Requirements Index for Information Processing in Hospitals

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The goal of the requirements index is to support the management of hospital information systems, especially strategic information management and selection of software products.

The German requirements index is available at the websites of

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- Dt. Gesellschaft für Med. Informatik, Biometrie und Epidemiologie (gmds, www.gmds.de),
- Dept. of Medical Informatics, University of Heidelberg (www.anforderungskatalog.uni-hd.de).

The Englisch translation of the requirements index is available at:

- www.umit.at/reqhis

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1 Introduction

1.1 Goal of the requirements index

Reference models describing typical information processing requirements in hospitals do not currently exist. This leads to high hospital information system (HIS) management expenses, for example, during tender processes for the acquisition of software application programs.

The goal of the research project “A requirements index for information processing in hospitals" was, therefore, to develop a comprehensive, lasting, technology-independent, and sufficiently detailed index of requirements for information processing in hospitals, in order to reduce respective expenses and to present guidelines for good information processing practice. This should support the systematic management of hospital information systems, especially strategic information management, as well as the selection of software application programs.

We hope that the requirements index can support the quality of information processing, as well as the communication between hospitals and vendors. Finally, a high quality of information processing supports a high quality of patient care.

1.2 Content and structure of the requirements index

The requirements index is separated into two main parts: functional requirements and function-independent requirements. This first official German version of a requirements index contains 233 functional requirements and 102 function-independent requirements.

The functional requirements are structured according to the primary care process from admission to discharge and supplemented by requirements necessary for the smooth organisation of patient care: for handling patient records, work organisation and resource planning, hospital management, research and education. The function-independent requirements represent requirements valid for any information management such as data security or system administration.

The different functional requirements have been identified base on the concept of use cases (e.g. [Cockburrn 1997]; [Lauesen, Mathiassen 1999]). First, the tasks are described in a structured way with their main goal (symbolised by ✓). Then, tasks are divided into subtasks, to which requirements are related. If necessary, important point are highlighted which can be helpful when using the requirements index (symbolised by ☝). The function-independent requirements are structured accordingly.

The editorial team welcomes any ideas and comments with regard to the structure and content of the requirements index for information processing in hospitals.

1.3 Use of the requirements index

The contents of the requirements index are practically oriented. They do not present standards, but guidelines for information processing. Anyone can adapt this requirements index to existing frameworks according to his or her project goals. This requirements index completes existing recommendations of the Deutsche Forschungsgemeinschaft (DFG) ([DFG 1992]; [DFG 1997]; [DFG 1998]).

The requirements index is not a union of sets of existing requirements indices for specific software application programs, which are mostly rather detailed, product specific, and specific to an environment, and which may be useful e.g. for concrete contracts between hospitals and vendors. For strategic information management or for the selection and comparison of software application programs, such a level of detail may prove to be a hindrance. Therefore, this requirements index for information processing in hospitals presents a general valid structure of the main requirements for information processing in hospitals.

The requirements are formulated independent of information processing tools, or of information system architectures. This means that the requirements are valid both for the conventional and computer-supported part of a hospital information system. This makes it quite different from other requirements indices.

The requirements are formulated independent of the different typical areas of a hospital (such as surgery, laboratory, radiology, ward). The information requirements of the different areas are generally similar, even when the details are site-specific. Therefore, they can be derived from the general requirements in this index.

The index can be regarded as a draft, which must, however, be refined according to the specific goals of a particular project. Here, more specific existing requirements may be helpful, as they show how general requirements may be instantiated in specific environments. See the references in chapter 4 for some sources.

2 Functional Requirements

2.1 Functional Group 1: Treatment of Patients

✔ Support patient care in outpatient or inpatient settings from admission to discharge, including activities such as documentation and billing, and if necessary, the transfer to other institutions.

Task 1.1: Patient Admission

✔ Record and make available relevant central patient treatment and administration data.
✔ Unique identification of a patient and allocation of a unique patient and case identification.
☝ The patient's admission begins the process of treatment. The admission data therefore have to timely be available for use in other tasks and activities.
☝ The process of an admission can be dependent on the existence of a central admission; their working hours can vary.

Subtask 1.1.1: Patient Scheduling and Reminder

A.1.1.1.a	Appointments can be scheduled by department.
A.1.1.1.b	Appointment suggestions can be made and scheduled upon the completion of a procedure (E.g. for a follow-up).
A.1.1.1.c	All initially obtained data have provisional character. They can be changed and completed later.
A.1.1.1.d	Patients can be called in based on their scheduled appointment.
A.1.1.1.e	If the appointment for a planned procedure has passed without the actual procedure taking place, the scheduling department is informed and the appointment is deleted after a defined number of days.
A.1.1.1.f	The state of the existing appointments can be sorted and presented through various characteristics (E.g. admission date, department, planned procedure, urgency).
A.1.1.1.g	When required, people can be notified when appointments have changed or have been delayed.

Subtask 1.1.2: Identification and Checking for Recurring Patients

A.1.1.2.a	Every patient will be given a unique patient identification number (PIN), being the precondition for a patient oriented data management. The PIN is free of semantics and can't be changed. A new number is created for each new patient. The patient is also be given a new case number.
A.1.1.2.b	All identifying characteristic features of a patient can be recorded.
A.1.1.2.c	Smart cards can be used to support identification.
A.1.1.2.d	Every identification triggers the examination for recurring patients. In case the patient isn't known, a new admission takes place. If the patient is known, the existing data show up in update mode.
A.1.1.2.e	Different search criteria such as patient identification number, case number, security number, birth date, name, clinic/department, timeframe of treatment, and care type can be used to re-identify a patient.
A.1.1.2.f	For recurring patients, the search and transmission of a patient record will be done by the admitting hospital unit under consideration of data security rules.

Subtask 1.1.3: Administrative Admission

A.1.1.3.a	All characteristics of a patient relevant to administration and accounting can be recorded.
A.1.1.3.b	Organisational supplies (Such as tags, magnetic cards, etc) can be generated based on the recorded characteristics.
A.1.1.3.c	In the case that administrative personnel are absent, caretakers, for example, need to be able to extract characteristics for identification purposes, as well as generate organisational supplies.
A.1.1.3.d	Non responsive emergency patients can be admitted tentatively. The data recorded during the emergency treatment can be used later.
A.1.1.3.e	Admission complexity is minimal for regularly returning patients (E.g. Dialysis patients).
A.1.1.3.f	New-borns are admitted in relation to the case of the mother.
A.1.1.3.g	Accompanying persons are admitted in relation to the patient.
A.1.1.3.h	Various preferences (Such as single room, window, telephone) can be booked based on the patient and how well the hospital wards in question are equipped.
A.1.1.3.i	Plausibility checking and assistance for data entry (Selection lists, default fields) secure the quality of admission data.
A.1.1.3.j	When required, all admission documents can be signed by the patient.
A.1.1.3.k	The clarification of the payment of costs is initiated.
A.1.1.3.l	The legal duties of disclosure are followed in conformity with §301 SGB V.

Subtask 1.1.4: Medical Admission

A.1.1.4.a	From a physicians point of view, relevant patient characteristics (Like primary diagnosis, reason for hospitalisation, anamnesis) can be recorded in a structured way.
A.1.1.4.b	Administrative data, and if necessary, nursing admission data and data regarding the reason for hospitalisation are available to the admitting physician.
A.1.1.4.c	With regard to different wards, partially standardised questionnaires can be created and used to obtain medical histories.

