HESAS

HEALTHCARE ENVIRONMENTAL SERVICES AUTOMATION SOICETY

Hospital Management System Integration

Draft

December 2020

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Message from the chairman

It is vividly evident that the world witnessed the worst public health and economic crisis due to COVID-19 pandemic. This inevitably mobilized the international community to act seriously and swiftly. However, the mortalities and morbidities induced by healthcare-acquired infections (HAI) are equally fatal, but the international community did not act similarly. Consequently, we are continuously and chronically suffering from HAI.

The current intervention for HAI is merely based on passively-set standards and enforcing these standards via regulatory agencies such as the centre for disease control and prevention (CDC), joint commission international (JCI), ministries of health, and other regulatory agencies. To efficiently address HAI, we inevitably need to mobilize the international community because HAI traverses a multitude of epistemological dimensions, requiring multidisciplinary tacit knowledge, and mandates active international collaboration. Besides, we believe that we can efficiently traverse deeply into the root-causes and solution landscapes by automating the entire healthcare environmental services and infection control within healthcare institutions using the latest advancements in computational epistemology, computational infection control models, computational epidemiological models, artificial intelligence, machine learning, distributed ledger technology, collective intelligence, cognitive technologies, internet of things, ubiquitous technologies, intelligent micro-measurement frameworks, artificial life, evidence-based program implementation, patient-centric care, strategy anchored execution, and symbiotic healthcare ecosystem services. Consequently, we developed these open standards that were tailored from diverse international standards to promote the automation of healthcare environmental services and infection control processes and best practices.

The Healthcare Environmental Services Operational Map (HESOM) and other standards were developed to efficiently leverage multidisciplinary experts and practitioners to contribute towards the eradication of HAI-induced mortalities and morbidities. Using ReXcels research and innovation environment, we cultivate collective intelligence by bringing together these multidisciplinary experts to iteratively develop these standards and adaptively support the innovation of computational technology that automates the execution and enforcement of these standards. As such, we cordially invite you to use these documents and participate actively in the further development of these standards to significantly reduce HAI-induced mortalities, morbidities, and their enormous negative economic externalities.

Hamid Adem
Interim Chairman, and Chief R&D Officer

Change Control

Version:	Date:	Changes:

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Purpose

1 Purpose

1. PURPOSE

The purpose of this document is to integrate with Hospital Management System process to accomplish the tasks required by the Environmental services.

The Hospital Management System integration process is responsible for supporting all environmental services functions and activities such that the environmental service performance is enhanced.

This process ensures that:

- Optimal integration is achieved with lesser errors.
- All the Environmental service requirements are optimally met via the current Hospital management system process.

This process is based on international well acclaimed standards like:

- *NHS- National Health Services Standard*
- *OSHA- Occupational Safety and Health Administration standard*
- *CDC- Centers for Disease Control and Prevention standard*
- *Lean six sigma- Quality Standard*
- *JCI- Journal of Clinical Investigation standard*
- *JCAHO- Joint Commission on Accreditation of Healthcare Organizations (JCAHO)*
- *EPA- US Environmental Protection Agency*
- *HCAHPS - Hospital Consumer Assessment of Healthcare Providers and Systems*
- *HIPA- Health Information Privacy Act standard.*
- *Activity based Accounting.*

*P.S: This process is a derivation from **ESM (Environmental Service Map),** which is a holistic and a comprehensive model for Environmental Services Management.*

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Hospital Management System Integration

Structure of the Document

2 Structure of the Document

2. STRUCTURE OF THE DOCUMENT

The Environmental services Hospital Management System process document comprises the following chapters:

Chapter–3: *Scope*: This chapter describes the scope of the document and the Cleaning process.

Chapter–4: *General Assumptions*: This chapter describes the underlined assumptions made for both the document and the process.

Chapter–5: *Hospital Management System Integration Framework***:** This chapter exhibits the interaction of financial process with other related processes and also describes the process sequence for cleaning process.

