications to help identify client/patient service needs in one social and health care organization in Finland. The co-creation project was implemented in 2018-2021 and the piloting took place for 8 months in 2021. To the best of the author's knowledge, this is the first study investigating an AI solutions development and pilot project for integrated social and health care organizations and the first that used both social services and health care data. This paper aims to express the value of utilizing an artificial intelligence application as part of assessing the customer's/patient's need for service and care and identifying service needs. The main research question is: *How to create value through artificial intelligence applications in assessing the need for social and health care services?* The research highlights factors that help organizations leverage artificial intelligence-based applications as part of identifying customer service needs and creating value for the service needs assessment processes.

2. Theoretical background

The theoretical framework bases on Value Pillars (EXPH, 2019), which are conceptualized from Value-Based Health Care (VBHC) by the Expert Panel on effective ways of investing in Health (EXPH). In health care, the concept of value has been reviewed in general in Michael Porter's Value-Based Healthcare model (Porter & Teisberg, 2006). However, Porter's original model, which is based on the American operating environment, as such is not directly applicable to the European public sector (social) and health care service system. Therefore, in this study, goals of value are based

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on the European Expert Panel's Value Pillars model, which is derived based on the Porter model. In this study, the concept of healthcare includes both social care and health care. The value objectives of health services do not preclude the application of the same concept to social services. In this paper, social and health care is understood as one service package, the task of which is to promote the health, well-being, and functional capacity of the citizen.

2.1. Public Value and Value pillars

Public health and social services are based on public sector funding. Global megatrends, aging and a shrinking workforce will have a significant impact on the delivery of public social and health services, especially in terms of available resources and their allocation. The need for social and health services is growing in Finland, as in many European countries due to demographic change (Hetemaa et al., 2022). At the same time, the resources of social and health care organizations to provide services in proportion to service needs are diminishing. About 10 percent of Finnish social and health care clients account for 80 percent of the cost of using social and health services (Koivisto & Tiirinki, 2020). Healthcare systems are under pressure to adapt to upward pressure on costs associated with new technological developments, increasingly complex patients with multiple chronic conditions, increased public expectations, and changing clinical practice (EXPH, 2019). In health services, the focus is increasingly shifting from volume to value; on reviewing and creating value. The value should define the framework for performance improvement in health care (Porter, 2010). Regarding public services, the value definitions have relied on the concept of Public Value, by Mark Moore (1995). Public value includes three components: 1) the contribution to the public sphere, 2) the addition of value through actions in an organizational setting and 3) the heuristic framework of the strategic triangle (the public value proposition, the authorizing environment, and operational resources needed to create public value). (Moore, 1995; Hartley et al., 2016)

In the healthcare sector Value-Based Health Care (VBHC), which origins from Porter's theory on strategic management (Porter & Teisberg, 2006), has become a common, widely debated, and cited subject in the healthcare sector. The core principles of VBHC are what matters most to patients: the health status patients achieve (outcomes), and the price patients must pay for it (costs). Providers should focus on generating maximum value for their patients by helping them achieve the best possible outcomes, and by doing so in a cost-efficient way (Porter, 2010).

Although VBHC has been one of the most important health sector concepts over the past years, it has been criticized for focusing too much on "health outcomes achieved per dollar spent" and on individual outcomes. VBHC concept is also linked to considerations concerning performance-based payment systems in US. EXPH suggests (2019) a broader perspective. It considers that the use of the term "value" in Porter´s perspective has become a buzzword for provider-centered management practices, and cannot be taken as a full health system, patient-centered, approach, especially since aspects of equity are missing.

EXPH has claimed, that while the concept of "value-based healthcare" is discussed as an idea to improve resource allocation there is no single agreed definition of value-based healthcare or even of what value means (for whom) in the health context. EXPH suggests that value-based healthcare is usable to inform decision-making and contribute to making healthcare systems more effective, accessible, and resilient, for example for fairer distribution, and more optimal use of resources. Their proposition for value in value-based healthcare is a comprehensive concept built on four value pillars:

1. *Personal value:* appropriate care to achieve patients' personal goals
2. *Technical value:* achievement of best possible outcomes with available resources
3. *Allocative value:* equitable resource distribution across all patient groups
4. *Societal value:* contribution of healthcare to social participation and connectedness