Subtask 1.1.5: Nursing Admission

A.1.1.5.a	Relevant characteristics (Such as anamnesis and reason for hospitalisation) about a patient can be structurally documented from the point of view of a nurse.
A.1.1.5.b	Administrative data, and if necessary, medical admission data and data on the reason for hospitalisation are available to the admitting nurse.
A.1.1.5.c	With regard to different wards, partially standardised questionnaires can be created and used to obtain care histories.

Subtask 1.1.6: Alteration of Previously Recorded Admission Data

A.1.1.6.a	Lists of incomplete admissions are available so that they can be completed. These can separately be constructed according to different criteria (E.g. area of admission).
A.1.1.6.b	The type of admission (E.g. outpatient or inpatient) can be changed without having to generate a new case number.
A.1.1.6.c	The joining and separation of patient data is supported.

Subtask 1.1.7: Patient Information and Information Services

A.1.1.7.a	Overviews of current occupancies can be generated (E.g. for the reception)

A.1.1.7.b	Other department relevant lists (E.g. list of new-borns, list of cancelled admissions) can be generated when required.

Task 1.2: Planning and Organisation of Patient Treatment

✔ Support in decision-making regarding medical and nursing measures.

☝ Decision making is a constant task. It is initiated by new information and leads to the acquisition of new knowledge.

☝ The requirements for subtask 'Access to the Patient Record' will be listed in task 2.4 (Analysis of the patient records).

Subtask 1.2.1: Decision-Making and Clarification

☝ To make a decision about further measures, it is assumed that all professionals as well as the patient have the necessary information and can together agree on further diagnostics and therapies.

A.1.2.1.a	Decisions during patient care can be supported through knowledge based functions and the active monitoring of data.
A.1.2.1.b	Decisions are comprehensibly retained in the patient record (Decision maker, content of the decision, outcomes).
A.1.2.1.c	Before the performance of procedures, the patient receives an in depth description of the risks involved with the procedure. This information, as well as the decision made by the patient are documented.

Subtask 1.2.2: Access to Knowledge Needed for Decision-Making

A.1.2.2.a	Access to concrete medical and nursing guidelines, directives, and standards is available.
A.1.2.2.b	The access to general medical knowledge is supported (E.g. reference material).
A.1.2.2.c	Support for medical prescriptions is possible (E.g. provide pharmaceutical information).
A.1.2.2.d	It is possible to attain external expert advice for complex medical or nursing questions (E.g. within the framework of consultations).
A.1.2.2.e	Information relevant to treatment should be available to all medical and nursing employees, as well as patients, in a way that is simple but as detailed as possible.

Subtask 1.2.3: Production and Updating of a Medical or Nursing Care Plan

☝ The requirements for appointment and resource planning can be found in task 3.1.

A.1.2.3.a	The planned diagnostic and therapeutic medical and nursing procedures will be documented with regard to type, scope, length, and responsibilities.
A.1.2.3.b	When required, the treatment plan can easily be changed.
A.1.2.3.c	Planning support exists for interrelated procedures (E.g. recurring appointments for physiotherapy).
A.1.2.3.d	The production of a care and cost plan is supported (At this time primarily for dentistry).

Task 1.3: Order Entry and Taking Samples

✔ Initiation and arrangement of a diagnostic or therapeutic measure with sampling through someone requesting a procedure at an order entry location.

☝ Requests for procedures can have different amounts of urgency.

Subtask 1.3.1: Preparation of the Request

A1.3.1.a	The selection of interventions that can be requested is found in a central registry containing a structured overview of all of these interventions.
A1.3.1.b	The selection of typical interrelated orders (E.g. small blood sample) is possible.
A1.3.1.c	The diagnosis, question, as well as additional clinical facts can be recorded on the form used to request an order.
A1.3.1.d	Previously recorded data such as general patient data, case data, and diagnosis data can be reused.
A1.3.1.e	Additional remarks can be recorded.
A1.3.1.f	The person responsible for the order, or a person who is allowed to do so, has to be able to authorise the order.

Subtask 1.3.2: Taking a Sample

A.1.3.2.a	Important information for taking a sample can be found on the request form.
A.1.3.2.b	The containers for the samples to be taken from the patient are clearly related to the actual order (Referential integrity, e.g. through labels).
A.1.3.2.c	Additional indications such as infectious, or urgent/hurry, are possible.

Subtask 1.3.3: Transmission of the Request

☝ Transmission doesn't directly correlate with subtask 1.3.1 (Preparation of the request), but can be seen as an independent task. This is important, for example, when nurses prepare orders and physicians send them off.

A.1.3.3.a	The order is transmitted from the person requesting the order to the person carry out the request in a timely fashion.
A.1.3.3.b	In the case that the container for the sample and the form with the actual request are transported separately, it is guaranteed that they can be brought together when they reach the person fulfilling the request.
A.1.3.3.c	The person fulfilling the request is informed of the order. (If necessary, it is entered into his work list.)
A.1.3.3.d	The requested procedure as well as the transmitted information are recorded in the patient record.

Subtask 1.3.4: Changes to Already Requested Procedures

A.1.3.4.a	The status of current requests can always be seen.
A.1.3.4.b	Summaries of current requests are available so that a request that needs to be changed can be selected. These can be sorted and presented by patient, person who made the request, or person who is carrying out the request.
A.1.3.4.c	Pending requests can be cancelled or modified. The person carrying out the request will be informed.

Task 1.4: Order Entry and Scheduling

✔ Initiation and arrangement of a diagnostic or therapeutic measure with scheduling by a person requesting a procedure at the location where procedures can be requested.

Subtask 1.4.1: Preparation of the Request

☝ The specifications are represented in subtask 1.3.1

Subtask 1.4.2: Scheduling

☝ The specifications are represented in subtask 3.1

Subtask 1.4.3: Transmission of the Request

☝ The specifications are represented in subtask 1.3.3 (Specification 1.3.3.b is omitted)

Subtask 1.4.4: Changes to Already Requested Procedures

☝ The specifications are represented in subtask 1.3.4

Task 1.5: Execution of Diagnostic or Therapeutic Procedures

✔ Support in the execution of all physician and nursing oriented procedures.

☝ Procedures are executed in all areas including ambulances, wards, and functional areas.

☝ The specifications with regard to flow control and work lists are represented in task 3.4 (Providing assistance and organisational resources).

Task 1.6: Administrative Documentation

✔ Creation of a valid collection of data in accordance with legal regulations (E.g. §301 SGB V in Germany) for controlling, internal budgeting, internal operational performance accounting, cost bearing accounting, and economic analysis.

☝ Procedure documentation should fairly easily be derived from clinical documentation.

☝ Data necessary for current case mix group accounting procedures (e.g. DRGs) can be recorded in the procedure documentation. The procedure documentation therefore has to flexibly be able to adapt to changing basic legal conditions.

☝ The creation and deposition of procedure catalogues is a cumbersome and complex task that, among other things, is dependent on relevant accounting laws and internal procedural spectrums. Under certain circumstances, this activity would be taken over, or at least co-ordinated, by controlling.

☝ A substantial part of procedure documentation is the documentation of diagnoses and measures. General specifications for these can be found in task 2.3 (Documentation of diagnoses and performance). Only the specific specifications are displayed in the following.

