

Abstract Information Model for Geriatric Patient Treatment

Actors and Relations in Daily Geriatric Care

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Abstract: The authors propose an abstract information for geriatric care, the geriatric information model (GIM). They adopt an information model from cancer care and introduce characteristics for geriatric care (patient population, multidisciplinary and multi-professional approach, cross-sectoral approach). Actors (patients, physicians, therapists, organisations), information objects, and information relations are defined. The GIM is validated by mapping four typical knowledge processes (multi-professional geriatric team session, interdisciplinary clinical case conferences, tumor boards, transition management) onto the model. The GIM is stated as useful for understanding information flows and relations in geriatric care. All processes for validation can be mapped onto GIM. In future work the GIM should be tested with more knowledge process and could also be used for identifying gaps in the IT support of geriatric care. A study on high and low information quality in geriatric care is also proposed.

1 INTRODUCTION

Patient treatment is a heavily data, information and knowledge driven process with inter- and multidisciplinary cooperation (Chamberlain-Salaun et al., 2013, 74ff.). The amount of available data, information and knowledge is increasing due to ongoing technological developments and medical research. Medical information gathered in the domestic and mobile environment of the patient will tighten this process in the future.

These challenges also apply for geriatric patient treatment (Mangoni, 2014) (Rölker-Denker and Hein, 2015). Geriatric treatment is characterized by a target population with complex diseases and an increasing amount of patients, a multidisciplinary and multi-professional treatment approach and a cross-sectoral treatment (see section 3. For better understanding, managing and controlling of information flows under these constrains an abstract information model is needed.

In this work we adopt the approach of Snyder et al (Snyder et al., 2011) who introduce an information model for cancer care (see section 2). Afterwards, the principles of geriatric care in Germany are introduced (see section 3). The model is then modified to the needs of geriatric care based on literature review and results from observational studies and interviews

with practitioners 4. The work is then validated with four typical knowledge processes being mapped to the model 5. The work then closes with a conclusion and outlook 6.

2 ABSTRACT INFORMATION MODEL

Snyder et al (Snyder et al., 2011) propose an abstract information model for cancer care. Information in cancer care is originated from clinician and patient side (actors) and there are different communication paths (relations). The actor-relations structure is depicted in figure 2.

2.1 Actors

Actors in the cancer care process resume have roles and functions. In detail these are:

- Patient: treated by a clinician;
- Other patients: patients with same or similar disease and/or treated by the same clinicians or hospitalized in the same health organisation;
- Patient's family and friends: people associated with the treated patient;

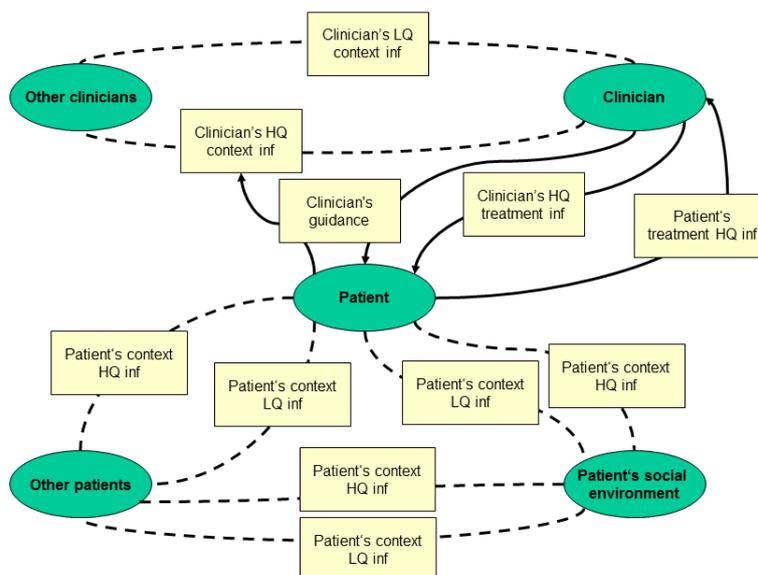


Figure 1: Abstract Information Model based on (Snyder et al., 2011).

