

Information needs in the Dutch long-term care sector

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This research contributes to the domain of long-term care by exploring representative information needs to better manage both quality of care and financial spendings, as a first step towards mature healthcare business intelligence in long-term care. This work describes the first step as part of our more elaborate exploratory research according to the Cross Industry Standard Process for Data Mining, wherein we perform a single case study at a long-term care institution with five locations throughout the Netherlands. We interview twenty-two domain experts and stakeholders in order to determine the information needs in long-term care from which we, then, derive the Top 10 needs using weighted valuation calculations.

1. Introduction: long-term care in the Netherlands

This research investigates the relatively unexplored long-term care sector in the Netherlands and the applicability of knowledge discovery techniques as a next step towards the strategic goal of more mature healthcare business intelligence (Mettler & Vimarlund, 2009). In 2008 the following general policy for long-term care in the Netherlands was formulated by Mot, Aouragh, de Groot and Mannaerts (2010):

“To ensure that for persons with a long-term or chronic disorder of a physical, intellectual or psychological nature, care of good quality is available and that the cost level of this care is acceptable to society.”

Long-term care is care for people with a long-term or chronic disorder, where the chronic disorder can be either of a physical, intellectual or psychological nature. The policy contains two goals for long-term care, which are ‘care of good quality’ at an ‘acceptable cost level’. These goals apply to all care institutions that deliver long-term care. In order to support these goals, care institutions should have insight in the quality and financial state of the internal organization.

Electronic Client Record (ECR) software is used to keep track of the quality and financial state of the internal organization. All the information stored in ECR software is client related, which makes the client the central entity. ECR software contains personal details, medical information, financial information, production information, care plan, incidents, documents, treatment plans, presence and absence. One should note that at least in the Netherlands, ECR software is different than Electronic Patient

Record (EPR) software, which is mainly used in hospitals. One could argue that the two are closely related, but one overarching system is unfortunately not yet in place in the Netherlands at this moment. Both ECR and EPR systems are tailor-made for the sector in which they are used.

Long-term care within the Netherlands has become one of the biggest expenses at this moment for the Dutch government, consuming no less than 38% of the total healthcare budget (Schäfer, et al., 2010). The expenditures of the Exceptional Medical Expenditures Act (AWBZ) alone have steadily increased from €14 billion in 2000 up to €27 billion (budgeted) for 2012, which is a doubling in just 12 years (Ministerie van Volksgezondheid, Welzijn en Sport, 2011; Ministerie van Volksgezondheid, Welzijn en Sport, 2011). According to the population forecast of the Dutch Central Bureau for Statistics (CBS) in 2010, the number of elderly in the Netherlands will increase from 2.4 million to 4.6 million in 2040 (Duin & Garssen, 2010). This implies that a growing number of people will need some form of care, which is also addressed in (Mot, Aouragh, Groot, & Mannaerts, 2010). Also, as life expectancy increases, more people will need some form of care for a longer period of time (Duin & Garssen, 2010). From a governmental perspective it is therefore important to increase the efficiency of long-term care in order to avoid that long-term care expenditures will become uncontrollable. The Ministry of Health, Welfare and Sport (2011) also addressed the importance of management information on quality:

“In order to supply care of good quality, it is essential that the care institution is managed well and that the institution has permanent information about the quality of the institution.”

A key concept to help manage efficiency in long-term care is the so-called Care Intensity Package (ZZP) mix. In the Netherlands eight ZZP category levels have been defined from 2009 onwards, starting with ZZP-level 1 which represents “Extramural living with some guidance” up until ZZP-level 8 which designates “Intramural living under full surveillance and 24/7 care”. The higher the designated ZZP-level of a client, the higher the operational costs to provide proper care to a client (Nederlandse Zorgautoriteit, 2012; Rijksoverheid, 2012).

