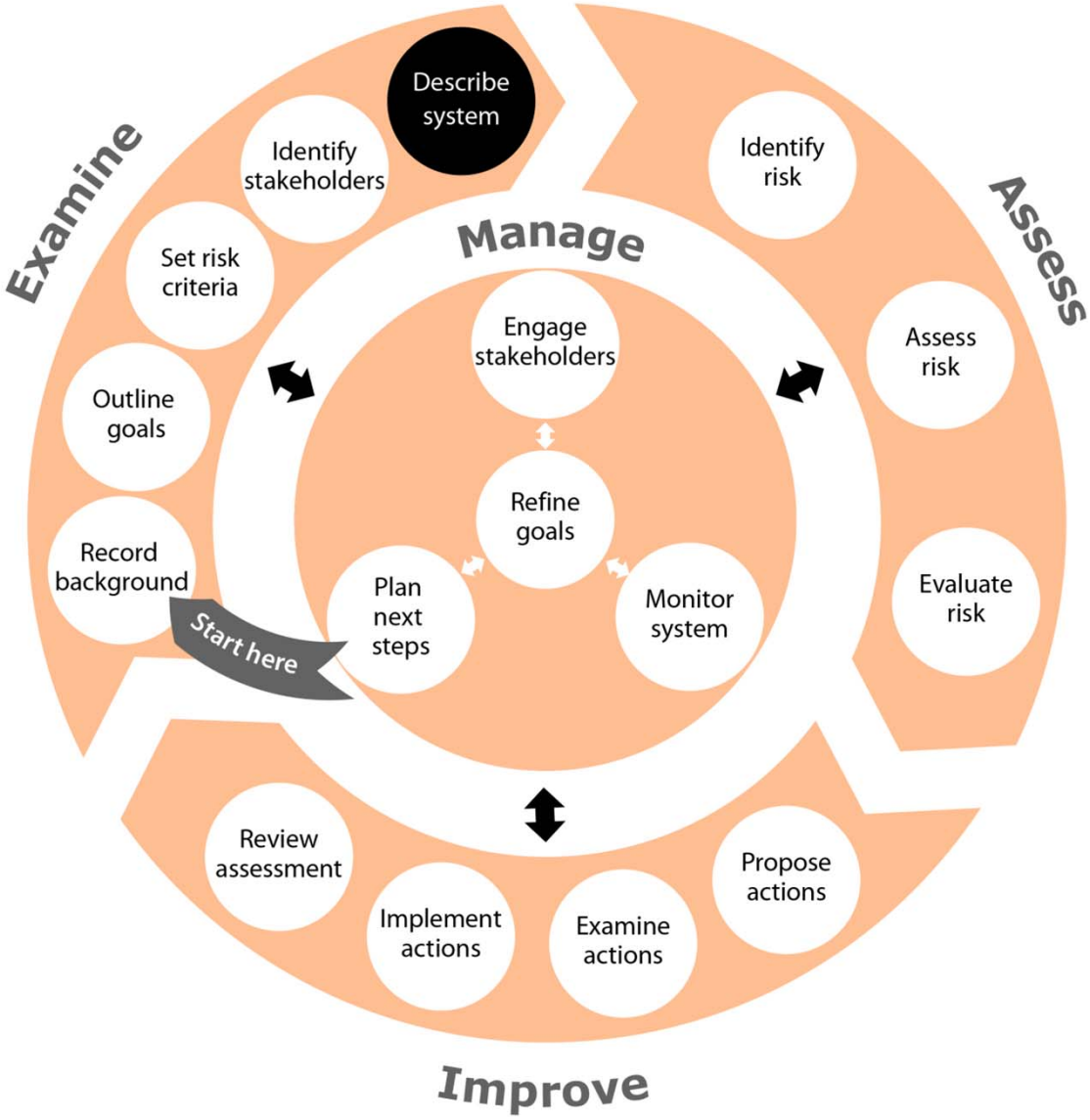
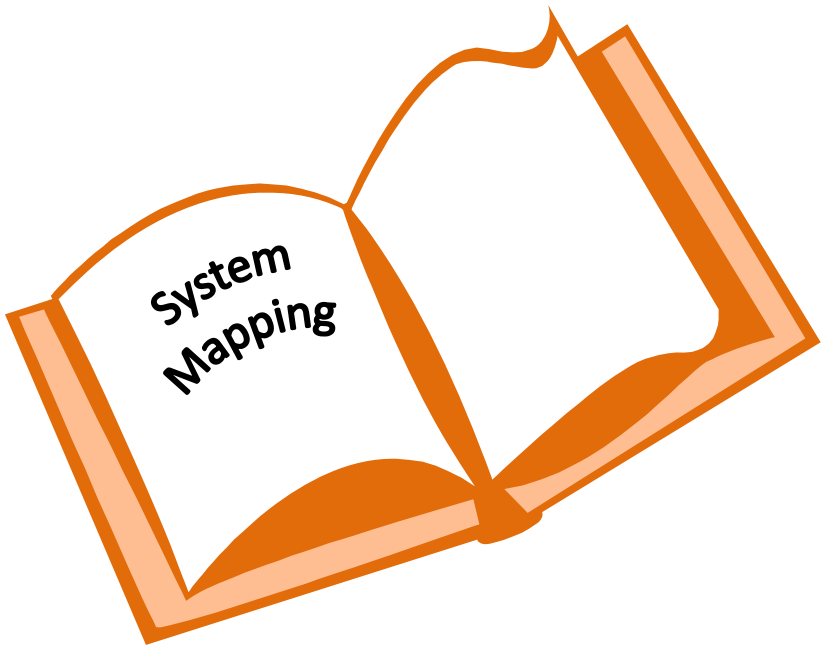
SSA Toolkit: Introduction to describing systems