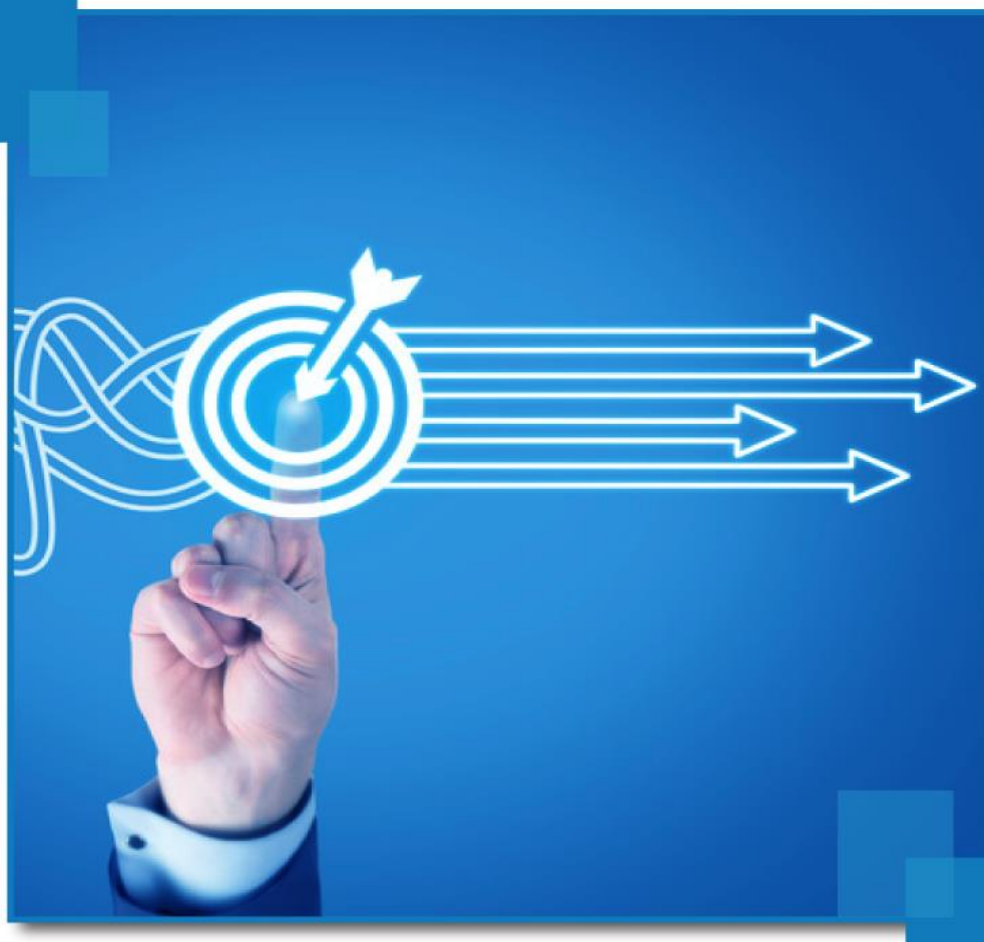
Chapter–6: *Hospital Management System Integration Process***:** In this chapter Financial process and sub processes (if any) will be depicted and specified using rigorous BPMN and process specification templates.

Chapter–7: *References***:** This chapter serves as a prime reference to Hospital Management System process and presents the details supporting it in tabular formats. The chapter describes relevant Business Rules, Risks, quality Attributes, Data Quality Dimensions, Operation Policies, KPIs, CTQs, Abstract Time-scales and SLAs terms specific to cleaning process.

This Hospital Management System integration process is supposed to be a living document and consists of various variable values which would frequently evolve or change as organization's process matures or changes

3 Hospital Management System Integration

Scope



3 Scope

3. SCOPE

This process is applicable to all environmental services and all the people who interact directly or indirectly with the environmental services:

- Physicians
- Nurses
- Cleaner
- Administrative staff
- Technical staff
- Health researcher
- Patients
- Visitors
- Suppliers

4 Hospital Management System Integration

General Assumptions

4 General Assumptions

4. GENERAL ASSUMPTIONS

Following are general assumption made for the Hospital Management System process.

- Senior Management Support is available throughout this process.
- This process uses automated tools to ensure smooth and efficient performance.
- Hospital management system is a comprehensive system which meets all the requirements of the hospital
- Hospital management system provides the capability for integration.
- Any activity related assumptions are explicitly identified in related Process Specification table in Chapter 6.

5

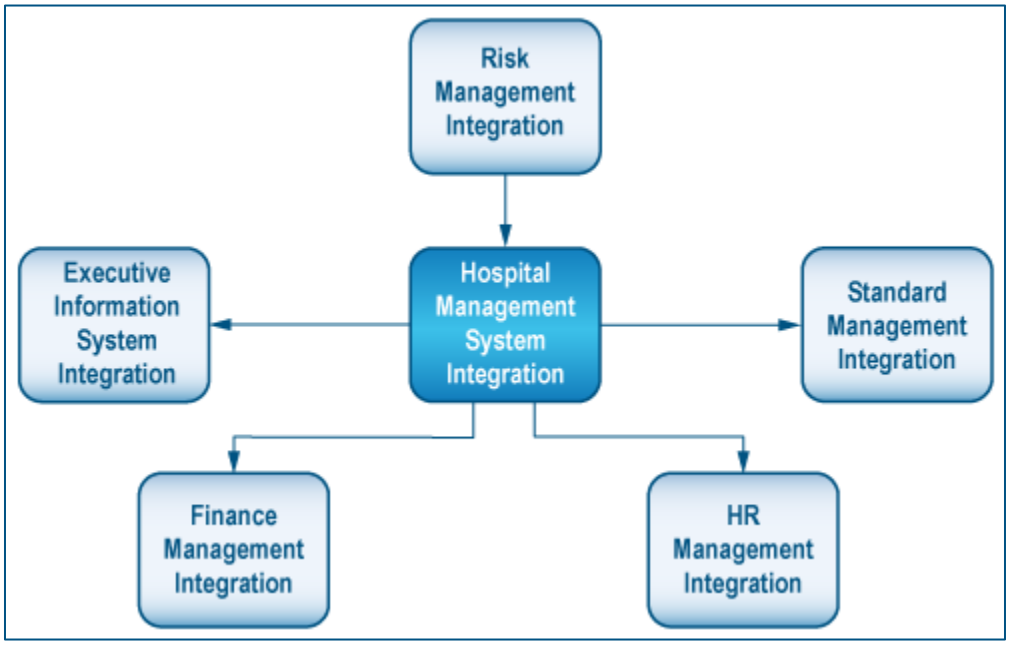
Hospital Management System Integration

Hospital Management System Integration Framework

5 Hospital Management System Integration Framework

5.1 Hospital Management System integration Process Interactions

The following depiction shows the points of interaction of organization's Hospital Management System process with other related enterprise processes. All the processes depicted below are defined in their own respective dedicated documents.