2.2 Assessment of the need for services in social and health care

Assessment of the need for services (ANS) is a part of the social and health care service process, where a social and health care professional assesses a client's need for services, the prerequisites for a client relationship together with the client and considers which services would meet the client's needs (Figure 1). In healthcare, ANS is usually an assessment of the need for treatment (Finnish Institute for Health and Welfare, 2022). It should be made in cooperation and agreement with the patient and finding out the customer's/patient's opinion before implementing the treatment or service. ANS in healthcare is organized on a uniform medical basis. It is the independent decision-making of a nurse or other health care professional, where the nurse must be able to apply broad-based and multidisciplinary theoretical knowledge and skills. The decision to implement treatment based on ANS is made by a healthcare professional. (The Finnish Social Welfare

Figure 1. Service process in social and health care

Act, 2014; Syväoja & Äijälä, 2009; The Finnish Act of the Patient's Status and Rights, 1992)

The purpose of ANS in social services is to determine the situation of the customer and his/her network sufficiently extensively so that the support needs can be met with adequate services. The customer and his/her legal representative must provide the professional responsibilities of ANS with the information the customer needs to organize and carry out social care. The ANS must also be made in those situations where the customers are unwilling to cooperate. The social welfare authority can obtain information relevant to ANS even without the express consent of the client. (The Finnish Social Welfare Act, 2014). ANS is a necessary part of the customer's/patient's process and a prerequisite for receiving social and health care services. In some situations, especially in situations involving the protection of children or the need for mental health services, ANS must also be carried out independently of the person's will (The Finnish Act of the Patient's Status and Rights, 1992; The Finnish Act on the Status and Rights of Social Welfare Clients, 2000).

Abundant and especially the so-called remedial services use can potentially be reduced by identifying customer problems and needs as early as possible. By streamlining cooperation between social and health professionals, it is possible to avoid duplication of work, reduce unnecessary transactions, and speed up customer access services. This may reduce subsequent service usage (Kaasalainen & Neittaanmäki, 2018; Koivisto & Tiirinki, 2020). Previous studies (e.g., Kivipelto et al., 2019) have examined different models for identifying cross-sectoral service needs. Some of the models are based on available register data, some on a combination of data sources and multidisciplinary teamwork. Some cost-based models have also been identified. Models for identifying and anticipating service needs, coupled with strong multidisciplinary expertise, service guidance, and customer engagement, have been little identified. There have been only a few European models (Kivipelto et al., 2019). The few models that were studied emphasized that it is important that identification also leads to targeted measures. Early identification can also lead to cost savings if identification leads to the right interventions (Kivipelto et al., 2019; Matheny et al., 2019).

2.3. AI technology in social and health care

Artificial intelligence (AI) is a widely used term for techniques using machines to simulate human thinking processes and intelligent behaviors, such as thinking, learning, and reasoning. The European Commission High-Level Expert Group on Artificial Intelligence (2019, pp. 7) has defined artificial intelligence as follows: *"...systems designed by humans that, given a complex goal, act in the physical or digital world by perceiving their environment, interpreting the collected structured or unstructured data, reasoning on the knowledge derived from this data and deciding the best action(s) to take (according to pre-defined parameters) to achieve the given goal."* It has also been defined as "the science of making machines do things that would require intelligence if done by people" (Mc Carthy et al., 2016,), which has been seen as the best definition of AI for health and social care (Joshi & Morley, 2019).

AI has already changed the traditional model of medicine, significantly improved the level of medical services, and guaranteed human health in various aspects (Joshi & Morley, 2019; Liu et al., 2020). AI offers the potential for improvement in patient care and a reduction in health care costs and efficiency, but at the same time there are significant risks in terms of inappropriate patient risk assessment, diagnostic error, treatment recommendations, privacy breaches, and other harms (Matheny et al., 2019; Joshi & Morley, 2019). In social services, support has been sought from artificial intelligence, especially for elderly care (Truelsen & Andersson, 2019).

In terms of technological solutions, proactive analytics and AI technology bring help to utilize social and health care information as a supportive function. With the help of supportive intelligence, key factors that need to be considered in the customer's/patient's service path or care can be highlighted from a large mass of data. In healthcare, AI has been used in ANS, especially for the optimization of care pathways. Studies have recognized the potential of AI in prediction, for example opportunities to advance the understanding of the causes of mental health illness, improve detection and diagnosis, develop risk-based approaches, enhance decisions, and help redesign services around the needs of patients (Dawoodbhoy, 2021).