John Clarkson
James Ward
Thomas Jun
Jon Berman
Joy Goodman-Deane



Contents

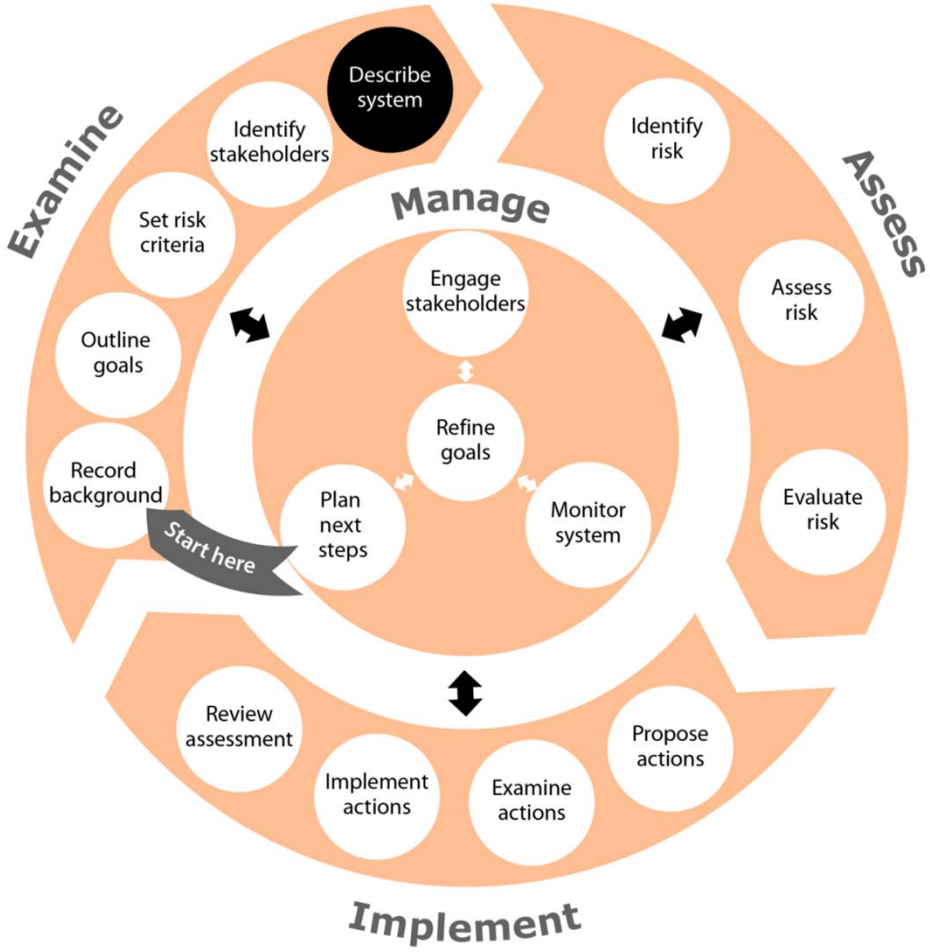


Introduction

This document is intended to accompany the SSA (System Safety Assessment) Toolkit (www.ssatoolkit.com). The Toolkit helps healthcare staff to think about 'what could go wrong' in a healthcare system, following the process shown opposite. This document provides further detail to support the activity Describe system, which is part of the Examine phase of the SSA process.

Describing the system clearly and accurately is important because it develops a clear understanding of the structure and behaviour of the system to be assessed in the SSA. Furthermore, it helps to identify all the main areas where things could go wrong, making sure that everything is covered and providing a robust basis for the SSA.

There are many different methods for describing a healthcare system. The SSA Toolkit recommends starting by creating a process map (or flow diagram). However, people who are familiar with system mapping may sometimes find it helpful to use another method. This document assists with this by providing an overview of the different kinds of methods available and some advice on how to select a method. People who are unfamiliar with system mapping are still recommended to start with process mapping as described on the SSA Toolkit website on the Describe System page.



This document is based on: System Mapping Approaches by J. Clarkson, J. Ward, T. Jun and J. Berman. In: Prospective Haxard Analysis by J. Clarkson, J. Ward, J. Berman, P. Buckle and R. Lim (2010). (ISSN 0963-5432).

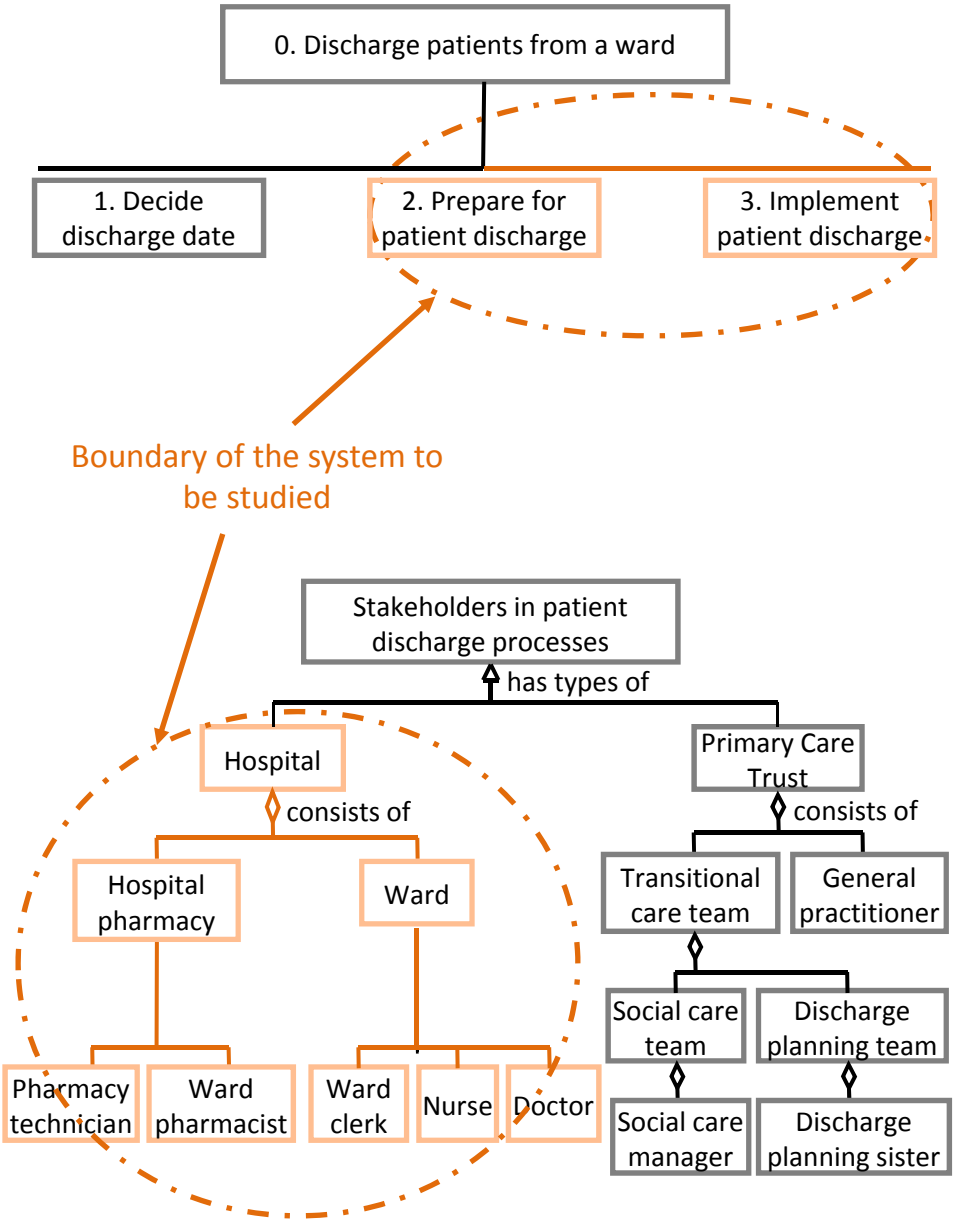
Introduction (cont.)