A.1.6.a	Information available from clinical documentation can be presented as a basis for administrative documentation.
A.1.6.b	Procedural complexities can be defined and used at any depth of aggregation. The compilation of single procedures into procedural complexes should be clinically meaningful.
A.1.6.c	Meaningful procedural complexes are recommended on hand of clinical patient data and procedure requests.
A.1.6.d	Procedure documentation and procedure requests can be compared in order to detect procedures that haven't been documented.
A.1.6.e	The documented procedures are correctly and uniquely assigned to a case or contact, procedural catalogue, the person who requested the procedure, and the person who carried out the procedure.
A.1.6.f	Cases without documented procedures can be shown with regard to or within the context of the patient.
A.1.6.g	A quality checking procedure exists to check the completeness and timeliness of procedure documentation.
A.1.6.h	Billing possibilities that are dependent on content and quantity of documented procedures can be displayed to support the plausibility of documentation.

Task 1.7: Billing

✔ Guarantee the correct, complete, and timely billing of a completed procedure in accordance with legal specifications.

☝ A prerequisite for billing is the complete and correct documentation of the procedures (Cf. task 1.6).

☝ Annual cut-off dates have to be taken into account during billing and analysis.

☝ The billing of procedures have to have the ability to flexibly adapt to basic changes in legal conditions (E.g. the introduction of case mix group based billing procedures like DRGs).

A.1.7.a	Billing takes place in a timely fashion (E.g. 14 days after a discharge from a certain ward, and at the end of the quarter in the ambulatory area).
A.1.7.b	Current legal specifications are taken into consideration during billing. Current fees and procedural catalogues are available.
A.1.7.c	Past patient contacts can be represented chronologically.
A.1.7.d	Possible variations in billing can be deduced, validated, and compared with the available procedural data. In the case of case mix group based billing procedures (E.g. DRGs), meaningful case groups can be suggested and assigned based on the documented diagnoses and procedures.
A.1.7.e	Subsequent justified corrections and additions to the recorded procedures are possible.

Task 1.8: Clinical Documentation

✔ Complete, correct, and timely recording of all relevant clinical patient data for support in patient care, billing, controlling, quality assurance, research, and education.

☝ A part of clinical documentation is the documentation of diagnoses and measures. Specifications for these can be found in task 2.3.

☝ Data should be recorded in a structured way in order to increase their analysis potential. This structure should be carried out in a uniform way (standardised forms). However, subject-specific peculiarities must be able to be illustrated.

A.1.8.a	All data relevant for patient care can be recorded. Subject-specific peculiarities can be taken into consideration.
A.1.8.b	All clinical data should be able to be combined (With consideration to data security) to form an overall picture of the patient. For this to occur, patient and case identification must be documented correctly.
A.1.8.c	Clinical documentation should always be checked for data quality (E.g. completeness, readability).
A.1.8.d	Documentation is complete such that every measure in the clinical data can be justified.
A.1.8.e	The documentation has to satisfy legal specifications. Therefore, all relevant decisions and measures must be kept in writing. In particular, the respective recorder as well as the date of the recording or change must be kept.
A.1.8.f	Legal registration obligations (E.g. epidemic registries) and legal documentation obligations are adhered to.

Subtask 1.8.1: Nursing Documentation

A.1.8.1.a	All six phases of the care process can be documented.
A.1.8.1.b	A care plan facilitating the recording of problems and resources, and goals and measures can be created.

A.1.8.1.c	Goals for care can be defined and checked over.
A.1.8.1.d	Encoding catalogues for care taking diagnoses and measures can be used.
A.1.8.1.e	Medical data such as vital signs and medications can be documented.
A.1.8.1.f	Previously defined care plans and complex measures can be used in documentation.
A.1.8.1.g	The stages of care can be derived from the available clinical data.

Subtask: 1.8.2: Physician Documentation

A.1.8.2.a	All medically relevant data such as anamnesis, diagnoses, therapies, and findings can be recorded.
A.1.8.2.b	The documentation of subject specific and special data (e.g. ICU, studies) is possible. This adds to the existing clinical data.
A.1.8.2.c	Arrangements with other occupational groups (e.g. Nursing) as well as their contributions can be documented.
A.1.8.2.d	The processing state of the arrangement (e.g. arranged, accepted, carried out, acknowledged) can be presented.

Subtask: 1.8.3: Receipt and Presentation of Findings

A.1.8.3.a	The notification of the recipient takes place through the presentation of a new finding.
A.1.8.3.b	New, not yet countersigned findings, can be sorted and presented in different ways (E.g. based on a person, based on a ward, temporally arranged, arranged by priority).
A.1.8.3.c	Quantitative values and values that repeat themselves (Above all, laboratory findings) can be presented chronologically.
A.1.8.3.d	Critical values are presented with optical, and if necessary acoustic emphasis.
A.1.8.3.e	The physician must be able to countersign a finding that has been received.
A.1.8.3.f	Findings that have been received are arranged in the patient record based on particular information.

Task 1.9: Discharge and Referral to other Institutions

✔ Support of the optimal continued care of the patient during referral by passing on all relevant information to the area where continuing treatment will take place.

A.1.9.a	Administratively relevant discharge data can be recorded.
A.1.9.b	The discharge triggers the initiation of final procedural billing (Cf. task 1.7).
A.1.9.c	The legal reporting obligations as in §301 SGB V are adhered to (Transmittal of discharge and billing dataset, including the reporting of discharge diagnoses to the bearer of costs within 3 working days of the discharge).
A.1.9.d	The information needed for continuous care is available in a structured form upon the discharge of a patient and is transferred (Especially in the form of physician letters) to the area where care will be continued in a timely fashion and in accordance with data security regulations.
A.1.9.e	The patient based information exchange with co-treating and further treating areas are supported.

2.2 Functional Group 2: Handling of Patient Records

✔ Creation, collection, archival, retrieval, presentation, and analysis of all (if necessary, multimedia) data and documents that developed during the course of the medical care of a

patient at a medical care location, independent of the storage media (electronic or paper-based).

☝ You will typically find a mixture of electronic and paper-based documents.

☝ All laws and regulations with regard to creation, modification, and storage of documents, as well as document retrieval will be adhered to.

Task 2.1: Creation and Dispatch of Documents

✔ Simple creation of all patient based documents, independent of the storage media.

A.2.1.a	Arbitrary document types (such as anamnesis, appraisals, physician letters, findings, etc) can be defined, created, and used.
A.2.1.b	Different document types (such as text, graphics, pictures, videos) can be created and used.
A.2.1.c	Already available data (such as from available documentation, or medical devices) can be reused for the creation of documents.
A.2.1.d	Text modules, papers, and catalogues can be previously defined and used.
A.2.1.e	A document can have different stati (e.g. created, approved, archived) and versions. Status and version administrators support the creation and administration of the documents.
A.2.1.f	All created documents are clearly marked with the date and time of creation, and the name of the person who created it. The use of electronic signatures is possible for electronically created documents.
A.2.1.g	Documents can be transferred to individual people for information's sake, or further processing. New documents are dispatched to the procedure-requesting, or co-treating areas.
A.2.1.h	Transfer standards are agreed upon and followed when data are transferred electronically.

Task 2.2: Management of Special Documentation and Clinical Registers

✔ Design structured registries and special documentation, e.g. for clinical research or quality management purposes.

A.2.2.a	The creation and use of subject-specific special documentation and a clinical registry on a long term basis is possible to answer special questions.
A.2.2.b	Simple tools are available for the creation of forms for data entry.
A.2.2.c	Data for special documentation and clinical registries can be stored in a structured form.
A.2.2.d	Already available administrative and clinical data can, when required, be transferred into special documentation or registries.
A.2.2.e	Special purpose data can be recorded together with normal clinical data. Documentation forms used for patient care can be adapted and extended for this purpose. The extended forms can only be used for a patient when defined inclusion criteria are met.
A.2.2.f	Patient based analyses based on arbitrary questions are, on the basis of structured data, simply and directly possible.