- Clinician: treating a specific patient;
- Other clinicians: other clinicians from the same discipline (higher or lower rank), associated discipline or health organisation in contact with the clinician in charge.

2.2 Relations

Patients and clinicians exist in a universe of information. Snyder et al differentiate between high-quality (HQ) information and low-quality (LQ) information, with only a portion representing HQ information. HQ information relations are:

- Clinician's HQ treatment information: Combination of clinician's medical knowledge (gained from education and experience) and acquired medical information (laboratory, medical imaging, EEG, ECG) with the information gained from examining the patient (sensorial information);
- Patient's HQ treatment information: Information provided by the patient, e.g. drug intake, health-relevant behaviours (nutrition, smoking) or familial-genetic preload;
- Patient's HQ HQ information: information shared along the patient and its family and friends and along the patient and other patients;
- Clinician's HQ context information: Information shared along the care team;
- Clinician's guidance: Clinicians can direct their patients to appropriate information resources.

At the same time, it must be noted that much of the information available to both clinicians and patients is biased, incorrect, or otherwise not useful. LQ information is shared frequently among patients.

- Patient's LQ information: information shared along the patient and its family and friends, and along the patient and other patients;
- Clinician's LQ context information: Low quality information is shared even among clinicians.

3 CHARACTERISTICS FOR GERIATRIC PATIENT TREATMENT IN GERMANY

The following statements mainly focus on the specific situation in Germany which the specifics of the German health care system being separated into different sectors. Nevertheless the used information in geriatric care is comparable to other countries while crossing the sectoral borders is the main challenge in Germany.

The information flows in geriatric treatment differ from the information flows in cancer care. There are four main reasons:

- Patient population;
- Multidisciplinary approach;
- Multi-professional approach;
- Cross-sectoral approach.

3.1 Patient Population

Geriatric patients often suffer from chronic conditions, multimorbidity, polypharmacy and cognitive deficits (Soriano et al., 2007, 15). They are often hospitalized in nursing or retirement homes and, due to cognitive impairments, not able to give proper information about their health status. This results in a strong demand on patients' information from clinicians' view. In addition the amount of geriatric patients is continuously rising with the demographic change in most industrial societies (Kolb and Weißbach, 2015). Therefore a structured information acquisition is essential for the future success of geriatric treatment.

3.2 Multidisciplinary Approach

Due to multimorbidity and chronic conditions, geriatric treatment follows a holistic and systemic approach including several different kinds of medical disciplines. The most frequent disciplines involved are internal medicine, family medicine, psychiatry and neurology followed by orthopaedics, surgery, trauma and abdominal surgery (Nau et al., 2016, 603ff.).

3.3 Multi-professional Approach

Geriatric treatment and geriatric care is a highly multi-professional process with several professions included (Tanaka, 2003, 69ff.). In Germany, geriatric is organised in different ways. In case of stationary care selected patients can be treated under supervision of the multi-professional geriatric team (MGT) in the so-called complex geriatric treatment (German: geriatrische frührehabilitative Komplexbehandlung) (Kolb et al., 2014) (Rölker-Denker and Hein, 2015, 314f.). The MGT consists of physicians, nurses, therapists (logopedics, physiotherapists, occupational therapists, psychologists) and social workers.

3.4 Cross-sectoral Approach

Geriatric patient are often treated over sectors borders and in other health care organisations (HCOs). In Germany, medical treatment is mainly separated into ambulatory care/out-patient care (general physicians, consulting/specialist physicians, ambulatory medical services provide by hospitals) and hospital care/in-patient care. Rehabilitation care, stationary care (nursing homes, retirement homes) and home care are other relevant sectors for patient treatment.

4 GERIATRIC INFORMATION MODEL

The key to the Geriatric Information Model (GIM) is depicted in figure 4, the GIM itself with actor-information relations in figure 4.2.

4.1 Actors

Within the GIM actors can be a single actor or a group, consisting of several single actors or other groups. Single actors describe a specific class of persons with similarities (e.g. patients, carers, clinicians) whereas a group subsume different actors. E.g. carers are one actor (because having the same characteristics) whereas therapists are group consisting of different kind of therapists.

