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Components for Material Master Data Management in Swiss Hospitals

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Abstract. The material master data catalogue in large hospitals may well exceed 50'000 articles required at one or another location for patient diagnosis and treatment. Most hospitals use a commercial material management IT system to deal with orders, eProcurement, incoming goods, warehouse management, internal commissioning and distribution. An analysis in three Swiss hospitals (including a hospital chain) demonstrated however, that despite existing standards maintenance of the material master data catalogue is often done manually based on different incoming formats such as csv, mail etc. We present components, which may enable seamless master data update using standardized formats and discuss in detail current barriers within hospital supply to give finally recommendations how to overcome them.

Keywords. eProcurement, Master Data Management, Supply Chain

1. Introduction

Material master data describe the reference description essential materials within an organization. In clinical settings, these are description, for example, of swaps, bandage scissors or injection syringes. Quality of processes and outcomes depend on well-documented, harmonized and valid master data, which also guarantees that orders from the departments are related to the desired materials. Usually, ten thousand of materials are needed, which makes their management challenging, even though most of the items should be stable in the medium-term. The actual amount of data to be managed depends on the granularity of the product to be described. The less detailed a description is, the less is to be managed, the more flexible can the ordering be, but the less precision is possible.

One central problem for material master data management is the gathering and updating of information, especially when there many different deliverers. Data exchange between a hospital and its deliverers is important for having updated information about available material. There is, however, often no standard update procedure within hospitals and no overview about available infrastructures and technologies. This is not only related to the connection between the end consumer and the material provider, but also to the whole chain of deliverers from raw material to the end product.

Here, we investigate whether there are automatable solutions for standardized material data management available that could be adopted by hospitals. For example, the

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catalogue item notification (CIN) standard proposes to unify the data update mechanism for materials based on other standards such as the global trade item number (GTIN) for uniquely identifying products or the global location number (GLN) for uniquely identifying deliverers. We are assuming a running hospital that wants to increase efficiency and data quality that is associated with providing up-to-date material master data. Out of our scope is the question of how material master data can be established.

2. Methods

The context of our work was the Swiss research project "Hospital of the Future", which aimed at realizing selected prototypes for a digitally enhanced future of the Swiss healthcare system. Within this project, material from two previous student projects could be used. A bachelor thesis from 2015 examined the complete hospital supply chain from the manufacturer to the patient for medications together with B. Braun Medical taking intravenous solutions as an example and devised a method for closed loop medication with barcode scanning at the bedside [1]. A student project from 2017 analyzed and described the process chain for eProcurement in hospitals and examined the use of 2D-Barcode, RFID and scales for material weighing operations at the hospitals incoming goods inspection [2].

Semi-structured interviews were conducted with the responsible persons for material management of a Swiss university hospital *A*, a Swiss hospital chain with 16 hospitals *B* and a Swiss regional hospital *C*. Further, interviews were conducted with a large supplier (Johnson&Johnson), a logistics company (Kühne und Nagel), two electronic data interchange provider (EDI provider) specialized on hospitals and a responsible person at GS1 Switzerland (coauthor E. Zetz). Results were collected for a summarizing report within a students' project.

3. Results

3.1. Current situation in the three hospitals

Typically, material master data comprises at least the following fields which are, for example, available in the SAP MM (materials management) system: (i) item designation, (ii) unique item ID, (iii) one or several article classifications, (iv) packaging sizes, (v) specific storage requirements, e.g. temperature or dangerous goods advice, (vi) storage location(s), (vii) minimum quantity, (viii) minimum order quantity, (ix) price, (x) manufacturer and distributor. The analysis showed an interestingly different situation for the three Swiss hospitals, even though all three used the SAP MM and its material master data catalogue for orders, incoming goods, warehouse management and internal commissioning.

Hospital *A* maintains a (shadow) material master data catalogue with a tool of Consense GmbH. This catalogue allows digital updates, mass data import and digital interfacing. After cleansing, its content can be transferred to the SAP MM system which has a material master data catalogue with approximately 50'000 articles. The SAP MM is connected to a digital hospital ordering system.

Hospital chain *B* has recently established a centralized data warehouse (ZENLOP) for currently 14 of the 18 hospitals, which stores 4'700 of the total 60'000 articles listed

in the MM system of the hospital chain [3]. eProcurement is established for orders with many suppliers, but update of the material master data catalogue is a manual process using different formats and catalogues from the various suppliers. Problems arise, e.g., if a manufacturer changes the package sizes, which in the worst case, is only detected upon delivery at the data warehouse and causes problems.

Hospital *C* with 14'000 articles is part of a purchasing organization together with two other hospitals. All three use the same EDI provider, which provides an own material classification with 17 levels and 180'000 classes of materials. The provider supports the hospitals with an own (mapped) master material catalogue, which is imported into the hospitals SAP MM. For the hospital procurement staff, a digital tool is available which supports the search for substitute products among all suppliers cooperating with the EDI provider based on the named large material classification. Figure 1 depicts the current situation for hospitals A and C.