There are many different methods that can be used to describe a healthcare system. They produce descriptions in a variety of diagrammatic and textual forms, each focussing on a particular, but limited, perspective of the system.

This document does not provide a comprehensive list of these methods. Rather it describes six methods as examples of the different types available.

- The first section (Selecting methods) provides advice on how to select an appropriate method(s) by considering the primary perspective of each method and the characteristics of the system that it can capture.
- The second section (Examples of methods) then provides brief descriptions of six different methods for describing systems.

General advice on describing systems can be found in the SSA Toolkit on the Describe System page. In particular, it is important to define the boundaries of the system that will be studied during the SSA. This may best be achieved by describing a system that is more extensive than the one which is to be studied and then explicitly defining the boundary within that description. This has the advantage of highlighting those parts of the larger system that interface with the system under study, showing what is, and what is not, included in the SSA.

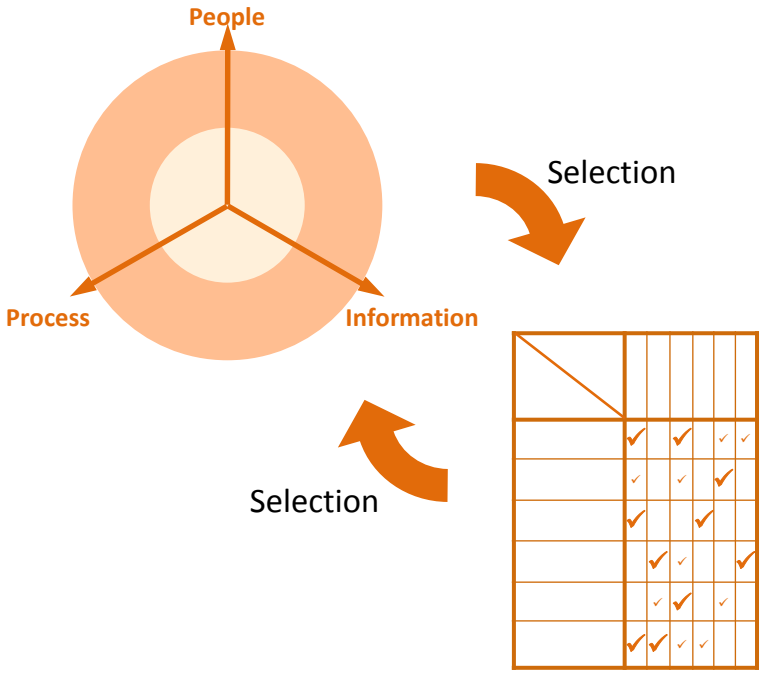


Selecting methods

The system description will be used in the SSA to identify places where things could go wrong, i.e. points of risk in the system. The selection of a system description method will therefore affect the comprehensiveness and robustness of the rest of the SSA.

The most suitable method will explicitly and unambiguously describe the system. It will capture the key characteristics of the system, and also communicate this information clearly to the participants in the risk assessment process.

In choosing the method it is important to consider both the primary perspective of the method and the characteristics of the system that each method can capture. How to do this is described on the following pages and summarised using a diagram and table (see opposite). It will be necessary to refer to both the diagram and the table to identify and select appropriate approaches.



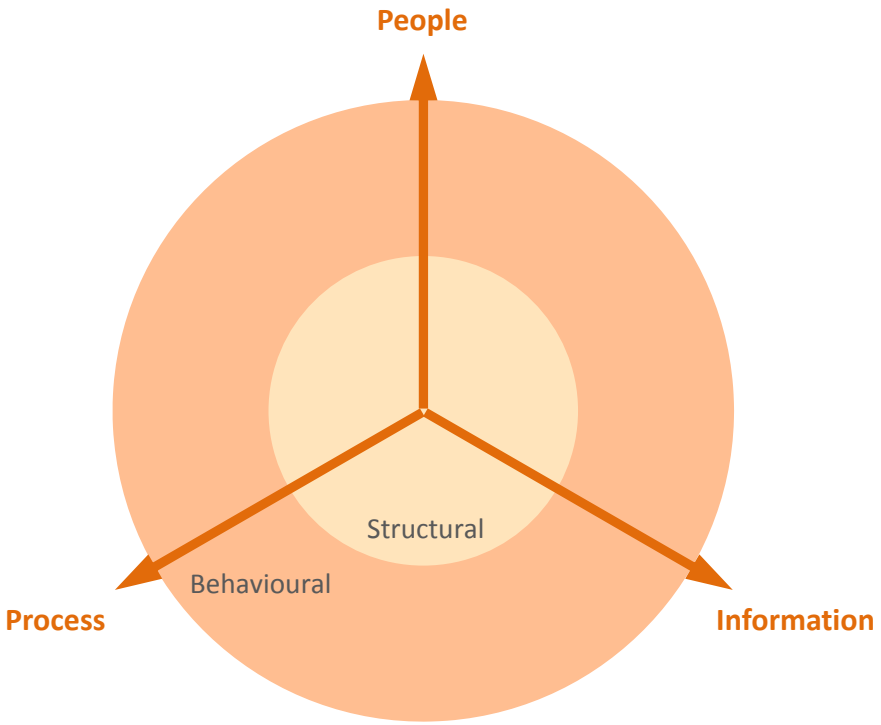
An iterative approach to method selection

A map of methods

System description methods view the system from different perspectives. In general, there are three main perspectives, focusing on the people, processes and information within the system. Methods may have one or more of these perspectives.