- Patient (actor): geriatric patient treated by a clinician;
- Other patients (group): patients with same or similar disease and/or treated by the same clinicians or hospitalized in the same health organisation;
- Patient's Social Environment (group): people associated with the treated patient;
- MGT (group): The team consists of clinicians, nurses, therapists, and medical social workers;
- Clinician (actor): treating a specific patient and part of the MGT with specific geriatric education and training;
- Care (actor): nurses in charge for the patient, often with specific geriatric education and training;
- Therapists (group): logopedics, physiotherapists, occupational therapists, psychologists and also other therapists if needed. They perform their specialised assessments to monitor the treatment outcome;
- Social service (actor): medical social service workers are responsible for the social assessment, communication with other HCOs, with courts (in case of guardianship). They organise transition management to other HCOs (care home, ambulatory care);
- Other HCOs (group): these are other HCOs also responsible for the patient in the past and/or in the future, often with HQ information being important for the treatment. These HCOs can be from ambulatory care/out-patient care (general physicians, consulting/specialist physicians, ambulatory medical services provide by hospitals), hospital care/in-patient care (other hospitals), rehabilitation care, stationary care (nursing homes, retirement homes) and home care;

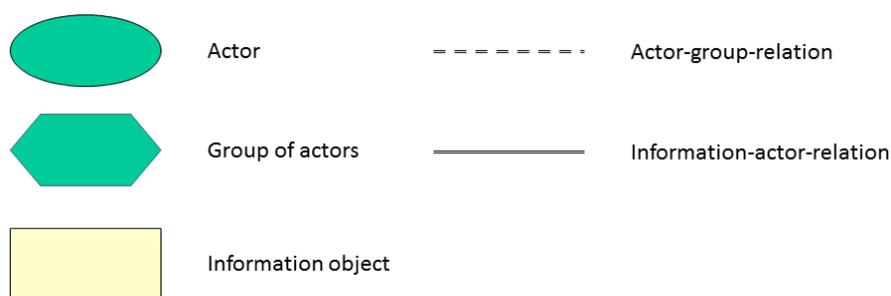


Figure 2: Key to Geriatric Information Model.

- Other clinical professions (group): these are all other clinical profession not in direct contact with the patient and not part of the MGT. This also includes other clinicians from the same discipline (higher or lower rank), associated discipline or health organisation in contact with the clinician in charge. They can be also from the geriatric discipline and/or internal medicine and share their information and knowledge in regular clinical conferences or they can be from other departments and disciplines and are often involved by consultation and/or patient transfer between the disciplines;
- Other knowledge actors (group): all other relevant knowledge actors outside the treating HCOs like medical societies, quality circles, medical specialist publishers, libraries, other hospitals from the same network (and not involved in the current treatment of the specific patient) etc. This group of actors could be also labelled as communities of practice (CoPs) (Wenger, 2000, 229ff.) (Li et al., 2009, 1ff.).

4.2 Information Objects

Information objects are shared between actors and groups (see section 4.3 below).

- Treatment Information: about current treatment, can contain diagnosis, treatment decisions, feedback from the patient about the progress, results of shared-decision, etc.;
- Context information: disease and behaviour related self-experiences (e.g. on procedures, medications), information about suitable contacts (specialised hospitals, physicians, disease-related support groups etc.);
- Patient's context information: health behaviour in the past, information on domestic and social environment;

- Clinical context information: laboratory findings, electroencephalography (EEG), electrocardiography (ECG), medical imaging, other information which is provided by specialised departments;
- Medical context information: medical background information, latest research results, clinical guidelines.