5.2 Hospital Management System integration Process

The Hospital Management system integration process comprises of following sequence of activities:

1. **Integration goals Identification**
2. **Business Process Re-engineering**
3. **Perform HL7 integration with HIS**
4. **Data and Record Integration**
5. **Provide Integration**
6. **Integration with hospital service modules**

5 Hospital Management System Integration Framework

7. **Messaging and Alerting Integration**
8. **Integrated Reporting**

Section 5.2.1 -5.2.6 describes the flow of high level process sequence for organization Hospital Management integration. **Section 6.1** Process Model sheds more light on the entire flow of Hospital Management integration process.

5.2.1 Integration goals identification

Following are the goals of Hospital management integration process. This comprises of following:

- **ES Performance Optimization**. This focuses on streamlining and improving existing environmental service processes performance for greater operational efficiency.
- **Efficient ES decision making.** Ensure the smooth and seamless information flow for effective decision making pertaining to the environmental services.
- **Better ES Coordination.** Comprehensive and easy to retrieve information and data when required, which would facilitate the coordination between environmental services and hospital management system process.

5.2.2 Business Process re-Engineering

This comprises of re-engineering the existing business process of hospital management as well as environment services processes to streamline and optimize information flow between the two processes.

This comprises of following:

- **Identify Integration goals**. This comprises of identification of strategic and informative goals between the processes.
- **Analyze "as is" Processes**. This comprises of analyzing the current processes, to identify points of failure, disconnections, and current values of the processes.
- **Design "to be" process**. The objective of this phase is to produce one or more alternatives to the current situation, which satisfy the strategic goals of the integration. This comprises of using innovative methods and practices and identifying the desired state of processes.
- **Implement Change.** This comprise of planning a transition from "As is" to the desired process. This plan must align the organizational structure, information systems, and the business policies and procedures with the redesigned processes

5.2.3 Perform HL 7 Integration with HIS

5.2.3.1 Establish implementation goals

Following are goals of HL 7 Integration:

- A full and accurate view of a patient's health history and situation (via application integration within an Electronic Health Record),
- The smooth function and cost-effective management of hospitals and clinics (via application integration of a Hospital or Clinic's Information System),
- The provision of high quality care for patients situated away from their usual physicians, healthcare providers, or in different regions or countries (via application integration within a National Electronic Patient Record).

5.2.3.2 Message Selection

Prior to starting integration, the system to be integrated must select the messages that it will use to send and receive HL7 information. After the message types have been selected, the next step is to verify what messages need to be exchanged. Once the sample messages are exchanged, the interface planning should be performed.

5.2.3.3 HL7 Interface Planning

HL7 planning encompasses the major activity for a typical health integration project. HL7 planning includes following:

- **Business requirements analysis**
  This comprises of the review of the overall project's business requirements and the role that HL7 interfacing will play in the realization of those requirements.
  HL7 interface analysis includes:
  - Review of (and potential input to) documented business requirements
  - Participation in stakeholder reference groups used to validate and refine business requirements. These groups allow the interface analyst to better understand the objectives and business rules that apply to any required HL7 interfaces
  - Working with project business analysis to exchange ideas on how front-end functional requirements will align with HL7 interface requirements
- **Application analysis**
  This comprise of review of the applications required to be integrated (using HL7 interfaces) in order to achieve the project's business requirements.

5 Hospital Management System Integration Framework

The applications that underpin the business workflows and business requirements influence the HL7 interface analysis process. In the HL7 interface analysis process, for a set of identified applications, the application analysis will include:

- Review of the business processes practiced by the users of a particular application. For example the business processes performed by the pathology staff whose activities contribute an electronic health record.

  Various tools that can be utilized for this review are as:

  - **Sequence Diagrams**

    These diagrams are intended to provide an overview so the transactions can be seen in the context of the organizations workflows. These diagrams are not intended to present the only possible scenario, just those required to accomplish the goals of communicating between information systems

  - **Activity Diagrams**

    These diagrams include "swim-lanes", which separate the tasks of cooperating systems. The purpose of the activity diagram is to illustrate the components of an activity diagram, not to design a system.
    This stage comprises of describing the actors (entities) that may be involved in sending or receiving related messages. It also comprises of identifying related messaging goals for the actors. Give below is an example:

Actor	Responsibility	Messaging Goals
Immunization Information System	• Provide access to a complete, consolidated immunization record for each person in its catchment area • Supply individual immunization records to authorized users and systems • Support aggregate reporting and analysis • Evaluate immunization history and make recommendations for next doses	• Receive immunization histories and updates • Receive demographic updates • Receive requests for individual records • Receive observations about a person • Send observations about a person • Send immunization records to other systems • Send demographic data

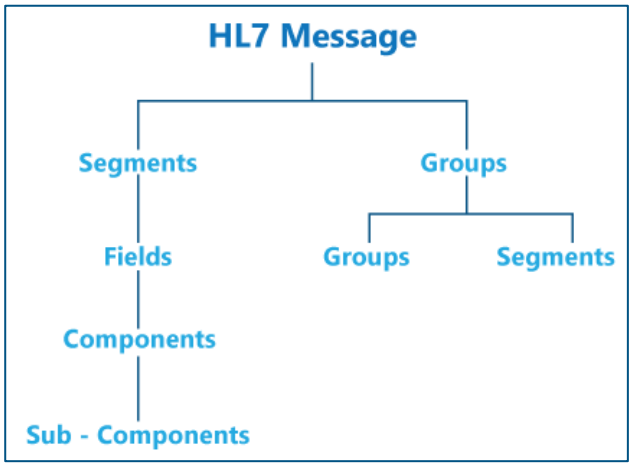
	• Store medical conditions that affect what vaccines are recommended	• Request immunization record Request person id • Acknowledge receipt of message

- Review of the actual application used by a particular group of users. For example the X application used by pathology staff, Y used by hospital radiology department staff, etc.
- Review of existing HL7 interfaces used (or potentially available) by those identified systems. For example the existing HL7 interface supported by the ABC emergency department application.