Task 2.3: Coding of Diagnoses and Procedures

✔ Complete, standardised, patient-based recording of diagnoses and completed measures as part of clinical documentation, as the base for case mix group oriented billing (E.g. DRGs), as well as the base for controlling, clinical analysis, and quality management.

- ☝ The documentation of diagnoses and procedures is carried out in connection with administrative (Task 1.6) and clinical (Task 1.8) documentation.
- ☝ The goals of the documentation of diagnoses and procedures need to be determined in order to avoid conflicts between different intended purposes (E.g. billing, caretaking, research).
- ☝ The use of provided catalogues makes it easier to do analysis. The use of free text can sometimes be indicated.

A.2.3.a	Diagnoses and procedures can, with justifiable expenditure, completely be recorded in a timely fashion.
A.2.3.b	If necessary, qualifiers (Like localisation, suspicions, status) can be recorded for the diagnoses.
A.2.3.c	Earlier documented diagnoses and procedures are visible and can, if necessary, be used.
A.2.3.d	The legally prescribed catalogues can be used for coding.
A.2.3.e	If necessary, area specific catalogues can be created and used. These will be based on the legally prescribed catalogues. If possible, these will be taken care of and made available by a central institution.
A.2.3.f	Text fragments or codes in the given catalogues can be looked for.
A.2.3.g	Plausibility checking and help in recording (Selection lists, default values) ensure the quality of data.
A.2.3.h	Already available information (E.g. from clinical documentation) can be presented.
A.2.3.i	Documented diagnoses and procedures can be used in the creation of documents (E.g. physician letters).
A.2.3.j	Cases without diagnoses and procedures can be shown in a patient-based or patient encompassing fashion.
A.2.3.k	A quality assurance procedure exists for the complete and timely documentation of diagnoses and procedures.

Task 2.4: Analysis of Patient Records

- ✔ Simple, timely, global and uniform access to all data in a patient record relevant to care taking, independent from the storage media.
- ☝ Data security regulations (Cf group V) are to be adhered to when accessing a patient record.

Subtask 2.4.1: Accessing Patient Records

A.2.4.1.a	Various people can access a patient record at the same time.
A.2.4.1.b	The patient record can be accessed at the same time from various locations (E.g. ward, ambulance, administration).
A.2.4.1.c	Different document media (Like text, picture, audio) and different document types (Finding, physician letter, anamnesis) can be accessed in the same way.
A.2.4.1.c	It is possible to access new and archived documents.

Subtask 2.4.2: Reading Patient Records

A.2.4.2.a	All patient based information about the current visit (E.g. current arrangement and its status, findings) can be read by those who are entitled to do so.
A.2.4.2.b	Relevant patient based information from past visits can be read by those who are entitled to do so.
A.2.4.2.c	The patient record facilitates various kinds of use like scanning the record, non-directive searches for information, or directive searches for documents.

A.2.4.2.d	An overview of all data available about a patient is possible. The purpose of this is to provide a care taking outline with diagnoses, therapies, movements, and measures.
A.2.4.2.e	Data can be selected and presented based on various criteria (E.g. by patient, case, document type, worker, status, timeframe of creation, purpose of access). Certain queries (E.g. legally required) can also be predefined.
A.2.4.2.f	Archived and new documents can be compared (E.g. for process observation).
A.2.4.2.g	Data can be presented as single values or values over time.
A.2.4.2.h	The existence of emergency data is clearly shown. Access is possible without any special access rules, but a separate, detailed protocol is necessary.
A.2.4.2.i	New data are emphasised.
A.2.4.2.j	Patient based and patient encompassing data can be aggregated (E.g. for diagnosis statistics).
A.2.4.2.k	The joint viewing of documents (e.g. in the scope of discussing findings) is possible even from spatially separate locations.

Task 2.5: Archiving of Patient Records

✔ Long term storage of all patient based documents upon completion of care, and guarantee of access, independent from the storage media.

☝ Correct archiving makes proving authenticity and genuineness of documents easier (E.g. in civil processes).

A.2.5.a	Standard communication interfaces are available for the taking over of documents to be archived.
A.2.5.b	Standards are to be determined and used with regard to the file formats of documents.
A.2.5.c	The patient based unification of all archived documents into a general patient record (If necessary, electronically) is possible.
A.2.5.d	Access to archived documents is possible within the legal prescribed and recommended time for keeping records. The readability of electronic documents is ensured for an even longer time (E.g. through the use of standard file formats and, if necessary, through changing storage media). A migration concept exists for this.
A.2.5.e	There is enough storage space available to ensure archival of the expected amount of documentation over the planned length of storage time.

Task 2.6: Administration of Patient Records

✔ Guarantee that patient records are quickly accessible.

✔ Organisation of the creation and lending out of records.

A.2.6.a	The administrative admission of a patient (Cf. task 1.1) triggers the creation of a new record, or the search for an old one.
A.2.6.b	Organisational regulations exist with regard to responsibilities for the archiving and administration of patient records.
A.2.6.c	The archived documents are stored following a defined storage system (E.g. by birthday, by patient ID).
A.2.6.d	Different document media and different storage locations are uniformly administered.
A.2.6.e	Record requests can be carried out from a clinical workstation with consideration to access rights.
A.2.6.f	A requested record is, if possible, delivered to the requester in a timely fashion. In

	the case of a readmission, archived documents are made available to the practitioner (in consideration of data security concepts), with regard to access rights, in a quick and simple way.
A.2.6.g	Borrowing and returning patient records can be administered according to predefined lengths of time. If necessary, the return of a record can be demanded. A summary of the current state can be produced.
A.2.6.h	The borrowing of patient records is possible independent from the time of day.
A.2.6.i	The exact location of a patient record can be determined.
A.2.6.j	Records can be destroyed (in consideration of legal obligations to keep records) with accordance to data protection regulations.

2.3 Functional Group 3: Work organisation and resource planning

✔ Support in the efficient organisation of patient care.

Task 3.1: Scheduling and Resource Allocation

✔ Support in the efficient administration of resources and appointments in connection with patient care.

☝ Beds, operating rooms, machinery, time, and co-workers are all resources that need to be planned.

☝ The people performing procedures would like to assign appointments themselves, but the people requesting the procedures would also like to have a say in the matter. A model for the suggestion and confirmation of appointments is therefore needed where both parties can find consensus.

☝ Specifications with regard to patient care planning can be found in task 1.2.

A.3.1.a	Functions such as reservation, confirmation, ordering, allocation, shifting, releasing, and overview are possible for the administration of resources.
A.3.1.b	All planned resources can be viewed and altered by the appropriate resource administrators.
A.3.1.c	The reservation of resources is possible. All possible free resources (E.g. next available appointment, free operating room) are shown for all reservations. Urgency and specific wishes can be considered during reservation inquiries.
A.3.1.d	Certain criteria (Like closing times and necessary authorisation, for example) can be indicated during resource administration. These are checked over with the reservation desires.
A.3.1.e	Additional information (E.g. physician for the planned measure when reserving a room) as well as small requests (E.g. for machinery, personnel) can be recorded for all reservations.
A.3.1.f	Available contingencies (E.g. maximum number of available resources within a certain period of time) are considered during reservations.
A.3.1.g	Various representations and analyses (E.g. time schedules, allocation statistics, etc.) can be produced based on resource plans. Conflicting appointments are brought to attention.
A.3.1.h	The effects of a change in planning (E.g. cancellation, changing appointments) with regard to dependent measures can be shown.
A.3.1.i	It is possible to cancel reserved resources. All effected areas are informed.
A.3.1.j	All involved people are informed about reserved resources (E.g. through occupancy lists for rooms and patient appointment lists).
A.3.1.k	The complete planning , active monitoring, and consistent changing of all patient appointments is supported with regard to certain restrictions (E.g. sequence or

	time intervals between investigations).
A.3.1.l	The care plan is used as the basis for the execution of measures (Cf. task 1.5). Work lists can then be generated, work list entries can be linked with tools (E.g. forms, software functions), and reminders can be produced.
A.3.1.m	Attention will be brought to the resources (E.g. appointments that still need to be made) that need to be reserved based on the patient care plan.