4.3 Actor-information Relations

The possible information relations are listed and explained below:

- Patient - MGT - Treatment Information: this is the main information relation in the geriatric treatment process. All necessary treatment from involved professions (clinician, care, therapists, social service) about the patient's health status is resumed here;
- Patient - Other patients - Context information: this information relation contains all disease-related information, but also experience-related information like information from other patients being treated by the same HCOs or even the same clinician;
- Patient - Patient's Social Environment - Context information: this relation is comparable to the previous relation because persons from the patient's social environment could be also suffering from a similar disease in the past or present;
- Other patients - Patient's Social Environment - Context information: in this relation other patients share their experience with the patient's social environment. This could be information on how to act in critical disease-related questions;
- MGT - Patient's Social Environment - Patient's context information: through this relation information about the patient's situation at home is shared. Treatment information could also be verified;

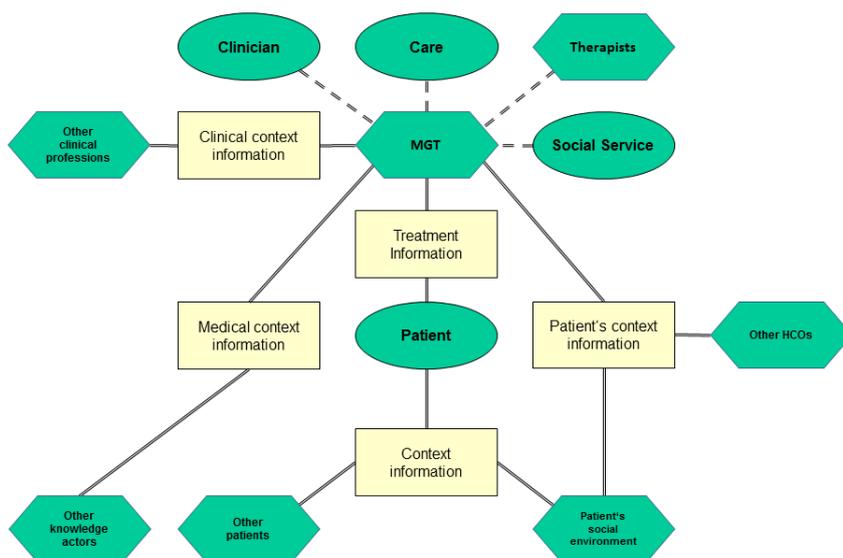


Figure 3: Geriatric Information Model.

- MGT - Other HCOs - Patient's context information: through this relation information about the patient's previous treatments (other hospitals, general and specialist physicians), his domestic situation (in case of care or retirement home, or ambulatory care services) is shared;
- Patient's Social Environment - Other HCOs - Patient's context information: by this information relation the patient's social environments shares patient' context information with other HCOs like information on health behaviour in other contexts (previous disease, behaving in rehabilitation treatments, etc.);
- MGT - Other clinical professions - Clinical context information: this relation contains the information provided by consultations or morning, lunch or radiological conferences with other specialist clinicians but also with other professions like therapists not involved in the formal MGT;
- MGT - Other knowledge actors - Medical context information: MGT members communicate with other members of their COPs about their current treatment, they investigate in (online) libraries or journals.

- Multi-professional Geriatric Team Session (Rölker-Denker and Hein, 2015, 314f);
- Interdisciplinary Clinical Case Conferences (Rölker-Denker and Hein, 2015, 315);
- Tumor boards (Rölker-Denker et al., 2015b, 54);
- Transition management (Rölker-Denker et al., 2015a,).

5.1 Multi-professional Geriatric Team Session

The MGT session is the regular meeting of the geriatric team 4.1. During this meeting all relevant information is discussed:

- Treatment information: Feedback from the patient on the health status is discussed as well as direct impressions from all persons in contact with the patient. Information passed towards the patient is also discussed as well as the further treatment process;
- Patient's context information: this information is of very high relevance for the MGT session. This includes information about the domestic environment, e.g. how many stairs has the patient to climb at home, are there any assisting services or ambulatory care services, unhealthy behaviours and supply with medication and assisting devices;
- Clinical context information: This includes from other clinical professions like consultation results from other disciplines, blood values and medical

5 VALIDATION OF GIM

To validate the GIM four typical knowledge processes are mapped to the model. The mapped knowledge processes are

imaging. During the session information which will be forwarded to other clinical professions is also discussed, e.g. information for treating surgeons;

- Medical context information: This includes information stored in clinical guidelines, e.g. the guideline on urinary incontinence for geriatric patients (AWMF (Arbeitsgemeinschaft der Wissenschaftlichen Medizinischen Fachgesellschaften) (engl: Association of the Scientific Medical Societies in Germany), 2016) but there also many other guidelines for age-related health issues and diseases (e.g. clinical nutrition, delirium, Parkinson disease, palliative care).