- **HL7 interface requirements**

  HL7 interface requirements forms the basis of the HL7 interface specification and typically includes:
  - HL7 interface business requirements - based previously in business requirements analysis and application analysis.
  - HL7 messages to support business requirements (e.g. Order new pathology test, Update patient demographics)
  - Data items required for each transaction and particular business rules required for a particular data item (e.g. business rules when updating a patient next of kins name)

  The depiction on the next page shows the HL 7 hierarchy.



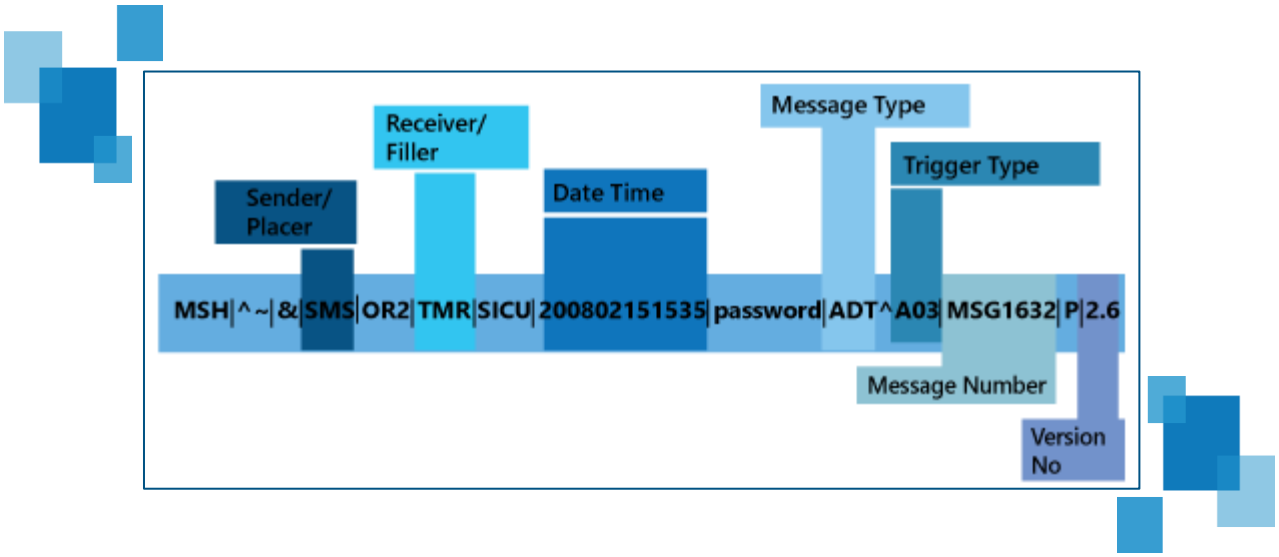
Appendix C gives more information about this.

- **HL7 interface specification**

  HL7 interface specification describes how the HL7 requirements will be realized in actual interface software components. This typically includes:

  - Technical description of the HL7 messages supported, the HL7 segments and HL7 fields.
  - How the HL7 messages relate to the application front-end functionality, data base and code tables
  - Specific technical business rules required and/or applied by the interface

  The depiction shows HL7 message header



Appendix D highlights Encoding and decoding rules.

5.2.3.4 Using Integration Engine

Interface Engines are useful tools for formatting messages and routing them between messaging partners. Following needs to be considered:

- The number of applications being interfaced and how likely that is to grow
- The robustness required of your interface
- Whether the interface is real time or batch
- Ability to support an interface engine

The integration engine should be able to provide following:

- **HL7 Mapping.**
  Integration Engine should offers the flexibility to handle non-standard HL7 messages in an efficient and accurate manner.
- **HL7 Message Testing**
  Integration Engine should provides robust HL7 testing features by loading test message files and providing the capability to test. Additionally, it should provide ability to conduct HL7 conformance checks, getting immediate validation of HL7 messages against the selected HL7 Standard.
- **HL7 Messaging**
  High volumes of HL7 message traffic or large numbers of connections should be robustly handled within Integration Engine. For healthcare IT environments that require high availability options, Integration Engine should ensure HL7 message flow is continuous.
- **HL7 Connections**
  Integration engine should be able to provide all type of connection - bi-directional, receiver, or sender – as well as the communication method - TCP/IP, File, FTP, and HTTP - required to exchange patient between applications and providers.
- **HL7 Interface Monitoring**
  Integration Engine should enable real-time monitoring of HL7 interfaces, notify the users in case of failures.

5.2.3.5 HL7 interface testing

This includes test planning, actual interface testing (such as HL7 interface unit testing, HL7 interface system testing and HL7 integration testing).