Task 3.2: Materials and Pharmaceuticals Management

✔ Support in the efficient administration of materials, meals, and medications in connection with patient care.

A.3.2.a	Up to date materials catalogues from different areas performing requests are provided.
A.3.2.b	For requests, the materials, meals, and medications that need to be ordered can be selected from these catalogues.
A.3.2.c	Frequently ordered materials and medications can be combined into complex orders, which can also be chosen as items in themselves.
A.3.2.d	The ordering of materials in organisational units (E.g. wards) can be cost-centre based or patient based.
A.3.2.e	The budget available for ordering can easily be viewed.
A.3.2.f	The ordering of medications and meals can be patient based. If necessary, the information can then be exchanged with data from clinical documentation.
A.3.2.g	The various steps for authorisation during the ordering of materials and medications are to be considered (E.g. order made by a caretaker, authorisation for release through a physician).
A.3.2.h	If necessary, general catalogues (The Red List for example) can be fallen back on.
A.3.2.i	Legal requests are fulfilled (E.g. patient based caseload documentation).
A.3.2.j	Documentation of material and medication use can be cost-centre or patient based.
A.3.2.k	An overview of all available materials, or medications on stock at a certain point in time can be produced at any time based on different selection and sorting criteria.
A.3.2.l	The reordering of materials and medications that have been used can be done based on various states of the stock on hand.
A.3.2.m	If the quantity of a material drops below a certain lower bound, the automatic reordering of a predefined quantity of that material occurs.

Task 3.3: Management and Maintenance of Equipment

✔ Support in the efficient management and maintenance of equipment in connection with patient care.

A.3.3.a	A list of equipment used in a certain area (E.g. medical equipment, computer systems) can be attained at any time through the use of various criteria.
A.3.3.b	Necessary repairs can be registered, organised, documented, and carried out.
A.3.3.c	Maintenance that is due can be registered, organised, documented, and carried out (Cf. medical product law).

Task 3.4: General Organisation of Work

✔ Support in efficient patient care by providing personal assistance and general organisational resources.

☝ Active support in workflow is especially of importance. That is, that pending subtasks are presented in the right peoples' work lists at the right time, so that they can process the subtask in the most effective way.

A.3.4.a	Typical workflows, as well as their quality criteria can be left and carried out through organisational assistance. In normal cases, work is carried out according to these workflow specifications, whereas in unusual situations, deviations can be made. All work should be organised in such a way that it can be carried out easily and quickly.
A.3.4.b	Modelled workflows can be simulated and animated in order to recognise weaknesses. Simulation protocols can be analysed from different points of view (E.g. turn-around times, costs).
A.3.4.c	Works lists for rooms, departments, people, patients, and equipment can be created from resource management (Cf. task 3.1) information.
A.3.4.d	These work lists contain specifications pertaining to time, place, type, and person responsible for a planned measure.
A.3.4.e	These work lists can be seen from different views (E.g. for a resource, a co-worker, a patient).
A.3.4.f	Optical and acoustic reminders for pending appointments can be given at a defined time.
A.3.4.g	The patient transport service is informed of the upcoming transfer for pending appointments in a timely fashion. Necessary information about the patient is also transmitted at that time.
A.3.4.h	The carrying out of a planned measure can directly be recorded in the work list.
A.3.4.i	In the case of a delay or other last minute changes, effects on further steps in the process are determined and all affected people (E.g. the waiting patients) are notified. Alternative processes can be presented and compared.
A.3.4.j	The planned and actual extent of resource utilisation can be determined based on work lists and resource management.
A.3.4.k	Individual workers' statistics on completed measures can be created based on the work lists (E.g. OP-Catalogue).
A.3.4.l	Individual forms (E.g. checklists, information forms) can be created to support the organisation of work.
A.3.4.m	All data which are relevant for the support of hospital management (E.g. for ISO9000 certification, for reorganisational measures) are documented.

Task 3.5: Office Communication Support

✔ Support in the communication between people responsible for patient care, research, and education.

☝ Increasingly merge verbal (E.g. telephone) and data communication.

A.3.5.a	Task-oriented communication between co-workers is possible. Possibilities for synchronous (E.g. telephone) and asynchronous (E.g. black boards, e-mail) communication are offered.
A.3.5.b	The timely accessibility to co-workers in especially important roles (E.g. emergency service, system administrators) is ensured.
A.3.5.c	Communication with external agencies (E.g. cost bearers, service providers, suppliers) is efficient and possible with fairly few inquiries.
A.3.5.d	Workers can obtain information on the Internet. The safety of data and systems is ensured.

A.3.5.e	Knowledge about typical workflows and organisational structures is available to all workers.
A.3.5.f	Access to information necessary for communication is supported (E.g. general address and telephone directories, as well as special address and telephone numbers for admitting physicians and follow-up institutions).

Task 3.6: Basic Information Processing Support

✔ Enable the efficient use of basic information processing tools.

A.3.6.a	Standard information processing tools can be used for the creation of certificates, analyses, presentations, etc.
A.3.6.b	Templates can be agreed upon and centrally used for typical documents (E.g. notes, questions).

2.4 Functional Group 4: Hospital Management

✔ Support of the efficient organisation of patient care.

☝ The following specifications are not given in detail. Good overviews for the typical requirements of hospital management can be found, for example, in Buch92, Admin98, and Kuhn98].

Task 4.1: Quality Management

✔ Monitoring and security of a defined quality of patient care.

Subtask 4.1.1: Internal Reporting System

A.4.1.1.a	Quality relevant indices (indicators) of hospital operation can be produced and presented from the already available data.
A.4.1.1.b	A hospital-wide comparison is supported on hand of the defined indicators.

Subtask 4.1.2: Measures for Ensuring Quality

A.4.1.2.a	Medical, nursing, and administrative guidelines can be defined, saved, and presented.
A.4.1.2.b	Basic quality requirements, like ones found in quality management manuals for example, are fulfilled.
A.4.1.2.c	Structured complaint management exists which allows for hospital management to be alerted and patients and care takers to be kept informed.

Subtask 4.1.3: Fulfilment of Legal Registration Obligations

A.4.1.3.a	Legal registration obligations (E.g. quality assurance in the area of billing or for ambulatory operations) are fulfilled.

Task 4.2: Controlling and Budgeting

✔ Support in controlling through hospital management, such that data about business operations are collected and aggregated.

Subtask 4.2.1: Personnel Controlling

Subtask 4.2.2: Process Controlling

Subtask 4.2.3: Stock Management Controlling

Subtask 4.2.4: Maintenance Controlling

Subtask 4.2.5: Finance Controlling

Task 4.3: Cost-Performance Accounting

✔ Allocation of costs to performances and presentation of these data for hospital management.