From the perspective of long-term care institutions it is important to have a better insight into the internal organization. At this moment ECR software is mainly used to support the core process of care institutions, which is the delivery of care. The ECR systems contain a lot of valuable data that are nowadays used to receive budget from the government and, moreover, to justify their existence. ECR data are also used on an individual basis to support a client in the best possible way. However, at this moment, the data that are collected in ECR software are not fully exploited yet. If only the collected unstructured data could be made explicit to some extent, the information arising therefrom could then be used to improve the efficiency and effectivity of the long-term care processes (Feelders, Daniels, & Holsheimer, 2000).

Therefore, this research aims to discover the most wanted information needs of long-term care institutions, which is captured in the following research question: *“What are the most wanted information needs in Dutch long-term care institutions to help manage the internal organization?”*

The remaining part of this paper is structured as follows. Section 2 outlines this work in its encompassing knowledge discovery context and sets the stage for our data collection process. In Section 3 the most wanted information needs are calculated and elaborated upon. Due to space constraints, the actual data analyses will be described in an extended follow-up paper. An impression of our findings is provided in Section 4. Section 5 contains the main conclusions of this work.

2. Material and methods: phase one in a data-driven case study

In this research data mining is used as one step within an encompassing knowledge discovery process. Therefore, we have structured this exploratory research according to the steps of the Cross Industry Standard Process for Data Mining (CRISP-DM) (Chapman, et al., 2000) after researching and comparing CRISP-DM with three other knowledge discovery processes: the Knowledge Discovery in Databases (KDD) process, the Sample Explore Modify Model Assess (SEMMA) method and the Three Phases Method (3PM) by (Vleugel, Spruit, & van Daal, 2010). CRISP-DM is a clearly described process and has been widely used for knowledge discovery processes ever since its inception, making it the ‘de-facto standard’ in the field, for developing data mining and knowledge discovery projects (Giraud-Carrier & Povel, 2001).

The CRISP-DM process consists of the following six phases: business understanding, data understanding, data preparation, modelling, evaluation and deployment. These phases are also employed in this research. However, due to space constraints we can only discuss the first phase in this paper.

Regarding Business understanding, multiple unstructured in-depth interviews have been performed to create an understanding of the long-term sector. Unstructured in-depth interviews are appropriate when the richness of detail through clarification of questions and answers is to be ensured. Yin (2009) states that open interviews are the best way to discover explorative information.

Table 1: Overview of interviewed experts in the long-term care sector.

<i>Level</i>	<i>Type of interviewee</i>	<i>Number of experts</i>	<i>Number of sessions</i>	<i>Valuation</i>
1	Board of directors / Director	8	8	10
2	Management	7	5	6
3	Stakeholders	7	5	3
	Total	22	18	--

Experts from different perspectives and various organizations have been interviewed in order to create a reliable and complete picture of the information needs in the entire long-term care sector. Our experts represent information needs of Nursing homes, Care homes and Home care (VVT), Mental care (GGZ) and Disability care (GZ). In total 22 experts were interviewed in 18 sessions. Table 1 shows that we interviewed eight experts from the board of directors level, seven

experts from the management level and seven experts from stakeholder positions. The concept of Valuation in the left-most column will be explained in the next section.

Information needs are the result of the interviews, which can consequently be translated to actionable data mining goals. The use of information needs is slightly different than the business goals as prescribed in the CRISP-DM method. In our view information needs are more elaborate than business goals.

3. Calculation: information needs in long-term care

The interviews resulted in a long list of information needs, both aimed at the quality of care and financial state of a care institution. In total we identified 33 needs related to quality of care, and 23 needs related to financial state. These information needs can consequently be translated into data mining goals which, in turn, can be modelled based on the data collected with ECR software. In our case study this resulted in 25 data mining goals which will be investigated in depth in our follow-up paper.