HL7 interface testing typically includes:

- **HL7 interface unit testing** .Typically interface specification based aiming to confirm that HL7 messages sent and/or received from each application conform to the HL7 interface specification.
- **HL7 interface integration testing**. Testing of business scenarios to ensure that information is able to flow correctly between applications.
- **HL7 interface system testing**. End-to-end scenario testing focused on ensuring all relevant modules of all relevant applications are able to integrate correctly.

After the testing period has completed the integrated system is placed in production mode. If a problem occurs during the go live phase, an action plan should be quickly developed and the necessary changes should be made.

5.2.4 Data and Records Integration

This process ensures that the environmental services record are well integrated with the hospital management system for and provide availability of records for reference and more effective patient care, faster decision. This involves integration with other process so as to provide:

- Authentic
- Accurate
- Reliable and
- Free from error vital information.

5.2.5 Provide Process Integration

This process integrates with the hospital management process to provide inputs to following capabilities of the environmental services:

- **Patient Profile Elicitation.** This comprises of obtaining patient information from the hospital management system that can provide valuable inputs for various environmental services process such as housekeeping, waste management, infection coordination management etc.
- **Nurse Information Integration.** This comprise of obtaining nurse related information (number of nurses, nurse shift schedules etc) from the hospital management system, that can provide inputs to various nurse related environment services processes e.g., nurse coordination process.
- **Infection Control Management Integration.** This comprises of integrating with the hospital management records to facilitate infection control processes of environmental services.
- **Quality Management Integration.** This comprises of integration with the hospital quality management system to monitor lean six sigma quality performance of environmental services.
- **Inventory Management Integration.** This involves integration to the hospital management system to ensuring the environmental inventories are well tracked and always available.
- **Supplier Management Integration.** This involves integration to the hospital management system supplier management process to ensuring the environmental supplies are well tracked and always available.
- **ES Performance Management Integration.** This involves tracking and monitoring the overall performance of environmental systems the KPIs, SLA that the hospital needs to fulfil.
- **Service level management Integration.** This comprise of identifying the relationships between hospital service level and environmental services level and integration between them so as to provide seamless continuity of service.

- **Knowledge Management integration.** This comprises of integrating with Hospital management system and deriving Knowledge Management capability for Environmental services to ensure that organizational knowledge is well preserved and properly disseminated to various sections of the organization.
- **Integrated Forecasting.** This involves integrating with hospital management system to obtain credible data which can serve as an input to artificial intelligence, simulation and forecasting techniques to identify various trending information so that effective decision making with regards to environment services can be performed.
- **General ES Administration**. Availability of timely, accurate and up to date information, advances and recoveries, control and check various environmental services rendered are in line with hospital management.
- **Daily ES Operations Management**. This involves reduction in paper flow, paper work, duplication reduced and into overall environmental service operations being more streamlined, and in line with the hospital management process.
- **ES Budgeting**. To ensure that the environmental services budgets are well planned to meet hospital services' strategic goals and objectives.
- **ES Resource Management.** This ensures that resources management for environmental services are well integrated to hospital management system, and thus are well managed, accurate and up to date.

5.2.6 Integration with Hospital Service Modules

This comprise of integration with following:

- **Core Service Management**
  This comprises of integration of environmental services with the following core services of hospital management:
  - Appointment & Queue Management
  - EMR (Electronic Medical Record)
  - Casualty & Emergency Management
  - In-patient Management
  - Out Patient Management
  - Pharmacy Management
  - Laboratory Information Management
  - Radiology and Medicine
  - Operation Theatres Management
  - Nursing & Ward Management
  - Blood Bank Management

- **Supportive Service Management**
  This comprises of integration of environmental services with the following supportive services of hospital management:
    - Ambulance Services Management
    - Stores and Inventory Management
    - Medical Insurance Management
    - Patient Referral System
    - Duty Roster Management
    - Physiotherapy and Rehabilitation
    - Dietary Management
    - House Keeping and Laundry Management
    - Bio-Medical Waste Management
    - Knowledge management

5.2.7 Messaging and Alerting Integration

This comprises integration with the Hospital management systems messaging infrastructure to enable:

- **ES Passive Alerts**. Are mainly used to remind workers of tasks which are fairly routine, discrete and things that are somewhat easy to remember.
- **Active Alerts.** An alert is active and is fairly intrusive to the receiver. It often demands more immediate attention than a passive reminder.

5.2.8 Integrated Reporting

This process is responsible for provision of various reports which refer to the integrated data collection and trending, for example

- Deviations Reports
- Performance reports
- Operational Reports
- Inventory Reports.