In addition, the methods can take a structural or behavioural approach. Structural approaches focus on how the system is structured, i.e. how the items in the system are positioned in relation to each other. They are particularly useful for defining the system architecture. Behavioural approaches examine how the items behave, e.g. how they change over time. They assist in the definition of the detail and may then be used to directly support an SSA.

Tip: Identify the perspective and approach that is most suited to the system under examination.



System description methods focus on one or more of the people, process or information perspectives, and can take a structural or behavioual approach.

A map of methods (cont.)

Three of the methods described in this document are behavioural methods:

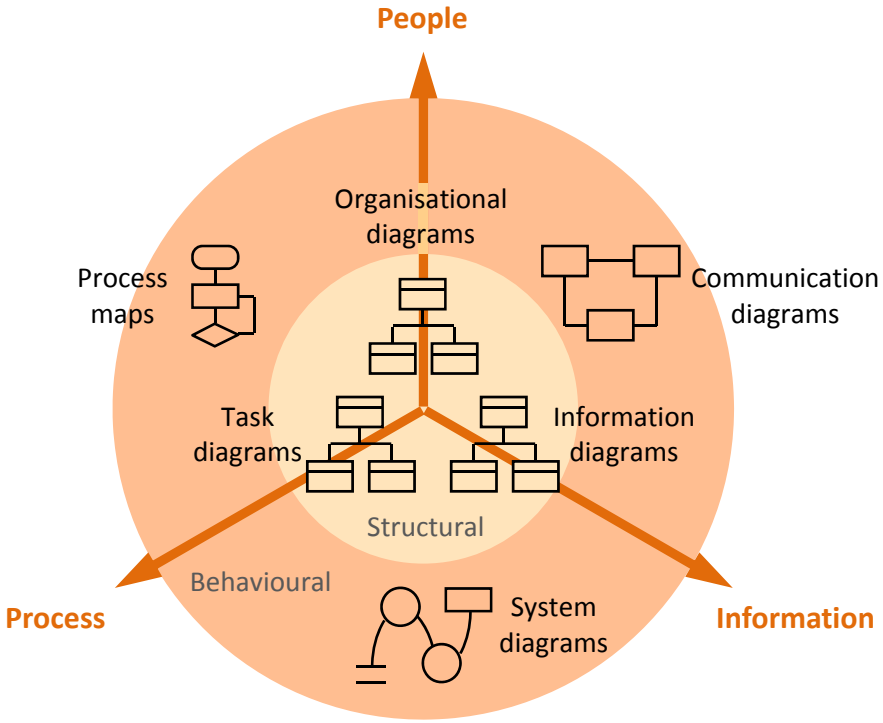
- Process maps, which include traditional flow charts and swim-lane diagrams, represent activities occurring in sequence or in parallel;
- Communication diagrams represent information and material flows between people (stakeholders) linked by some common process;
- System diagrams represent how data (or objects) are transformed through activities, where such data are stored, and how such activities are sequenced.

Putting these methods into practice requires detail about people, processes and information which may be more formally defined by the structural methods:

- Organisational diagrams describe a hierarchy of people and/or roles within single or multiple organisations
- Task diagrams describe a hierarchy of operations (tasks) and plans (necessary conditions to undertake these operations)
- Information diagrams describe a hierarchy of information and/or materials (things) used or needed in physical or electronic form

This is not an exhaustive list. There are other methods that also are capable of providing insight into the operation of a system.

Tip: Note which methods are most closely associated with the perspective and approach identified earlier. Use of more than one method may be necessary to complete the system description.



The system description methods in this document can be placed on the map according to their perspective on the system and the type of approach they take

Matching the method to the system

Different methods for describing systems can capture different characteristics of the system, as shown in the table opposite. A large tick indicates a significant match between the method and characteristic, a small tick a partial match, and no tick indicates there is no match. In practice, more than one characteristic may need to be investigated to describe the operation of a given system. Therefore, more than one method may be required to complete the system description.

Identify those characteristics that may influence the choice of method. Note which methods capture those characteristics.

System mapping approach / **Characteristics of interest**	Process	Communication	System	Organisational	Task	Information
Process and procedure *e.g. patient pathways*	✓		✓		✓	✓
Human behaviour *e.g. performance measures*	✓		✓		✓	
Role and responsibilities *e.g. team working*	✓			✓		
Communication *e.g. referral*		✓	✓			✓
Human-technology interface *e.g. medication devices*		✓	✓		✓	
Procurement and supply *e.g. medication flows*	✓	✓	✓	✓		