Subtask 4.3.1: Cost Category Calculation

Subtask 4.3.2: Cost Centre Calculation

Subtask 4.3.3: Cost Unit Calculation

Subtask 4.3.4: Performance Calculation

Subtask 4.3.5: Planning Calculation

Subtask 4.3.6: Process Cost Calculation

Task 4.4: Financial Accounting

✔ Regular and continuous recording of all business transactions that are connected to organisational values. That is, with capital movement, monetary transactions, assets, and debts.

Subtask 4.4.1: General Ledger

Subtask 4.4.2: Accounts Receivable

Subtask 4.4.3: Accounts Payable

Subtask 4.4.4: Backup funds Bookkeeping

Subtask 4.4.5: Fixed Asset Bookkeeping

Subtask 4.4.6: Estate Administration

Task 4.5: Human Resources Management

✔ Support in all measures to gain, preserve, and increase the performance readiness and performance ability of workers.

Subtask 4.5.1: Administration of Personnel Data

Subtask 4.5.2: Personnel and Job Planning

Subtask 4.5.3: Roster Planning

Subtask 4.5.4: Personnel Accounting

Subtask 4.4.5: Workplace Layout and Ergonomics

Subtask 4.4.6: Administration of Travel, Further Education, etc.

Task 4.6: General Statistical Analysis

✔ Collection and aggregation of business operation data for the presentation of information for all decisions with regard to the different levels of management of the hospital, clinics, departments, and stations.

Subtask 4.6.1: Creation and Presentation of Statistics

Subtask 4.6.2: Quality-Assurance Measures

Subtask 4.6.3: Creation of ad-hoc Queries

2.5 Functional Group 5: Research and Education

✔ Support in efficient research and education.

☝ Clinical research requires patient data (Cf. specifications in task 2.2)

☝ For the meaning of information-technical support in research, see "Memorandum for Clinical Research" from the German Research Association DFG99b.

Task 5.1: Planning and Analysis of Studies and Experiments

✔ Support in the planning, execution, and analysis of studies and experiments.

A.5.1.a	Tools to aid in the systematic planning and execution of studies and experiments are available.
A.5.1.b	Tools exist for the flexible design and use of forms to obtain data.
A.5.1.c	Tools exist for the planning and execution of analyses.
A.5.1.d	The storage period for research data, as specified in the guidelines of good research (Cf. DFG98b), are adhered to.

Task 5.2: Access to Knowledge

✔ Support in the access to information relevant to research and general knowledge about specific subjects.

A.5.2.a	General medical and nursing knowledge (E.g. magazines, reference material) is available to all scientifically oriented workers at any time, and preferably in many different locations.

A.5.2.b	Specific medical and nursing knowledge like examination and treatment standards are made available.
A.5.2.c	Indexes of up to date literature are centrally kept. It is possible to access these indexes electronically.
A.5.2.d	Access to medical and nursing reference terminology (E.g. UMLS, ICD, ICNP) is possible.
A.5.2.e	Information about possible research grants is centrally collected, prepared, and presented to anyone who is interested.

Task 5.3: Organisation of Publications and Presentations

✔ Support in the creation of publications and presentations (including the documentation of literature).

☝ Specifications for the elementary tasks of information processing can be found in task 3.6.

A.5.3.a	Uniform tools are available for the administration of publications.
A.5.3.b	Central collections of relevant institutional publications are available and can be sorted by year, institution, theme, person, etc.
A.5.3.c	Suitable tools are available for the creation of presentations in various formats (E.g. transparencies, graphics, film, slides).

Task 5.4: Computer-Assisted Training

✔ Support the use of computers in education.

A.5.4.a	Tools are available for the development and evaluation of computer-based training programs and multi-media instruction.
A.5.4.b	When required, tools can be used for the construction of tele-teaching and tele-learning modules.

Task 5.5: Organisation of Education

✔ Support in the organisation of education

A.5.5.a	Tools are available for the organisation of lectures, seminars, courses, exams, etc. The organisation of rooms, lecturers, students, and times is also required.
A.5.5.b	Tools are available for the creation and use of information media where students and lecturers can be informed about the organisation and contents of the course.

3. Function-independent requirements

3.1 Group I: Management of the Information System.

☝ It is recommended that a department for information processing is introduced into the organisation for the strategic planning and further development of the information system. The director of this department (Chief Information Officer, CIO) should be a member of the hospital administration or at least hold a functional position related to the management of the hospital.

☝ The German Society for Medical Biometry, Informatics, and Epidemiology (GMDS), as well as the Society for Informatics (GI) together offer a "Certificate of Medical Informatics" (GMDS93). This certificate should certify that the owner has a broad wealth of experience and possesses specialised knowledge in the area of medical informatics. It also certifies that he or she can take on leading positions in the areas of science and economics.

Aspect I.1: Strategic Information Management Planing

✔ Guarantee transparency with regard to the architecture and state of information processing in the hospital.

✔ The determination of a strategy for the systematic continuous development of the hospital information system during a predefined period of time.

☝ The goals of the hospital information system depend on the business goals of the hospital. Among other things, economics as well as the fulfilment of legal requirements are considered during goal setting.

☝ Manuals exist for the construction of strategic information management plan. Examples of existing strategic information management plans are mentioned there, and are also arranged on the internet site of the requirements index.

A.I.1.a	The goals of the hospital and of the hospital information system are described in the strategic information management plan.
A.I.1.b	The strategic information management plan contains a description of the current state.
A.I.1.c	Major weaknesses in the current state are mentioned in the strategic information management plan.
A.I.1.d	The future (ideal) state is comprehensibly derived from the goals of the hospital, the current state, and the described weaknesses.
A.I.1.e	A rough plan exists which mentions projects that need to be carried out, estimated costs, and milestones.
A.I.1.f	The organisational structure of people responsible for information processing is described.
A.I.1.g	The strategic information management plan considers information processing as a whole. The conventional part has to at least be considered in the analysis of weaknesses and the future (ideal) state.
A.I.1.h	The strategic information management plan is approved by hospital management.
A.I.1.i	The strategic information management plan of a hospital is its own document which is regularly (E.g. every 4 years) updated in the context of a temporally limited project.

Aspect I.2: Management of Information Processing Projects

✔ Reducing the risk that:

- the expenses of a project cannot be calculated,
- cost and time restrictions are not adhered to,
- projects don't achieve the desired results,
- projects take on unplanned subsequent expenses.

☝ Procedural models for the management of information processing projects are described manifold in the literature (E.g. Haux98). Only fundamental specifications are summarised in the following.

Subaspect I.2.1: Planning Information Processing Projects

A.I.2.1.a	The goals of the project are clearly formulated and also detained for incomplete projects.
A.I.2.1.b	A written project plan that contains detailed work packets, required resources, and milestones, exists for project management.
A.I.2.1.c	The project plan is approved by the client.

Subaspect I.2.2: Support and Execution of Information Processing Projects

A.I.2.2.a	The project team consists of people from all groups affected by the project.
A.I.2.2.b	The project's progress is monitored at regular intervals.
A.I.2.2.c	The project is documented.
A.I.2.2.d	Changes to the planning of the project are documented and everyone who is involved is notified.
A.I.2.2.e	A final document exists which clearly describes the support and operation of the implemented application system.

Subaspect I.2.3: Selection of Information System Components

☝ The implementation of a product on the market and standard software, or its further development, is often preferred over a new development.