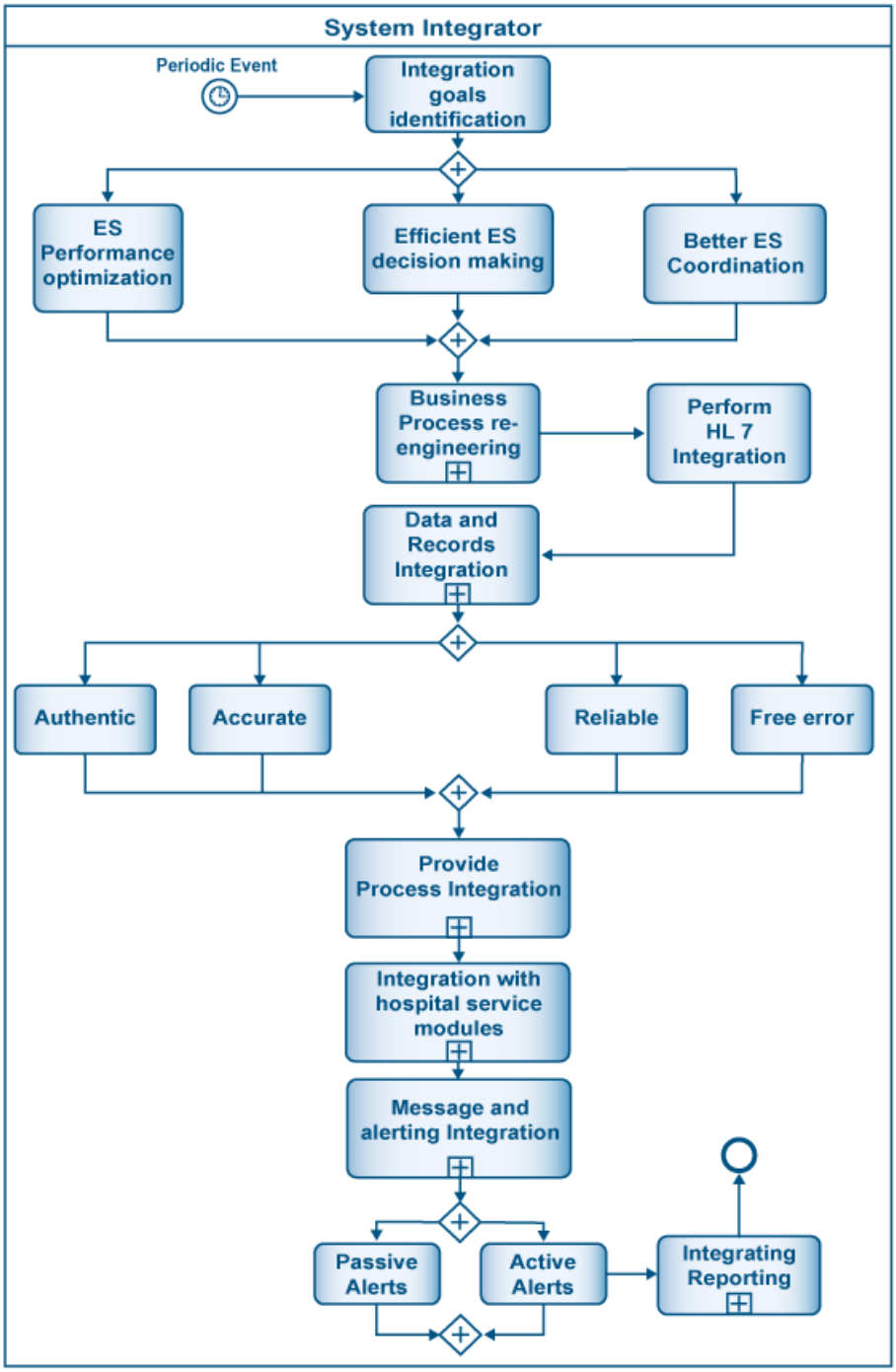
6

Hospital Management System Integration

Hospital Management System Process

6 Hospital Management System Process

6.1 Process Model



6 Hospital Management System Process

6.2 Process Specification

Specification	Description
Summary/Purpose	To integrate with organization's Hospital Management System process.
Scope	This is a Level 1 Process Specification.
Primary Reference	• NHS- National Health Services Standard • OSHA- Occupational Safety and Health Administration standard • CDC- Centers for Disease Control and Prevention standard • Lean six sigma- Quality Standard • JCI- Journal of Clinical Investigation standard
Related ESM Practices	Enterprise Information system integration, Finance Management integration, HR Management integration, Standard Management integration, Risk Management integration.
Related Business Driver	• Cost Effectiveness • Better service performance • Reduction of wastes
Related Operational Policies	OP-001, OP-002, OP-003, OP-004, OP-005, OP-006, OP-007 (Ref 7.5)
Assumptions	Senior Management support is available throughout this process.
Voice of Customer	Hygiene, High and Consistent Quality of standards, Free of Infections, Timely Services, High Coordinating, Remove Waste, Excellent Ergonomic, Safety, Appearance, Excellent Worker Attitude. (Ref 7.10)
Customer Satisfaction Measure	Customer satisfaction index
COI Correlation	None

6 Hospital Management System Process

<table>
<tr><td>Raw Materials</td><td>None</td></tr>
<tr><td>Equipment & Accessories</td><td>Automated System for Hospital management.</td></tr>
<tr><td>MSD Management</td><td>Lifting/carrying, Disability, Force, Loaded motion, Physical ergonomics, Posture change, Excessive force, Scarceness, Noise, Concentration, Floor hazards, Clothing, Psychosocial factors. (Ref 7.12)</td></tr>
<tr><td>EBC Procedures</td><td>None</td></tr>
<tr><td>Timing Dimension</td><td><table><tr><th>Type</th><th>Normal</th></tr><tr><td>Average</td><td>30 min</td></tr><tr><td>Std</td><td>12 min</td></tr></table></td></tr>
<tr><td>Trigger</td><td>• Periodic review</td></tr>
<tr><td>Basic Course of Event</td><td>Hospital Management System Process Integration
1. System integrator identifies integration goals (ES performance optimization, Efficient ES decision making, Better ES coordination)
2. System integrator performs business process re-engineering
3. System integrator perform HL 7 integration
4. System integrator performs data and record integration (authentic, accurate, reliable free error)
5. System integrator performs process integration
6. System integrators integrates with other systems
7. System integrators performs message and alerting integration (passive alerts and active alerts)
8. Hospital Management System performs integrating reporting
9. End</td></tr>
<tr><td>Alternative Path</td><td>None</td></tr>
<tr><td>Exception Path</td><td>System Down
1. Keep paper track until system is up and running
2. Update the System and clear all logs.</td></tr>
</table>