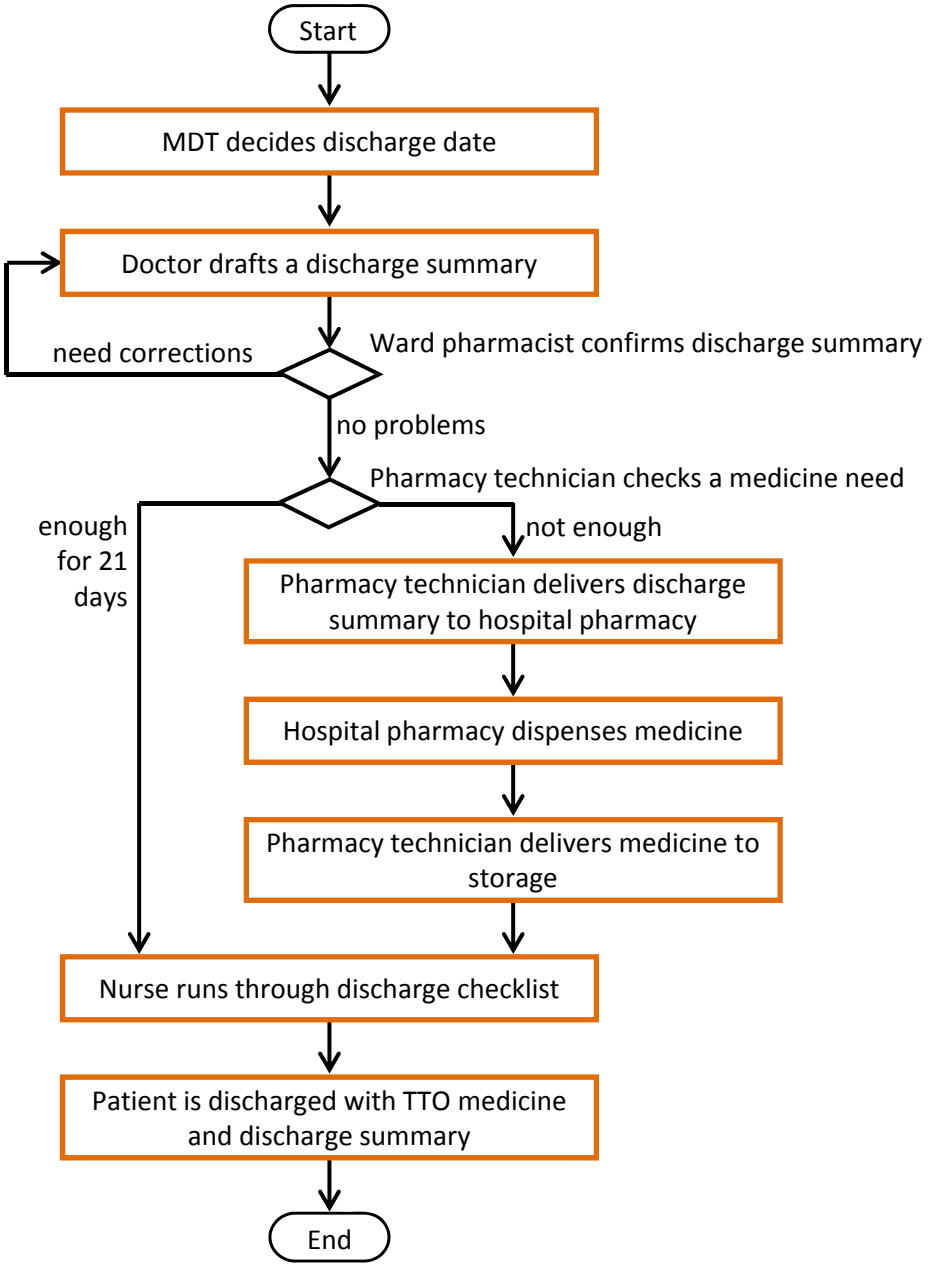
The system description methods capture different characteristics of the system

Examples of methods

This section provides brief (one page) descriptions of the six methods for describing systems that were mentioned earlier in this document. These methods all produce diagrams to describe the system, and each focuses on a particular perspective of that system, as described on p6.

These descriptions have been kept intentionally short. They provide a rough idea of the method as a whole, to help in the selection of methods. For each method, a reference is provided to the further detail required to actually put that method into practice.

In the example shown opposite, the system performance is described by a process map. Communication and system diagrams would provide further perspectives on the behaviour of the system.



An example of a system description

Process maps

Process maps, which include traditional flow charts and swim-lane diagrams, represent activities occurring in sequence or in parallel. They are a diagrammatic representation of the ordering of activities, showing key steps (boxes) and the conditions for moving between them (links).

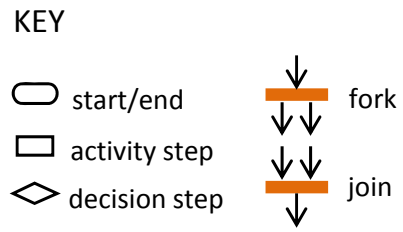
The simplest form of process map is a traditional flow chart. Further annotation, as in a swim-lane diagram, may be used to identify the key stakeholders responsible for each activity (see below right). These diagrams are particularly suitable for creating understanding of an overall process.

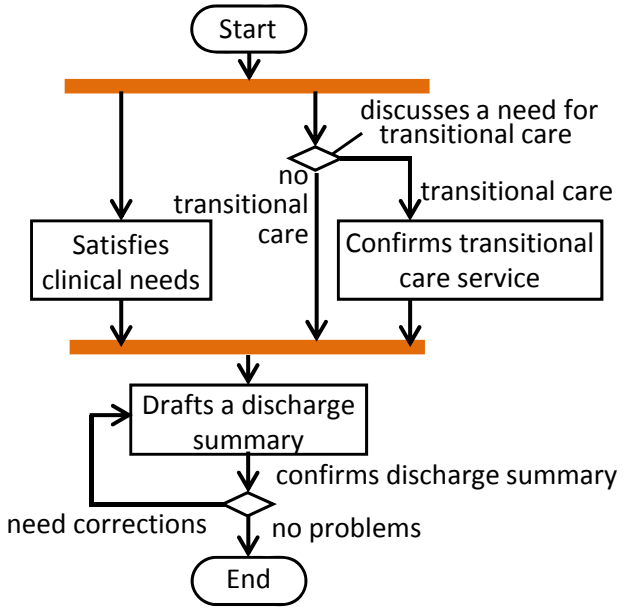
The possible deviation or failure of each step or link can be used as a basis for identifying the risks in the system as part of an SSA.