A.I.2.3.a	A systems analysis and assessment is carried out through the use of recognised methods before an information system component is selected. This ensures that weaknesses like media breaks are recognised and a fundamental understanding of the problem area exists.
A.I.2.3.b	The specifications for the information system component that is to be selected are detailed in a requirements specifications document. It is comprehensibly written and easy to understand.
A.I.2.3.c	The selection process should be carried out systematically and should be documented comprehensively.
A.I.2.3.d	Representatives of future user groups as well as decision makers should be included in the selection process.
A.I.2.3.e	Obtaining a system should be done through a request for proposal (RFP).

Subaspect 1.2.4: Preparation and Implementation of Information System Components.

☝ The design sequence, "From concept, to application software, to hardware", should be adhered to.

☝ Business processes shouldn't be determined by the application system. Rather, the application system should fit into the existing environment.

☝ The inclusion of external advisors can be useful.

A.I.2.4.a	The adaptation of the components to the conditions on location is done

	systematically and carefully. It should be carried out as specifically as needed, but as uniformly as possible.
A.I.2.4.b	A strategy exists for the migration from the old application system to the new application system. This indicates as short a migration path as possible.
A.I.2.4.c	During migration, all relevant old data can be carried over into the new application system, possibly in an automated fashion.
A.I.2.4.d	All people who are affected (Users, adapters, and administrators) are informed in time and carefully trained.

3.2 Group II: Operation of the Information System

✔ Guarantee of the continuous and trouble-free preparation of all computer-based and conventional (Especially all operation relevant) information system components.

☝ It is of central importance that there are ample and well trained personnel available for the different tasks. Suggestions with regard to this are made by GMDS (Überla97).

☝ The higher the degree of computer penetration for the realisation of the tasks described in chapter 3, the more critical are the failures of computer based application systems.

A.II.a	A written concept is available in which all of the various steps of responsibilities are exactly ordered for all subtasks of the operation.
A.II.b	Concepts for problem management, as well as an emergency concept, are available for all subtasks. Disturbances in the operation are fixed within a defined amount of time.

Aspect II.1: Management of Hospital-wide Data

✔ Making available, filing, and protection of clinic-wide data volumes (E.g. patient database and tumour registry) as well as the checking for completeness, timeliness, and data quality.

A.II.1.a	Certain basic catalogues (Like cost centres, physician lists, health insurance companies) are offered and taken care of centrally.
A.II.1.b	Measures for the alignment and exchange of decentralised data volumes are to be met where there is a distributed hospital information system architecture.
A.II.1.c	The specifications with regard to data integration (Cf. subaspect III.1.1) are taken into account.

Aspect II.2: Operation of Information System Components

✔ Guarantee of the efficient use of centralised and decentralised information system components through systematic procurement, adaptation, operation, and care.

☝ The care is simplified through clinic-wide guidelines for procurement and adaptation. However, it needs to be considered that area and task specific solutions can still be meaningful.

A.II.2.a	Central guidelines for procurement, adaptation, and training mechanisms are available and are regularly updated.
A.II.2.b	Tools for automatic software distribution are used for more broadly used computer based application systems.
A.II.2.c	Software maintenance contracts are finalised with suitable providers of especially relevant computer based application systems.
A.II.2.d	Constant changes to the configuration of computer based application and computer systems are to be avoided. Larger changes should be carried out in the form of a new project.

Aspect II.3: Network Management

✔ Adaptation and operation of local communication networks (E.g. active elements, cabling, resource administration), as well as regional networks (E.g. in the scope of telemedicine projects).

☝ The DFG regularly gives suggestions for standard network infrastructures (e.g. DFG94).

☝ Web front ends and internet technology should be considered with regard to the increase in co-operation between single health care institutions and the growing importance of the internet.

A.II.3.a	The network is structurally built in a hierarchical fashion.
A.II.3.b	The structure of the network is carefully documented.
A.II.3.c	Tools for monitoring the network are available.
A.II.3.d	The transfer capacities are large enough for the supported tasks. The data transfers occur within a defined amount of time.

Aspect II.4: User Support

✔ Enabling the efficient use of the information system components (E.g. through regular training sessions and various levels of support).

A.II.4.a	The support is organised on hand of a support concept (E.g. combination of on-location support and central resources) consisting of different levels.
A.II.4.b	The users are informed about who the contacts are. This information, as well as hints for operation, etc. are provided centrally.
A.II.4.c	Regular training sessions are offered for new staff. Re-training sessions are also offered.
A.II.4.d	Typical error messages and their solutions are centrally documented and can, if necessary, be read. Frequency analyses can also be performed on the information.

Aspect II.5: Management of Data Security

✔ Guaranteeing data security and data safety (E.g. through the use of firewalls and realisation of access concepts)

A.II.5.a	The data security and data safety aspects mentioned in V are adhered to. A data safety representative checks realisation and advises users and operational specialists.

Aspect II.6: Information System Reporting

✔ Informing the user about changes and innovations with regard to information system components.

✔ Creation of reports about expenses and quality of the operation for the management of the hospital information system.

A.II.6.a	All interested groups are regularly taught about expenses and quality.
A.II.6.b	Besides the state of information processing, problems and disturbances are often reported. Solutions are to be discussed among all involved parties, and implemented in a controlled fashion.

3.3 Group III: Integration of the Information System

✔ Guarantee that the different (computer based and conventional) information system components work together smoothly and efficiently.

- ☝ The specifications catalogue can only describe general methodologies. For a concrete incident, if the occasion should arise, a communications matrix that considers all affected interfaces between application systems can be helpful.
- ☝ The different integration aspects sometimes require deviations from the maximum possible functionality. The pros and cons of a specialisation versus a well integrated system have to be weighed one by one.

Aspect III.1: Process Integration

✔ Optimal embedding of the use of data and information processing functions in workflows, independent of which application system makes these data or functions available.

Subaspect III.1.1: Data Integration

✔ Enable the multiple use of data that has only been entered once, and through this, the avoidance of recording errors and data inconsistencies.

A.III.1.1.a	Data should, when possible, be recorded at the location and time of origin.
A.III.1.1.b	Data such as patient demographics and primary diagnosis should only be recorded once.
A.III.1.1.c	All data should be able to be used for different purposes.
A.III.1.1.d	Communication breaks should be avoided in the transfer of data.
A.III.1.1.e	A global data model with clinical-wide relevance and semantic-free object identification for central objects like arrangements, patients, cases, measures, and documents, for example, exists.
A.III.1.1.f	Changes to existing data that are stored redundantly in another application system are communicated and synchronised over standard interfaces.
A.III.1.1.g	It is possible to logically bring together all data on a specific patient.

Subaspect III.1.2: Function Integration

✔ Reduction of overlapping functionality in different application systems.
✔ Avoidance of redundant execution of functions that lead to the same outcome.

A.III.1.2.a	More frequently needed functions (E.g. patient identification) are only available in one application system.
A.III.1.2.b	Outcomes that arise through the execution of a function of an application system are thereafter available to other application systems.

Subaspect III.1.3: Flow Integration

✔ All application systems should smoothly integrate into the workflows of the user.

A.III.1.3.a	The application systems can be adapted to the workflows of the user.
A.III.1.3.b	The functions needed by the different user groups are available at the user workstations in an uncomplicated and timely fashion.
A.III.1.3.c	The data needed by the different user groups should be available at the right location, at the right time, and in the right form.

Aspect III.2: Tool Integration

✔ Realise the technical prerequisites needed for integrated information processing.
☝ The integration of tools is necessary for all other aspects of integration.

☝ The heterogeneity of tools for information processing (E.g. hardware, network components, network protocols, forms, telephones, etc) is to be kept as simple as possible in order to minimise costs of operation and maintenance.