The use of artificial intelligence technology in ANS in social services is relatively new. To the best of the authors' knowledge, there are so far very few solutions that use AI technology to assess the need for social care services. In 2018 a joint project of various actors in Finland examined whether problems for

children and young people can be identified at an earlier stage. The project was a research project and it used data from social and health care and education. The result was Finland's largest forecast model to date, which can analyze probabilities for unwanted "endpoints" at the individual level (Mielikäinen, 2018). However, due to regulatory limitations, this model was not tested in service production, linking to customer service processes.

3. Research design

This study is a multiple case study (Yin, 2018; Crowe et al., 2011) that takes an inductive approach, seeking to enhance understanding of the subject matter of value potential of AI-based forecasting models in ANS (Figure 2). The case study approach is a suitable way for generating an in-depth, multi-faceted understanding of a complex issue in its real-life context and it can give powerful insights into many important aspects of health and healthcare delivery (Crowe et al., 2011). The case study approach is well suited for gathering information on explanatory 'how', 'what', and 'why' questions (Yin, 2018).

The study investigates how to create value through artificial intelligence applications in ANS in both social and health services. The research focuses on co-developing and testing two applications based on predictive analytics developed for use in a case organization. The case organization is a public actor organizing social and health care services in the region of Southern Finland. The organization's social care, and healthcare services, including primary and secondary care are functionally integrated into the same organization.

The case study focuses on the pilot project, which includes the interaction between the user (case organization) and provider (AI-models developer company) in the delivery of service. The empirical data consists of case organization's documents (organization's strategy, pilot project plans, team meeting notes, and workshop material) and 3 interviews with experts from the organization and the solution development company. The documents were chosen as the data collection method, as a lot of ready-made material for use in the research had been created during the solution development process. After the first analysis steps, data collection was supplemented by semi-structured interviews. The interview puts the expert's views at the center and the subject of the human research situation. The interview as a research method allows the interviewee to bring their own opinions and at the same time offers the interviewer the opportunity to ask in-depth questions and ask for reasons for the opinions. (Yin, 2018)

4. Case description

The case organization is an integrated provider of social and health care services in Southern Finland. It produces health services (primary and secondary care), family and social welfare services, and services for the elderly for all the citizens of the region. The organization has collected data from both customer and patient records for over 10 years. The strategic goal of the case organization's organizational performance management is to connect information management to practical activities, especially by targeting the identification of service needs and service chains of customers who use a lot of services. The organization strives for one-time registration, better utilization of information, and more efficient processes, developing and utilizing customer relationship management information systems.

The organization aims to make the utilization of information more efficient in decision-making at various levels: from the services of the individual citizen to the development of an organizational system at the organizational level. The goals of the organization's information management and data utilization are:

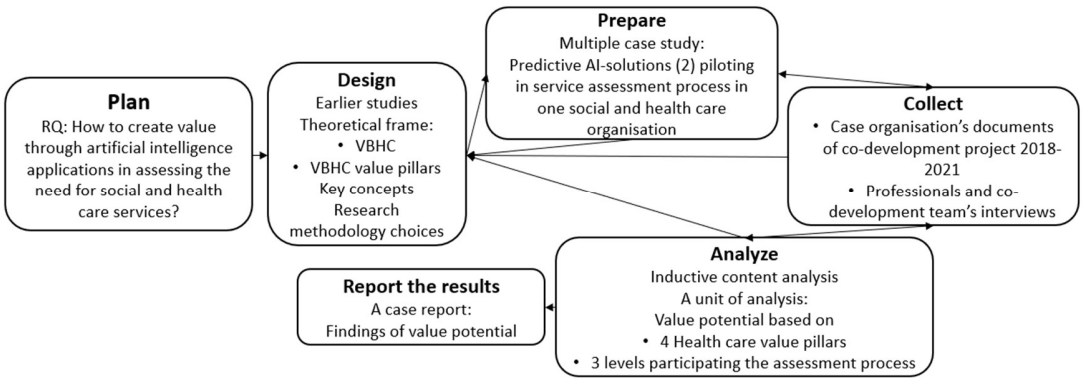

Figure 2. Research design, following Yin (2018)

- smooth customer processes: the customer's case proceeds without unnecessary delay and duplication of work by professionals
- the professional's work is focused on the right things
- the organization provides preventive services instead of remedial ones
- cost savings
- better customer experience.