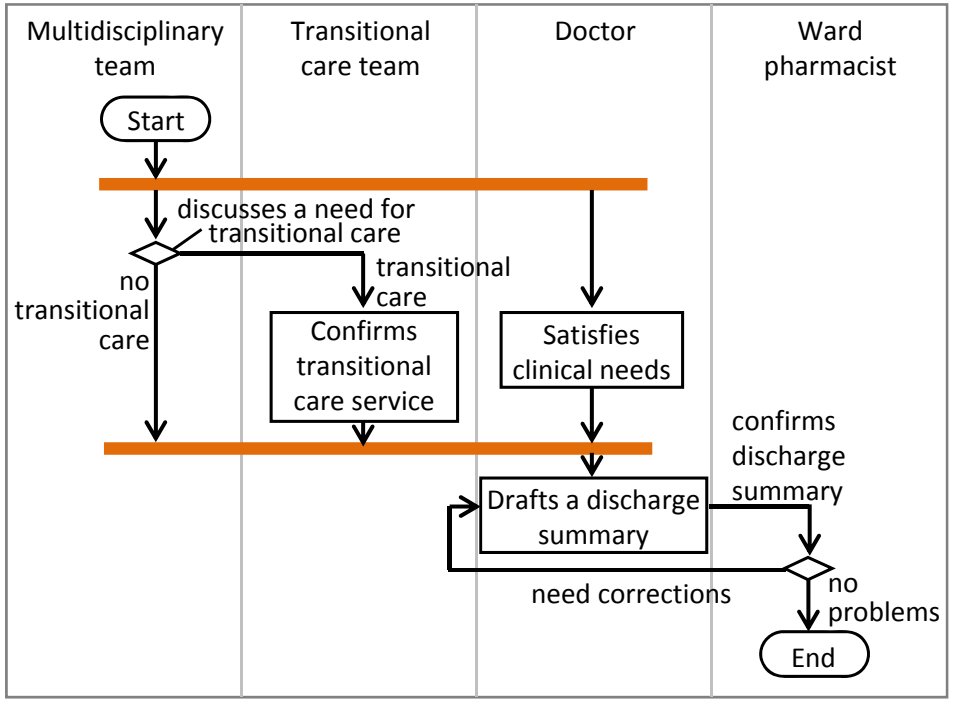
Process maps are described further in the SSA Toolkit on the Describe System page.

Further information:

Hunt, V.D. (1996) Process Mapping: How to Reengineer your Business Process, John Wiley & Sons Ltd.







Process maps of a hospital discharge process

Communication Diagrams

Communication diagrams represent information and material flows between people (stakeholders) linked by some common process. They are a diagrammatic representation of the information and material flows (links) between stakeholders (boxes). They can show the order of the flows using numbers.

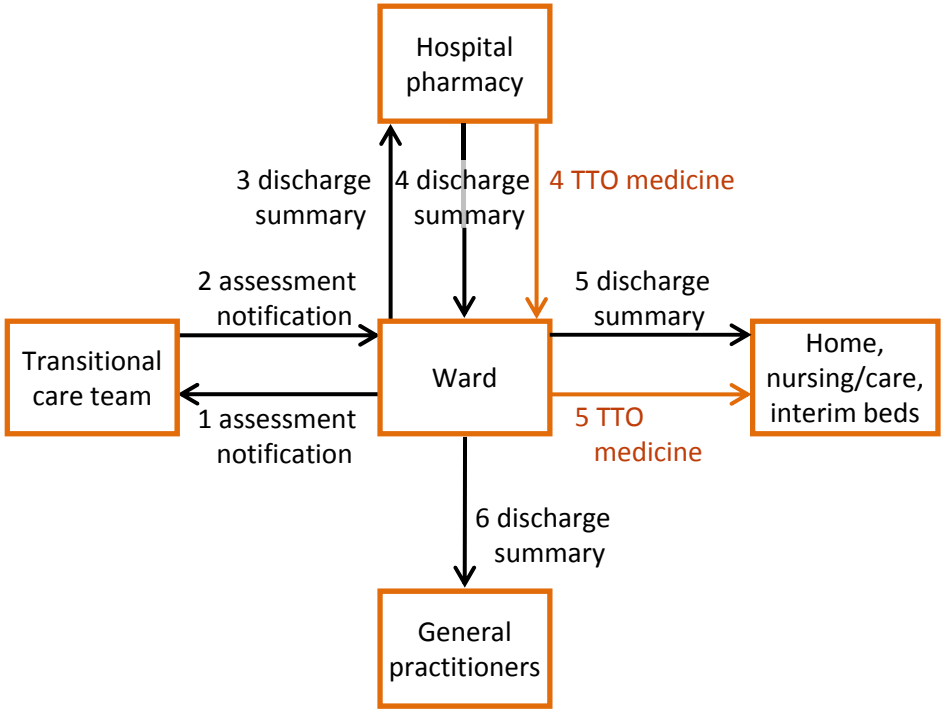
They are particularly suitable for describing interactions between trusts, departments, teams and individuals, where the 'flow' indicated by the diagram allows an effective description of a supply chain.

The possible deviation or failure of the flows and/or absence of the stakeholders can be used as a basis for identifying the risks in the system as part of an SSA.

Communication diagrams are described in the SSA Toolkit on the Describe System page.

Further information:

Holt, J. (2007) UML for Systems Engineering: Watching the Wheels, London, Institution of Engineering and Technology.



Communication diagram of a hospital discharge process

KEY

Stakeholder

Information flow

Medicine flow

System diagrams

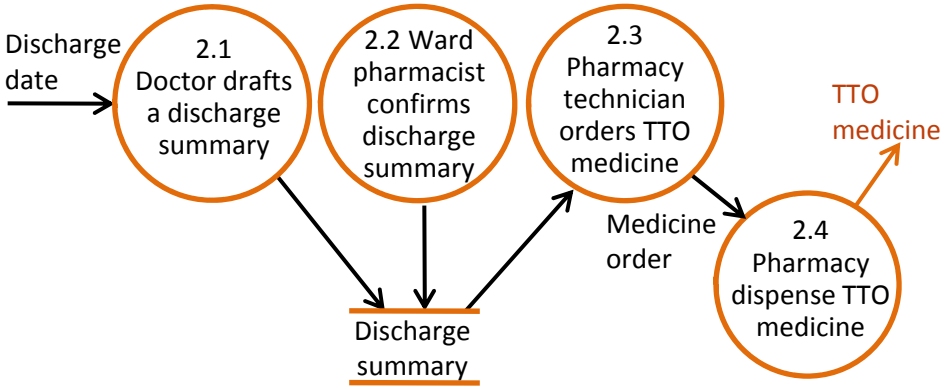
System diagrams represent how data (or objects) are transformed through activities, where such data are stored and how such activities are sequenced. They are a diagrammatic representation of the data-flows/ functions and events/state-transitions within a dynamic system. There are two different types of such diagrams, as shown opposite.