Subaspect III.2.1: Access Integration

✔ Simplification of the use of application systems through uniform user access.

A.III.2.1.a	All functions relevant for a user are available at the clinical workplace in a simple, integrated fashion.
A.III.2.1.b	Users should only have to authenticate themselves once ("Single-Sign-On"). This also requires a personal authorisation concept such as for the quick and simple changing of users (Cf. group V: Data Protection).

Subaspect III.2.2: Presentation Integration

✔ Simplification of the use of application systems and the reduction of training expenses.

A.III.2.2.a	The user interfaces of different application systems are similar and can be used uniformly.
A.III.2.2.b	Data from different application systems is presented adequately and consistently (Also see group VI: User Interfaces).

Subaspect III.2.3: Integration of Communication

✔ Support in the efficient communication between application systems.

✔ Reduction in expenses for developing interfaces.

☝ In the conventional area, standard interfaces are e.g standardised forms and agreements on who, when, and how they were filled out, or when and where they need to be dropped off.

☝ A rule of thumb is that standards leave room for interpretation. It is absolutely necessary that even when using standards, detailed specifications and agreements should be made about the contents.

A.III.2.3.a	Standard interface protocols are used for the exchange of messages between computer based application systems.
A.III.2.3.b	Because of the significance of communication in the computer supported part of an information system, interface definitions are to be kept in writing and detailed functionality tests should be carried out and documented.
A.III.2.3.c	Besides computer supported tools, medical-technical equipment (E.g. picture-producing devices and laboratory equipment) should also have interfaces.
A.III.2.3.d	The number of interfaces between application systems as well as the number of interface protocols used should be kept to a minimum.
A.III.2.3.e	The responsibilities for point in time, content, and quality of communication are clear.
A.III.2.3.f	The correct receive of transferred data can be checked.

Subaspect III.2.4: Technical Integration

✔ Creation of technical specifications for integrated information processing.

A.III.2.4.a	There are a sufficient number of efficient computers available for use at different locations. Different tasks need to be supported at the different locations (E.g. room on a ward, physician rooms, caretaking rooms, operation rooms, administration work places, secretarial workplaces).
A.III.2.4.b	All computer systems are networked. The network infrastructure has to sufficiently and constantly be efficient.

3.4 Group IV: Architecture of the Information System

✔ Guarantee that the different (computer based and conventional) information system components work together smoothly and efficiently so that the information system as a whole enables a high quality of information processing.

☝ Generally speaking, an open, flexible system architecture which simply enables the exchange or introduction of new tools should be chosen. The communication between different application systems should occur over standardised communication interfaces (Cf. the specifications for integration in group III).

Aspect IV.1: Data Schema

☝ The specifications mentioned in subaspect III.1.1 must be taken into account.

A.IV.1.a	The data schema and the documentation of the semantics of the tables in computer based application systems are documented.
A.IV.1.b	A concept for the evolution of the data model exists.
A.IV.1.c	The data model is simple to use and expand on (E.g. for particular statistics and analyses).
A.IV.1.d	Patient master data and case data are administrated separately.

Aspect IV.2: Adaptation and Maintenance

☝ Also compare the specifications in group VI (User Interfaces).

A.IV.2.a	Application system functionality can be adapted up to a ward and user level.
A.IV.2.b	The implementation of masks, menus, and document types is possible in application systems without the need for programming (parameterisation support).
A.IV.2.c	Application systems are built in modules so that single parts (e.g. functions) can be turned on and off (Scalability).
A.IV.2.d	The functionality of application systems can be expanded or adapted to other (E.g. legal) specifications. Development tools are available for this.
A.IV.2.e	Predefined standards are to be adhered to and proprietary solutions are to be avoided for information system components.
A.IV.2.f	Individual application systems have to offer well defined access interfaces in order to be included in the course of operations.
A.IV.2.g	Up-to-date handbooks and instructions for operation are available online and in printed form.

Aspect IV.3: Efficiency

☝ The required efficiency of the information system components is determined according to the respective function.

☝ The specifications for efficiency and storage capacity can be determined through application statistics from data processing.

A.IV.3.a	The user's need for information is satisfied by the information system components within a defined amount of time.

3.5 Group V: Data Protection

- ☝ A data safety concept based on the BSI-Recommendations (BSI99) should exist. Security goals, security guidelines and security procedures are described in these recommendations. An overview of data security in healthcare is given in (Blob97).
- ☝ It is especially important to define the rights, duties, and areas of responsibility for users.

Aspect V.1: Data Security

- ☝ Take into account the value of securing personal data through the implementation of technical and organisational measures; guaranteeing the informational self-determination of patients and staff.
- ☝ The working group "Data security" of the German Association for Medical Informatics, Biometry and Epidemiology (GMDS) has compiled a concept for access to patient data.

A.V.1.a	A detailed access rights concept exists and is widely used. This concept describes who has access to which data, and at which time (Access control, authorisation) (Cf. notes in (DGI98b)).
A.V.1.b	All application systems support the hospital's access rights concept.
A.V.1.c	Users, or creators of data, can be identified surely and simply (E.g. through a login name and password for computer based application systems) (Authentication). The origin of data can be determined (Authenticity).
A.V.1.d	The data are protected from unauthorised changes. All changes (Even those during transmittal) are recognised and stored (Data integrity).
A.V.1.e	The value of securing all data is to be considered. Data transmittal has to be confidential (Privacy).
A.V.1.f	The transmission and receive of data is demonstrably logged (Liability/committal)).
A.V.1.g	Cryptographic procedures and digital signatures can be used in the computer supported part of the information system.
A.V.1.h	Firewalls are to be used for external electronic communication (See note in (DGI96)).
A.V.1.i	Remote maintenance is only permitted under special safety precautions (Cf. (DGI98a), (DGI99)).

Aspect V.2: Data Safety

- ✔ Avoidance of the loss of data through suitable (E.g. data securing) measures.
- ☝ Data safety encompasses personal data as well as other data.

A.V.2.a	All data are regularly secured and separately stored based on the 'generation principle'.
A.V.2.b	All components of the information system function without errors. Abusive misuse is avoided.
A.V.2.c	The information system components have defined minimal availability.
A.V.2.d	Failure concepts are available in the case of system disturbances (Computer defects, power outage, fire) (Cf. group II – Operation of the Information System).

3.6 Group VI: User Interface

- ✔ Making effective and efficient work possible through the use of information components.

☝ The following specifications are oriented towards the ISO-Norm 9241 for software ergonomics.

A.VI.a	The component if simple and quick to use and is adapted to the work tasks (Suitability for tasks).
A.VI.b	The component offers a good functional overview, uses understandable descriptions, and when necessary offers situation specific explanations (Self description).
A.VI.c	The component doesn't force any work procedures. It enables the uncomplicated continuation of interrupted work processes and the ability to change users quickly (Cf. specification III.2.1.b); the scope of the given information can be parameterised (Controllability).
A.VI.d	The component offers uniform masks and forms for similar tasks. The user interface is arranged uniformly, can be uniformly used, and the response times can be calculated (Expectation conformity).
A.VI.e	The component catches (entry) errors without the loss of data. It delivers error messages and enables their quick correction (Error robustness).
A.VI.f	The component can be adapted to the needs and wishes of the user. It adapts to the state of the user's knowledge, and the organisation of the masks and forms can also be adapted (E.g. only view authorised data and functions)(Individualisation).
A.VI.g	The information system component is simple and can quickly be learned. The input possibilities are oriented towards the knowledge of the user (Ability to learn).

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