The focus is on the early identification of customers and anticipation of the use of services. By utilizing the information available to the customer and sufficiently comprehensive already (for example from separate registers) at the beginning of the service path, it is possible to find services that are suitable for that customer (Koivisto & Tiirinki, 2020). Based on this observation, the organization started seeking support to identify service needs at an earlier stage. The organization's integrated database provided good opportunities for this.

The organization strives extensively to anticipate the service needs of all age groups and links them to the development of the processes of ANS. The goal is to provide more operational and everyday support services in advance. The organization can utilize the data of different registers in information management by combining them, as it acts as the registrar of both the patient data register and the social care customer data register.

4.1 Case and sample selection

The case and data were selected to maximize the utilization of the information (Flyvbjerg, 2011). The organization's main goal was to develop a tool to support the work of a professional: to go through large masses of data and find common factors for different predefined endpoints. The goal was to get a model that 1) facilitates the customer's access to the right service at the right time, and 2) generates financial benefits for the organization when the customer's need for service can be detected even earlier, and the need for service can be met with basic services.

The organization's project of finding the customer and patient groups who use a lot of services and co-development of AI predictive models started in 2018. The first goal was to define customer segments using a large amount of social and health care services. The following customer groups or service usage situations, 20 different "endpoints" (Table 1), were defined as service-intensive segments. Those were able to identify from the data, i.e., that the service users who belonged to the segments defined by the professionals could be found with the help of statistical entries. Customer data was viewed from the organization's multiple databases: Electronic Health Record (EHR) and Client Data Record (CDR) of social services.

Table 1. Service-intensive segments

1	Substance abuse problems in people under 18 years of age
2	Child welfare: Emergency placement or foster care, children under 18 years
3	Emergency visits more than 3 times / 6 months
4	Returned from the wards after 31 days
5	Psychiatric treatment period 3 times a year
6	Emergency contacts for mental health and substance abuse services 3 times a year
7	Multiple service need assessments, rehabilitation plan, client plan, care, and service plan
8	The most expensive 10% of customers or more than 50 000 € / year
9	Need for long-term social assistance (need for supplementary social assistance)
10	Long-term unemployment (within the municipal part)
11	Emergency treatment: recurrent chest pain
12	Emergency treatment: alcohol
13	Under the age of 65 in regular care
14	Moved from regular care services (home care, service housing) to a ward or emergency
15	At least 2 social emergency contacts per year under the age of 65
16	Cared for caregiver
17	In addition to the diagnosis of intellectual disability, those covered by health services
18	Large hours of personal assistance
19	Wide learning difficulties
20	Service needs passed down from one generation to the next

4.2 AI forecast models for child welfare and mental health services

Once all 20 endpoints/segments were defined, two of the endpoints were selected for further development and testing. The selection criterion was that those customers/patients who ended up at the endpoints could be easily identified from the existing data. The selected endpoints were:

1. *Child welfare:* Emergency placement or foster care of children under 18 years. A series of events that anticipate and avoid a large-scale child's foster care or emergency placement (taken into care) from the organisation's databases.
2. *Mental health:* a series of events that anticipate and avoid large-scale emergency contacts for mental health and substance abuse services 3 times a year from the organization's databases.

The goal was to develop a mathematical model for predicting future cases based on historical data. The model was taught in previous corresponding cases. The

model used pseudonymized data as variables from the organization's social and health care registers. The co-development project continued by defining data processing rules and technical architecture and building a technical environment for the testing period. That included the construction of a data lake and pseudonymization and transfer of data. At the same time, end-user view functionalities were built into an ERP system used by professionals.

Data protection and data security issues, e.g., consent policies for extensive registry information were a big issue before starting a piloting period because the use of data from two different registers requires separate consent from the customer to make a risk forecast. The client's consent to use the data in the various registers was required because a professional may be able to process data through AI forecast to which he or she may not have direct rights under the applicable access rights. Information and consent documents were prepared before the start of the testing period, and a separate electronic consent procedure was introduced. Only the professionals who handled the client had access to the client's data without pseudonymization. The co-development period included pre-workshops between the development team (preliminary review and preparation of data), workshops with the professionals, and internal workshops (co-development team).

4.3 Testing period

The purpose for testing the solution was to 1) test whether the factors found are of statistical significance, 2) raise the impetus of the AI model and statistically significant risk factors to support decision-making by professionals working with each target group, and 3) functionally test the first models with organization's professionals to get feedback on usability and functionality of the models. In the pilot phase, the following groups were defined as groups utilizing the AI component:

1. child welfare initial assessment team (7 social workers/social counselors) / Child welfare
2. mental health and substance abuse emergency services team (8 nurses) / Mental health.