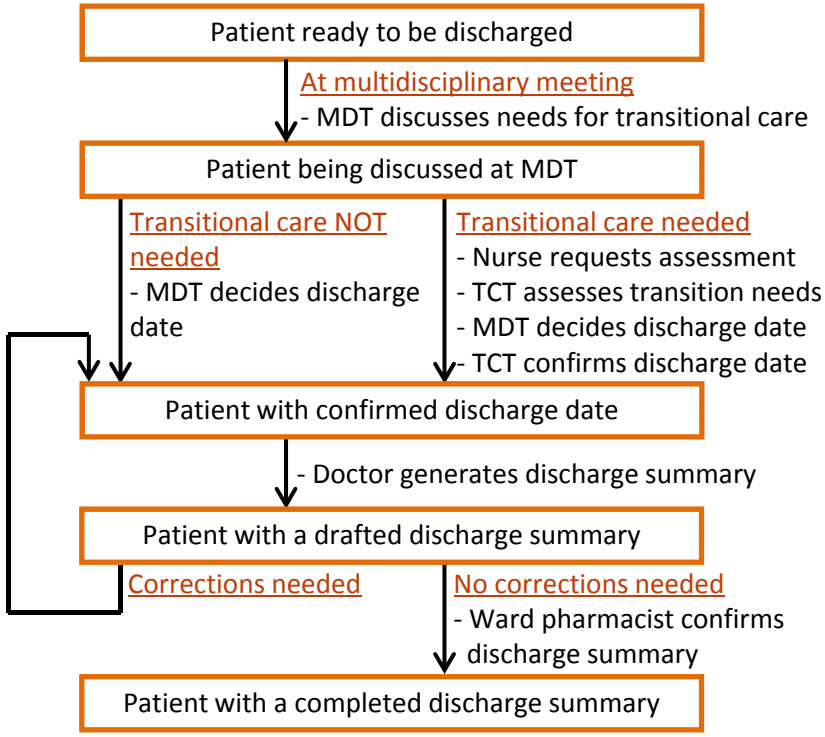
System diagrams are particularly helpful in describing real-time data-driven processes, e.g. human-technology interactions. These diagrams are particularly suitable for creating understanding of an overall process.

The possible deviation or failure of each data-flow, function or state-transition can be used as a basis for identifying the risks in the system as part of an SSA.

Further information:
Yourdon, E. (1989) Modern Structured Analysis, Prentice Hall.
Also at: http://yourdon.com/strucanalysis/wiki/

TTO: To Take Out
MDT: Multidisciplinary team
TCT: Transitional care team





System diagrams of a hospital discharge process

Organisational diagrams

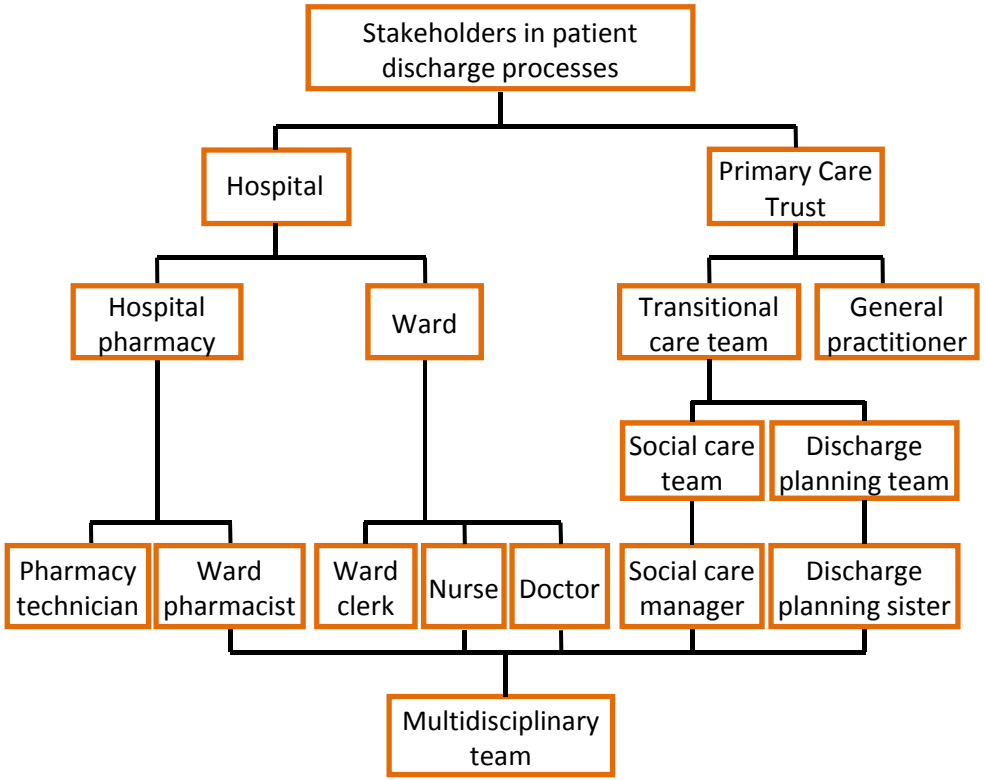
Organisational diagrams describe a hierarchy of people and/or roles within single or multiple organisations. They are a diagrammatic representation of departments, teams and individuals (boxes) and their relationships (links).

They are suitable for identifying key stakeholders in a system; enabling subsequent data collection to support risk assessment and refinement of the scope and boundary of any such study.

Organisational diagrams alone are not sufficient for supporting the identification of risk in an SSA, but they are often used as a base for building other types of diagrams, for example, process maps or communication diagrams.

Further information:

Paul, D. & Yeates, D. (Eds.) (2006) Business Analysis, British Computer Society.