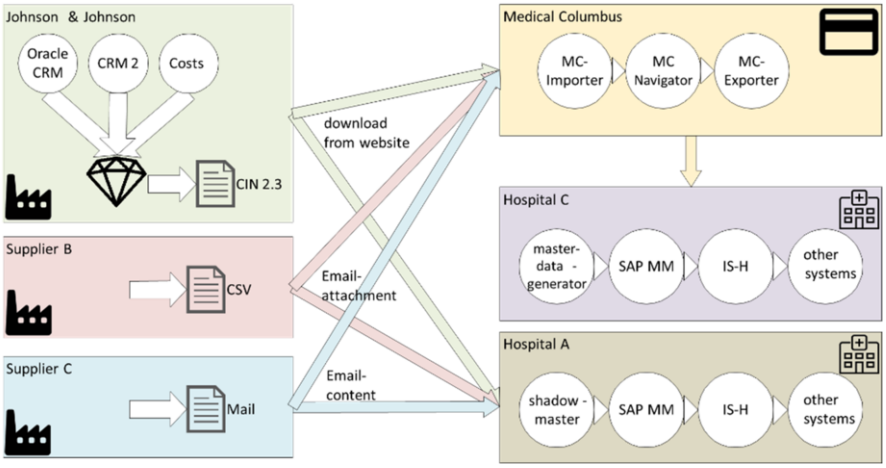

Figure 1. Current situation. Left side three exemplary supplier, right side one EDI provider connected to hospital C and standalone hospital A. Material master data updates arrive via several communication channels (email, download) in different formats at the hospitals.

3.2. Available standards and classifications

For the supplier part the following facts could be derived: Depending on size of the manufacturer and level of digitization the quality of material master data is varying. The GS1 standard Global Trade Item Number GTIN (formerly EAN) [4] is established in the Swiss healthcare system and has, for example, in 2012 replaced the former Pharmacode for drugs. It doesn't solve, however, the master data problem. There are cases where one manufacturer used more than 150 GTIN numbers for the same article depending on time of manufacturing, package size and various other factors. This can cause problems within hospital IT systems who often do not support more than 10 GTIN numbers for one article. For material master data exchange GS1 proposes the Catalogue Item Notification CIN messages [5,6]. There are two versions. CIN version 2.3 is based upon csv messages, whereas CIN version 3.1 [6] is based on XML. CIN uses GTIN for article and package identification and the Global Location Number GLN [7] for the identification of the manufacturer and provider. Country specific extensions can be defined and GS1 Switzerland has thus defined a local extension px13 Healthcare Information Module for

the Swiss healthcare system. Johnson&Johnson for example can currently deliver material master data with CIN 2.3 for about 80'000 articles available in Switzerland on a weekly basis. This, however, requires considerable effort using three different IT systems within J&J for data maintenance. Many small companies are still unable to deliver such data.

In addition, GS1 provides a standard network support for the automated exchange of material master data with a publish – subscribe mechanism. The Global Data Synchronization Network GDSN [8] defines a source data pool where suppliers and sellers can upload new product data. The recipient, in this case the hospital, subscribes to the GS1 global registry and requests article information based on the GTIN. Data is transferred to the recipient data pool and published to the customer. Although the 34 global GS1 data pools contained in 2017 information about 23'000'000 articles from 41'000 sources, the system is not yet spread in the Swiss healthcare system. In the same year, the Swiss company Contentis had only 2 participants and 6 articles in their pool [9].

Classification of articles into groups and classes of materials is essential if a hospital procurement team wants to search for an alternative article with similar properties from another provider. For drugs, the WHO Anatomical Therapeutic Chemical Classification system classifies the active substances in a five level hierarchy [10]. Unfortunately, no such fully open, agreed and standardized classification is available for all materials. eCl@ss is a cross sectoral product classification with 41'000 product classes in four levels in its current version 10.0 [11]. It supports the detailed classification of medicinal products, e.g. 34 medicinal product, 34-22 iv injection, infusion and transfusion systems, 34-22-01 syringe (Medicine) down to 34-22-01-01 iv injection syringe single use. For each product class specific attributes can be defined with a choice from 17'000 potential product attributes. Although the classification itself is openly visible, it may be used only under license. We noted that eCl@ss is used in German hospitals, but it is currently rarely in use in Swiss hopitals. In our observation, hospital group B was in the process of introducing eCl@ss, although without attributes. eCl@ss can be transmitted using CIN 3.1 as AdditionalClassification. Some EDI provider such as Medical Columbus have included eCl@ss in their material master data catalogue and support navigation to alternative articles.