Testing was performed in connection with genuine customer/patient contacts. Professionals were able to check the customer's/patient's risk forecasting result during the assessment of the service needs process and only based on the customer's consent. Utilizing the information generated by the AI model in daily work requires a professional user interface view. The "AI forecast model data" tab was developed for the organization's professional ERP, where the stimulus generated by the AI component rises and from which the professional can see the classification data and variable data associated with a specific customer. The user evaluated whether the classification was correct, the variables useful, and provided feedback on the risk classification generated by the model. This information was stored pseudonymized. The feedback went back to the AI component and was used to refine the forecast model.

5. Results and discussion

5.1 Technical testing results

During the co-development and testing period, the technical ability of the forecast model to identify customers in the risk category from the available data was examined. In the design phase, the number of potential customer cases in the organization was assessed, i.e., the professional's ability to utilize the information provided by the model to assess the customer's service needs during the test period. During the testing period, the utilization of the data from the prediction model was very limited (Tables 2 and 3). According to the testers, this was mainly due to the consent policy, which was a prerequisite for the utilization of the solution, and the unsuitability of the utilization of the AI forecasting model in relation to the service situation. ANS in social and health care, especially child protection and mental health emergency, is very sensitive and issues can be difficult to deal with. According to the professionals who tested the solutions, the forecasting model should be able to be utilized without a customer consent policy. Some customers did not want to give their consent, and some gave their oral consent but did not receive a signature on a paper or electronic document, which prevented the professional from opening the client's risk information view.

Regarding the technical capability of the AI prediction model, based on the testing period, the child protection model did not prove to be reliable: the model identified only 3 children (15%) out of the 20 children who were urgently placed or taken into care during the test period. One explanation for this may be the small amount of child customer data in the databases. The mental health services model, on the other hand, was able to identify 45% of those clients whose risk was realized during the testing period. The technical results of the co-development and testing period are shown in Table 2 and Table 3.

As a result of the research, it was found that the forecast model for child welfare, emergency placement, and foster care, still needs further development. The organization aimed to have a forecasting model that could be used in basic family services (counseling, pupil

Table 2. Technical results of the co-development and testing period/Child welfare

Results of the co-develop-ing period	Classification generated using register data based on AI-model 33 000 children (under 18 years)	Classification "No risk" 29 218 children	Classification "Risk for foster care of emergency placement" 3 830 children	Risk realised (child ended up to emergency placement or foster care) during year 2021 25 children	Estimated usage volume (risk prediction to be used at the ANS) during the testing period (6 months) 240 children	**Results of the AI-model testing period (6 months)**	Professionals' possibility to check the risk at the assessment of the need for services process of 270 children	Risk prediction read by professionals (AI-model used at the ANS) during the testing period for 25 children	Risk realised (ended up for emergency placement or foster care) during testing period: 20 children, of whom 3 (15%) were classified as at risk

Table 3. Technical results of the co-development and testing period/Mental health services

Results of the co-develop-ing period	Classification generated using register data based on AI-model for 20 000 adults who have at least one registry entry of mental or substance abuse service	Classification "No risk" for 11 308 adults	Classification "Risk for at least 3 contact for emergency mental and abusement services" for 3 952 adults	Risk realised (adult contacted emergency mental or substance abuse services at least 3 times in one year period) during year 2021: 400 adults	Estimated usage volume (risk prediction to be used at the ANS) during the testing period (6 months): 900-3 600 contacts (5-20/day)	**Results of the AI-model testing period (6 months)**	Professionals' possibility to check the risk at the ANS of 2 800 adults	Risk prediction read by professionals (AI-model used at the ANS) during the testing period for 27 adults (40 consents were requested and 27 were received)	Risk realised (ended up for at least 3 emergency mental or substance abuse service contacts/year) during testing period: 268 adults, of whom 123 (45%) were classified as at risk

care, primary health care, and social services for families with children) and to better identify the customer's service needs before the need for child welfare services.