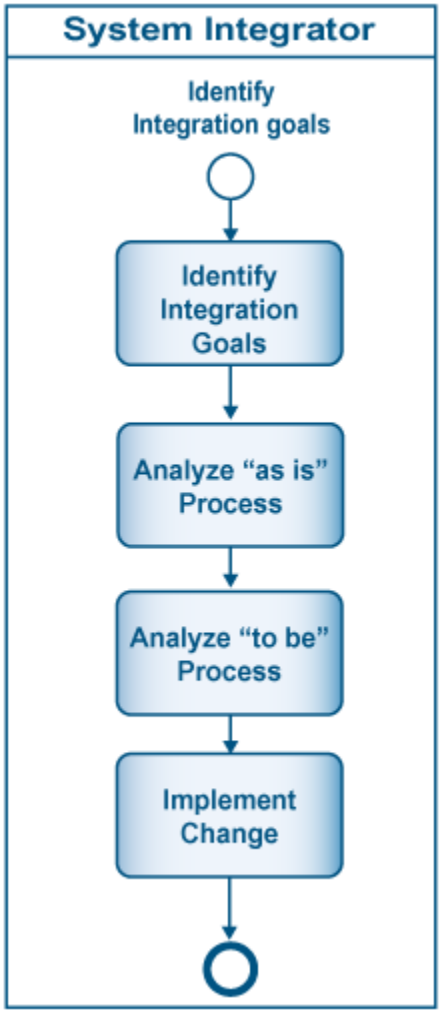
	3. End.
Extension points	Enterprise Information system integration, Finance Management integration, HR Management integration, Standard Management integration, Risk Management integration
Preconditions	Senior Management support is available to this process.
Post –conditions	Hospital Management system process gets established.
Related Business Rules	BR-001, BR-002, BR-003, BR-004, BR-005, BR-006,BR-007 (Ref 7.1)
Related Risks	RR-001, RR-002, RR-003, RR-004, RR-005, RR-006,RR-007 (Ref 7.2)
Related Quality Attributes	Reliability, Confidentiality, Authenticity, Data Integrity, Availability, Non-repudiation, Accountability, Security Integration, Performance, Scalability, Extensibility, Adaptability, Testability, Auditability, Operability and Deployability (Ref 7.3)
Related Data Quality Dimensions	Accuracy, Reputation, Objectivity, Free-of-Error, Relevance, Completeness, Timeliness, Appropriate Amount, Understandability, Interpretability, Concise Representation (Ref 7.4)
Related Primary SLA Terms	(Ref 7.9)
Related KPIs	RPR, IRAR, IC, MRI, ESER, HIE (Ref 7.6)
Related CTQs	RPRV, IRARV, ICV, MRIV, ESERV, MOM, PWOM, CTQ, IOM, TOM, WRM, DRM, HIEV (Ref 7.7)
Actors/Agents	System integrator
Delegation	Delegation Rule -1: Agent Not Available 1. Delegate the task to the agent with same role 2. Update the task 3. Log the delegation Delegation Rule -2: Agent Overloaded

	1. Delegate the task to the agent with same Role 2. Update the task 3. Log the delegation
Escalation	Rule 1: Performance, operational legal Issues 1. Escalate to environmental services department head. 2. Log Escalation
Process Map	Section 5.1
Process Model	Section 6.1
Other References	APPENDIX A: BUSINESS PROCESS MODELING NOTATION REFERENCE APPENDIX B: CHAIN OF INFECTION APPENDIX C: HL 7 PROTOCOL APPENDIX D: HL 7 ENCODING AND DECODING RULES

6.3 Roles & Responsibilities

Roles	Responsibilities
System Integrator	• System integrator identifies integration goals • System integrator performs business process re-engineering • System integrator performs data and record integration (authentic, accurate, reliable free error) • System integrator perform HL 7 integration • System integrator performs process integration • System integrators integrates with other systems • System integrators performs message and alerting integration (passive alerts and active alerts) • Hospital Management System performs integrating reporting

6.4 Sub Process – Business Process Re-engineering



6.5 Sub Process – Business Process Re-engineering Specification

Specification	Description
Summary/Purpose	To establish the process of business process re-engineering.
Scope	This is a Level 2 Process Specification.
Primary Reference	• NHS- National Health Services Standard • OSHA- Occupational Safety and Health Administration standard • CDC- Centers for Disease Control and Prevention standard • Lean six sigma- Quality Standard • JCI- Journal of Clinical Investigation standard
Related ESM Practices	Enterprise Information system integration, Finance Management integration, HR Management integration, Standard Management integration, Risk Management integration.
Related Business Driver	Streamline coordination between processes.
Related Operational Policies	OP-001 (Ref 7.5)
Assumptions	Senior Management support is available throughout this process.
Voice of Customer	Hygiene, High and Consistent Quality of standards, Free of Infections, Timely Services, High Coordinating, Remove Waste, Excellent Ergonomic, Safety, Appearance, Excellent Worker Attitude. (Ref 7.10)
Customer Satisfaction Measure	Customer satisfaction index
COI Correlation	None
Raw Materials	None