The GS1 alternative is the Global Product Classification GPC [12]. It has a four level hierarchy of segment, family, class and brick. For the brick, attributes can be defined for detailed specification.

Despite such options, proprietary internal classifications are common. Hospital A, for example, maintains an own internal three level classification with several hundred classes. Service providers such as Medical Columbus maintain extremely detailed proprietary classifications, in their case 17 levels with 180'000 classes.

3.3. Potential improvements

After switching to the EDI provider, the head of logistics and materials management of hospital C reported that he is satisfied with the quality of the master data catalogue from his EDI provider. In this case, the service provider has invested considerable efforts to provide a clean and well maintained catalogue to all hospitals in his customers' register. This service, however, is restricted to those suppliers with whom the service provider has payment agreements. Some articles, e.g. prostheses for implantation are not covered.

To improve the situation for Swiss hospitals we identified a problem list (table 1):

Table 1. Current weaknesses of material master data management and potential solutions

Hospital Problem	Potential Solution
Insufficient master data quality	Manufacturers and suppliers should improve source master data quality
Missing automated master data updates	Use of GDSN in combination with CIN 3.1
Unstructured communication of master data	Use of GDSN in combination with CIN 3.1
Restrictions in current MM IT systems (e.g. field length)	Improve MM IT systems for better support of healthcare requirements
Duplicate catalogue entries	Improved update control
Different use of catalogue fields	Improved education of catalogue maintainers
Complex order process	Connect to EDI provider
Difficult search for replacement articles	Use standard catalogue such as eCl@ss or connect to EDI provider.

Provided that more suppliers use the current CIN 3.1 standard and GDSN network an improved communication using the GS1 Global Registry, Source Data Pool and Recipient Data Pool of GDSN could be realized (fig 2). For classification purposes, the proprietary eCl@ss catalogue is currently better suited and further disseminated in German speaking healthcare environment. GS1 GPC has the potential to attract more customers on the long run, but would need extensions for optimal support in the healthcare area.

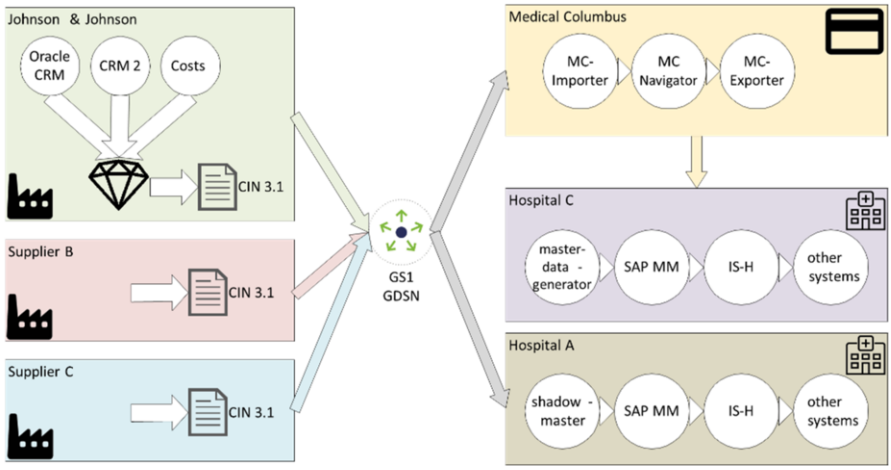

Figure 2. Desired future situation. Material master data is distributed over standard interfaces in a single format

4. Discussion

The technical conditions for an optimized maintenance of master material data catalogues do exist. Connection to the GDSN network either directly or via an EDI provider is possible and semi-automated update of the SAP MM master material data catalogue can be achieved. But the new version CIN 3.1 is not yet common place and the digital delivery of material master data is not a standard for small and highly specialized manufacturers in the healthcare area.

The process can be accelerated if hospitals put pressure on the supplier or manufacturer to adhere to the new standards, which can be reinforced if hospitals build

purchasing groups. The latter requires either synchronization of the eProcurement IT systems between the different sites or adoption of an EDI provider. Administrative regulatory pressure could be helpful, if supplier of healthcare goods do not apply these standards.

On the other hand, the manufacturers or provider incur considerable costs for the IT update which they will likely add to their sales prices. Connection to GS1 data pools results in costs as well for provider and for the hospital.

In summary, there is considerable potential for improving material data management in hospitals by defining automatable workflows based on existing standards, especially those stemming from the GS1 context. Using GTIN for article and package identification, the Global Location Number GLN, the Global Data Synchronization Network GDSN for exchange of material master data, and eCl@ss for highly-granular product classification allows to streamline and automate the whole material data workflow. There is, however, a lack of information regarding options and costs in hospitals, which should be addressed, among others, by more publications on this issue.

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