The forecast model for mental health and substance abuse emergency services is to be linked to basic services: primary health care and adult social work at social and health care centers. The goal is to detect and consider the need for customer support for mental well-being services even before things fall into crisis and require acute interventions. In addition to the prediction model for contacts in mental health and substance abuse emergency care, there was also a desire to continue developing the prediction model for psychiatric ward care. The ward care forecast model can be used to enhance multi-professional assessment and teamwork in ANS and arranging services, especially for home-based services.

5.2 Factors impacting the realization of value potential

As a result of the analysis, five factors impacting the realization of the value potential of AI forecast models in the ANS were identified (Table 4). These factors are 1) Information generated by the forecast model, 2) Data protection regulations, 3) Suitability for the service situation, 4) Suitability for the professional work process, and 5) Organizational management support and guidance. The *significance of the information produced by the forecast model* had the highest positive impact on realizing the value potential (11 factors). The factor with the highest negative impact on realizing the value potential was the *data protection regulations* (7 factors), especially the consent required from the client/patient as a condition for the use of the forecast model. There were two positive and two negative factors related to the *suitability for the professional work process* and two negative factors of *suitability for the service situation.* One factor raised regarding the support and guidance provided by the organization to its professionals. In the words of one interviewee "*Delivering as given*" without clear information from management on what to use for the solution, why, and for whom, the testing was not sufficiently focused on the development of the work process.

Table 4. Identified value factors

Factors impacting the realization of the value potential	**Positive factors**	**Negative factors**
Information generated by the forecast model	11	6
Data protection regulations	1	7
Suitability for the professional work process	2	2
Suitability for the service situation	0	2
Organizational management support and guidance	0	1
Total	14	18

Looking at the Value Pillars and considering the ANS of the customer/patient, the professional/manager, and the organization/public service provider, the greatest value potential is related to the customer's/patient's level (see Table 5). Some factors increase the value potential realization in the personal, technical, and allocative value pillars e.g., the *factors behind the customer's need for service or care can be identified* at a sufficiently early stage to allow the service to be provided to him promptly on time and gathering the different actors using the information produced by the forecasting model. Also, the same value potential factors connected to the professional's or manager's role in the evaluation process were found. The value is found also in the professional's

Table 5. Factors increasing and reducing the value potential realization

		Customer/patient	Professional/manager	Organization/public service provider
Personal value Appropriate care to achieve patients' personal goals	**Positive factors**	**Data protection regulations** •The customer's right to restrict the use of his own data may increase confidence in the service system **Significance of the information generated by AI** •The customer's service need and related factors can be identified early and service/care can be provided •Gathering relevant actors using the forecasting model	**Significance of the information generated by AI** •Support for the professional in compiling a network of different actors using the information generated by the forecast model to support the customer	**Significance of the information generated by AI** •Assembling the processes of multidisciplinary work in the organization to gather different actors using the information produced by the AI model
	Negative factors	**Data protection regulations** •Appropriate care or service (factors influencing the risk assessment) not received in a timely manner **Significance of the information produced by AI** •Customer's service need and related factors identification at an early stage: possible undesirable interventions •AI misclassification, can lead to false conclusions in ANS •Access to sensitive information through AI model can undermine trust in a professional/service system **Suitability to the service situation** •The consent practices in AI use unsuitable for sensitive ANS situations	**Significance of the information generated by AI** •An erroneous conclusion made by AI can negatively affect a professional's conclusions	**Data protection regulations** •Legislation restricts the use of social and health care data through the use of new technologies - the potential of AI models cannot be exploited to support customer/patient-specific processes
Technical value Achievement of best possible outcomes with available resources	**Positive factors**	**Significance of the information produced by AI** •Customer's need for service and related factors, can be identified early •Assembling different actors using the information generated by the forecasting model to support the customer	**Significance of the information produced by AI** •Assembling different actors using the information produced by the forecasting model	**Significance of the information produced by AI** •Allocation of resources the right time and to the right customers, if AI used at primary service level, before special services
	Negative factors	**Significance of the information generated by AI** •AI can misclassify, which can lead to erroneous conclusions in the ANS **Suitability for the service situation** •The term AI may be questionable in the customer's opinion and may affect the customer's consent to use the AI model	**Data protection regulations** •Consent as a condition for the use of AI model (access to separate registers) **Organizational management support and guidance** •Insufficient managerial support can reduce the value potential of AI model **Suitability for professional work process** •Separate user interface	**Data protection regulations** •Consent as a condition for the utilization of proactive analytics (access to data in different registers) for the utilization of customer/patient data for primary use
Allocative value Equitable resource distribution across all patient groups	**Positive factors**	**Significance of the information generated by AI** •The customer's need for service and the factors behind it can be identified at a sufficiently early stage to allow resources to be allocated correctly •The need for the customer's service or care and the factors behind it can be identified at a sufficiently early stage (undesirable interventions are also possible, but they may be more effective than those addressed at a later stage)	**Suitability for the professional's work process** •Increasing the required information to the risk forecast (current practice is to make requests for information from another register), which saves the professional time	**Suitability for the professional's work process** •Increasing the required information to the risk forecast (current practice is to make requests for information from another register), which saves the organizations resources
	Negative factors	**Data protection regulations** •Appropriate treatment or service (factors influencing the risk assessment) may not be received timely, if customer declines the use of information **Significance of the information generated by AI** •AI can misclassify, leading to false conclusions in the ANS, and misallocation of resources **Suitability for the professional work process** •In a case-by-case utilization the inequality of customers in assessing the need for services can be inequal		
Societal value Contribution of healthcare to social participation and connectedness	**Positive factors**			**Significance of the information generated by AI** •The opportunity to influence the cost of services by better reaching those in need of services, significance for public health and the economy
	Negative factors	**Data protection regulations** •Restriction of available data to social and health data only: information in the registers of other authorities (eg police) could increase the accuracy of the risk forecast		**Data protection regulations** •Legislation does not allow for the flexible use of existing customer and patient data to identify service needs using AI models. The value of a comprehensive data base cannot be exploited.