5.2 Interdisciplinary Clinical Case Conferences

Interdisciplinary clinical case conferences consist of members from different medical fields, the scope of these conferences is to discuss complex patient cases and to derive possible treatments (Feldman, 1999). The conferences are organised on a regular basis (Rölker-Denker and Hein, 2015, 315) (Rölker-Denker et al., 2015b, 54). During these conferences the following information is discussed:

- Treatment information: The MGT clinicians present their treatment information about the patient;
- Clinical context information: The other members of the clinical case conference provide their knowledge about the specific case and discuss with the inquiring clinicians possible treatment alternatives;
- Medical context information: other clinical professions provide and explain clinical guidelines the asking clinicians are not aware of.

5.3 Tumor Boards

Tumor boards are similar to clinical case conferences but focus on oncological diseases and overcome sectoral borders by connecting clinical physicians with residential physicians and other oncological professions (Rölker-Denker et al., 2015b, 54). Geriatric oncological treatment is also multi- and interprofessional, includes the patients' social environment (Magnuson et al., 2016) and even allows patient participation (Ansmann et al., 2014, 865ff.). Mainly the same information is discussed as in the clinical case conference but in addition:

- Treatment information: in case of participation the patient can give information about the health

status and also take part in the decision process on further treatment;

- Patient' context information: as residential physicians are also part of the clinical case conference (in terms of "other HCOs") they can provide more context information about the patient as clinical physicians could.

5.4 Transition Management

The goal of transition management is to ensure an optimal patient path through the different interfaces of cross sectoral care (Huber et al., 2016). Transition management does not only include communication between hospitals and downstream health care organisations (releasing a patient into rehabilitation or stationary/ambulatory care), it also includes the communication between hospitals and upstream health care organisations (moving patient from stationary care into hospitals) (Arve et al., 2009).

- Medical context information: up to now there is no national guideline on transition management by medical societies. But there are several local networks that develop such guidelines and make them publicly available;
- Patient's context information: this information is shared along all responsible HCOs and contains information about further medication, previous medication, recommendations on health-related behaviour (nutrition, physical activities, etc.).

6 CONCLUSION AND OUTLOOK

6.1 Conclusion

We developed an abstract geriatric information model (GIM) for the purpose of better understanding the typical actors of geriatric treatment and the information relations between them. The GIM was validated by mapping typical care settings which occur during the geriatric treatment. It was shown that all processes could be mapped into the GIM and all defined actors and information relations within the GIM are of relevance. Some knowledge processes are limited to a subset of actors (e.g. clinical case conferences do not imply the patient or the patient's social environment) whereas other knowledge processes include all actors and information relations (e.g. the MGT session).

The GIM is not intended to be used for developing sophisticated clinical information systems like other approaches, e.g. the HL7 Clinical Information Modeling Initiative (CIMI) (HL7 Clinical Information

Modeling Initiative, 2016). The purpose of CIMI is to develop interoperable healthcare systems on a technical basis. The focus is not on the communication between persons involved in the geriatric treatment. Nevertheless links to this work are mandatory in future work because geriatric treatment is cross-sectoral 3.4 and includes data and information from different IT systems.

6.2 Outlook

The GIM was only validated with four typical knowledge processes in geriatric treatment. Referring to previous studies of the authors (Rölker-Denker and Hein, 2015) (Rölker-Denker et al., 2015b) there are more knowledge processes to be mapped towards the GIM.

The approach of HQ and low quality information was not included in the GIM so far. There have been no dedicated studies on the information quality in daily geriatric treatment so far and, for thus, there are no validated results available. There are studies for general information quality, e.g. analyse the impact of internet health information (Laugesen et al., 2015) but there are no dedicated studies in the geriatric context.

The GIM can be also used for identifying gaps in the IT landscape (Snyder et al., 2011). Healthcare organisations can check all the actor-relation-couples and see if there are gaps.

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