Organisational diagram of the stakeholders in a hospital discharge process

KEY

Person, role or organisation

Task diagrams

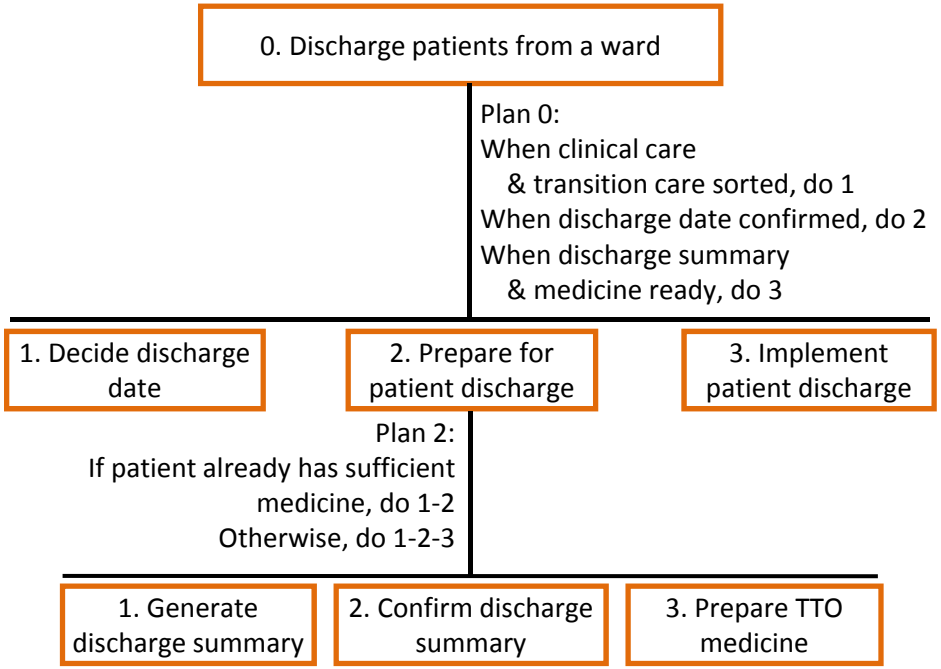
Task diagrams describe a hierarchy of operations (tasks) and can also show plans (necessary conditions to undertake these operations), if desired.

The hierarchical nature of this representation allows the description of a particular task with as much or as little detail as necessary; making it appropriate for describing whole processes as well as specific issues, such as the operation of medical devices and the organisation of procedures.

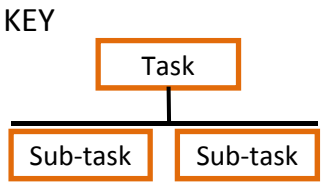
The possible deviation or failure of each task (or plan) can be used as a basis for identifying the risks in the system as part of an SSA.

Further information:

Kirwan, B. & Ainsworth, L.K. (Eds.) (1992) A guide to task analysis, Taylor and Francis.



Task diagram of a hospital discharge process



TTO: To Take Out

Information diagrams

Information diagrams describe a hierarchy of information and/or materials (things), used or needed, in physical or electronic form. They are a diagrammatic representation of the structure of information or documents (boxes) and their relationships (links).

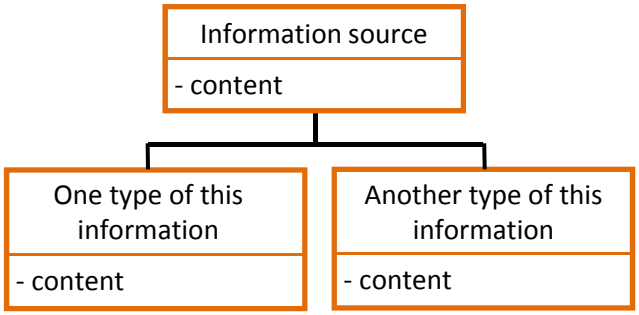
They are suitable for understanding documentation issues. This may include the degree of standardisation of documents, the level of usage of electronic documents and links between electronic and paper-based documents.

Information diagrams alone are not sufficient for supporting the identification of risk in an SSA, but they are often used as a base for building other types of diagrams, for example, communication diagrams or data-flow diagrams.

Further information:

Shlaer, S. & Mellor, S.J. (1988) Object-oriented Systems Analysis: Modelling the World in Data, Prentice Hall.

KEY



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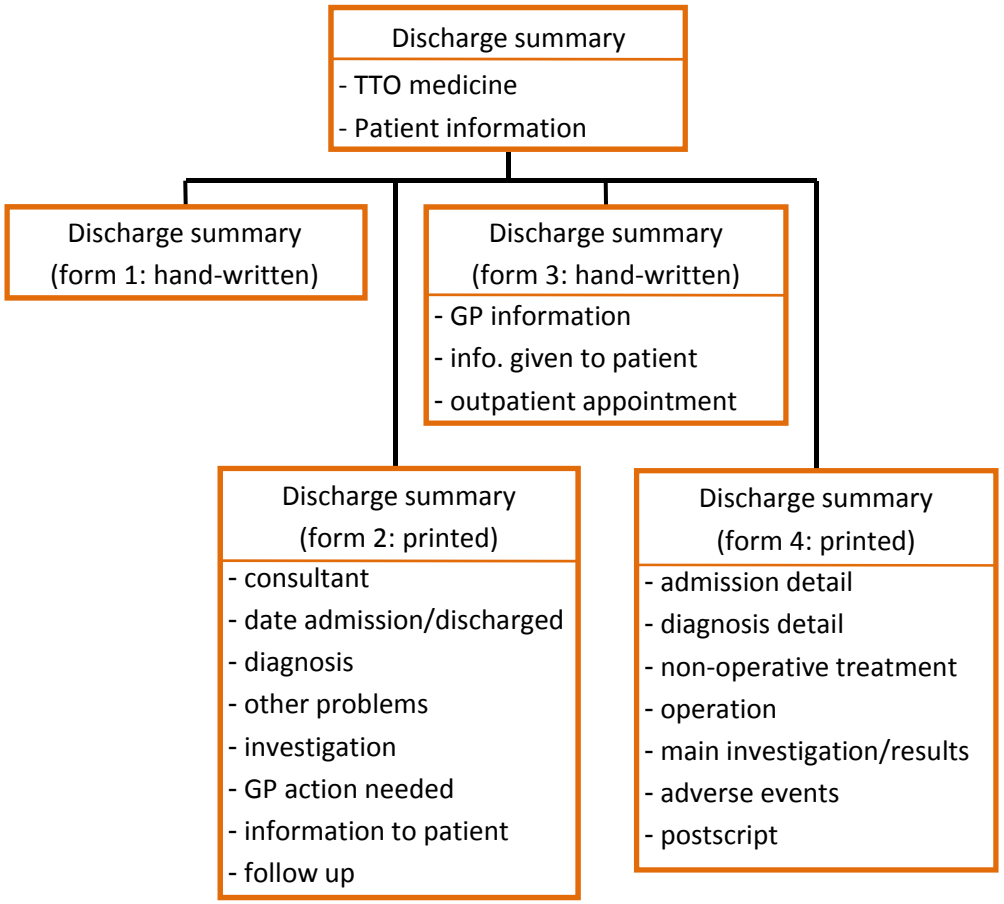

Information diagram of a hospital discharge process