workflow: *time is saved utilizing the forecast model data*. Positive factors are a compilation of different actors *using the information produced by the forecasting model* (as the significance of the information produced by the forecasting model) and information generated by the AI forecast model for the information system used

by the professional (as suitability for the professional's work process). As negative factors were identified c*onsent as a condition* for the use of proactive analytics (as access to data in different registers), *separate user interface* (as suitability for professional work process), and *insufficient organizational and management support and guidance*. The lack of guidance from the organization's management became apparent in all interviews. A detailed description of the factors affecting value potential realization, mirroring the Value Pillars and those involved in the service need assessment process, are presented in Table 5.

The research question in this study was: *How to create value through artificial intelligence applications in assessing the need for social and health services?* The results of the study give four propositions derived from the results:

P1: Existing information, produced by AI model, should be used to assess service needs without the express consent of the customer.

P2: The data used by the AI model must be comprehensive enough to identify risks. If there is not enough data for the AI model, it will not be able to identify risks with sufficient accuracy. AI model suits better to adult services than to children.

P3: Solutions must be carefully integrated into the professional work process and tools.

P4: In a development and deployment project, the organization's management and supervisors must support and guide personnel in utilizing the technology.

6. Conclusions

This study is one of the first studies to address value creation through AI in service needs assessment in a public, integrated social and health care organization. The study gives new information both for the scientific level and the managerial level. The results are used to better identify factors related to value creation: to help to understand complex phenomena from a practical point of view and to consider important methods in the implementation of AI prediction models, such as the support needed by professionals and issues related to data protection practices. According to this study, the use of technology that utilizes data has a great potential from the point of view of public value creation. The information generated by AI forecasting models helps to understand the customer's need for service in a timely manner and streamlines the professional work process. The pilot project showed that obtaining consent from customers was difficult and prevented the use of the AI prediction model in the evaluation process. Concerns about the use, regulation, and transparency of data need to be addressed, but at the same time more flexible use of social and health register data needs to be considered to ensure that resources are allocated in a value-added way. More collaborative projects and research are needed to utilize AI technology in social and health care. The development and use of knowledge management solutions must be strongly linked to the organization's strategy and must be managed at different levels of the organization, as part of the management and development of the organization's core mission processes.

Through empirical results, the phenomenon opens to researchers and offers many areas for further research. As the results show, there is a need for further research on creating value through data-based customer management solutions in the social and healthcare field. More research is needed concerning public value demands, the lack of resources and the rights of a customer/patient. Public service providers must figure out how the existing data should be used to allocate resources in a timely manner and to the right destinations, even without the person's consent. There is also a need for cost-effectiveness research.

As a case study, there are several limitations on this study. The study is conducted in a limited geographical area and with a small group of testing professionals. The technical capability of the solution can't be evaluated enough, because of due to low operating volume. This impairs the generalizability of the research result. However, the study offers its view of the value potential realization of AI forecasting models in assessing the need for service.

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