Customer experience is the most frequently mentioned information need of both experts and stakeholders. This information is used to increase the quality of care and improve the quality of life. However, customer experience is mostly measured by an external company of which we did not have access to its data. Staffing with respect to the Care Intensity Package (ZZP) mix is the most important indicator for directors in order to control the expenditure and revenue. Staffing information gives insight in the expenditures, whereas the ZZP-mix provides important information for the directors to control the revenue. Forecasting the future ZZP-mix is also mentioned by many experts. Any consequences of changes in laws and regulations could then be directly discovered by care institutions. Information regarding incidents could be used to increase the quality of care. Especially the causes of incidents could lead to improvements that would increase the quality of care.

Table 2: The Top 10 information needs at the long-term care institution.

#	Type	Information need	Board	Management	Stakeholders	Score
1	Q	Customer experience	8	8	10	16.6
2	F	Staffing with respect to ZZP-mix	7	4	2	14.8
3	F	ZZP-mix per business unit	7	4	0	13.6
4	F	ZZP-mix prognosis	7	4	0	13.6
5	F	Staffing with respect to operations	6	4	2	13.5
6	Q	Number of incidents occurred	6	4	2	13.5
7	Q	Types of incidents occurred	6	4	2	13.5
8	Q	Causes of the occurred incidents	6	4	2	13.5
9	F	Operations per ZZP	7	3	1	13.0
10	F	Production information (planned, realized, declared)	7	3	1	13.0

The Top 10 information needs that have emerged from the interviews are listed in Table 2, wherein **Q** represents the Quality of care information needs and **F** denotes

the Financial state information needs. The score for each information need was calculated based on the relative importance of the interviewee. The following formula was used to create a fair sorting:

$$Score = \sum_{Expert\ level} \frac{Times\ mentioned}{Number\ of\ interviews} \times Valuation$$

Equation 1: Information needs scoring formula.

We value an information need to be more important when mentioned by experts on the director level (level 1) then when mentioned by experts on stakeholder positions (level 3). For example, the score for the number one information need *Customer experience* is calculated using Table 1 and Table 2 as follows:

$$\left(\frac{8}{8} \times 10\right) + \left(\frac{4}{5} \times 6\right) + \left(\frac{3}{5} \times 3\right) = 16.6$$

Equation 2: Example application of Equation 1.

4. Results: interpretation of findings

We interpret and briefly discuss our findings from a long-term care perspective only, i.e. from the long-term care perspective of the institution in our case study. Together with the institution we have evaluated the results of our analyses. Due to the highly explorative nature of this study, the results do not provide deeply profound insights. In order to gain a deeper understanding of the internal business, we could have customized our information needs more specifically for the long-term care institution in our single case study. That would enable to create a list of subjective data mining goals specifically tailored for that one care institution, while accepting the risk of overfitting the list of important information needs.

Highlights of our findings include the following: (1) Customer experience is the number one information need of both experts and stakeholders, but is mostly measured by external companies which do not provide access to the institution's customer experience data, and (2) Staffing with respect to the Care Intensity Package (ZZP) mix is the most important indicator for care institution directors to help control expenditure and revenue.

5. Conclusions and discussion

Long-term care in the Netherlands has become one of the biggest and ever-growing expenses for the Dutch government: from €14 billion in 2000 up to €27 billion in 2012. This research reports on the first phase of a more ambitious knowledge discovery process, which investigates Dutch long-term care institutions to provide new insights into their internal business. This study focussed on the overarching

information needs of Dutch long-term care institutions within all subsectors such as the Nursing homes, Care homes and Home care (VVT), Mental care (GGZ), and Disability care (GZ) subsectors in long-term care.

Through 22 interviews with domain experts and stakeholders we have identified the following Top 10 information needs in this domain, taking into account each stakeholder's importance: Customer experience, Staffing with respect to the ZZP-mix, ZZP-mix per business unit, ZZP-mix prognosis, Staffing with respect to operations, Number of incidents occurred, Types of incidents occurred, Causes of the occurred incidents, Operations per ZZP, and General production information (planned, realized, declared).

With this explorative research a first but firm step has been made to improve efficiency through already gathered data of care institutions. Our follow-up paper will embed these research efforts in more depth as a next step towards more mature healthcare business intelligence.

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