6 Hospital Management System Process

Equipment & Accessories	Automated System for Hospital management.
MSD Management	Lifting/carrying, Disability, Force, Loaded motion, Physical ergonomics, Posture change, Excessive force, Scarceness, Noise, Concentration, Floor hazards, Clothing, Psychosocial factors. (Ref 7.12)
EBC Procedures	None
Timing Dimension	<table><tr><th>Type</th><th>Normal</th></tr><tr><td>Average</td><td>30 min</td></tr><tr><td>Std</td><td>12 min</td></tr></table>
Trigger	Identify integration goals
Basic Course of Event	**Business Process Re-engineering** 1. System integrator identify integration goals 2. System integrator analyze “as in” process 3. System integrator analyze “to be” process 4. System integrator implements change. 5. End
Alternative Path	None
Exception Path	**System Down** 1. Keep paper track until system is up and running 2. Update the System and clear all logs. 3. End.
Extension points	Data and record integration
Preconditions	The management is supportive of changes in the processes.
Post –conditions	Business process –re-engineering process is established.
Related Business Rules	BR-001 (Ref 7.1)

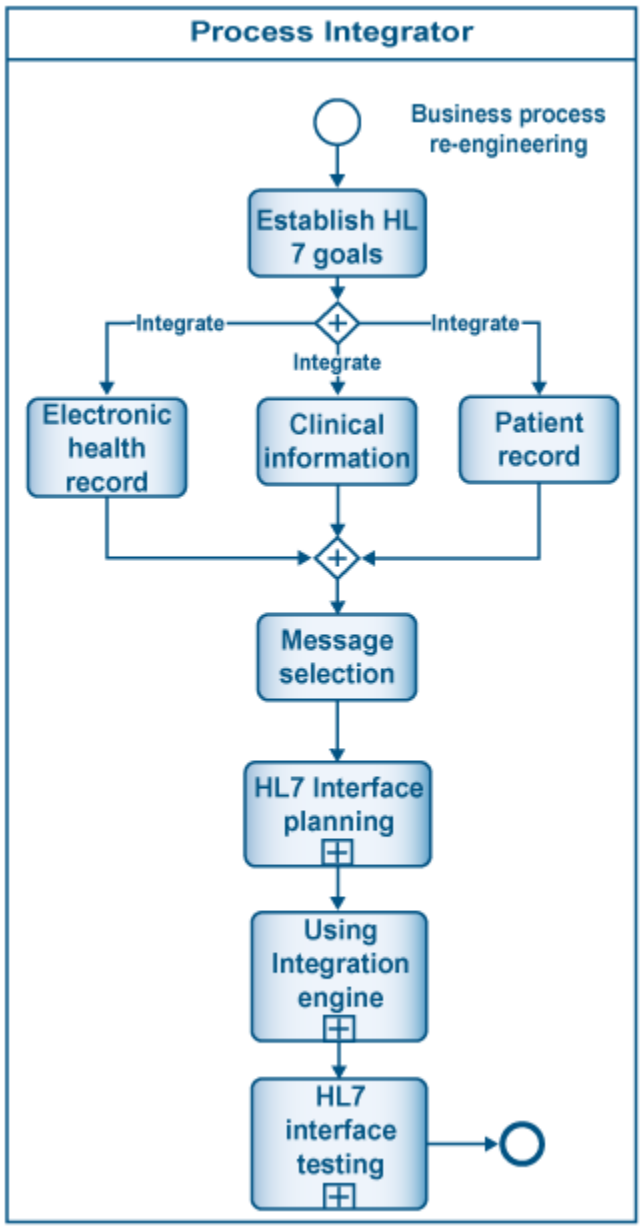
6 Hospital Management System Process

Related Risks	RR-001 (Ref 7.2)
Related Quality Attributes	Reliability, Confidentiality, Authenticity, Data Integrity, Availability, Non-repudiation, Accountability, Security Integration, Performance, Scalability, Extensibility, Adaptability, Testability, Auditability, Operability and Deployability (Ref 7.3)
Related Data Quality Dimensions	Accuracy, Reputation, Objectivity, Free-of-Error, Relevance, Completeness, Timeliness, Appropriate Amount, Understandability, Interpretability, Concise Representation (Ref 7.4)
Related Primary SLA Terms	(Ref 7.9)
Related KPIs	RPR (Ref 7.6)
Related CTQs	RPRV (Ref 7.7)
Actors/Agents	System integrator
Delegation	Delegation Rule -1: Agent Not Available 1. Delegate the task to the agent with same role 2. Update the task 3. Log the delegation Delegation Rule -2: Agent Overloaded 1. Delegate the task to the agent with same Role 2. Update the task 3. Log the delegation
Escalation	Rule 1: Performance, operational legal Issues 1. Escalate to environmental services department head. 2. Log Escalation
Process Map	Section 5.1
Process Model	Section 6.4
Other References	Appendix A: Business Process Notation Reference

6.6 Sub Process – Business Process Re-engineering Roles & Responsibilities

Roles	Responsibilities
System integrator	• System integrator identify integration goals • System integrator analyze “as in” process • System integrator analyze “to be” process • System integrator implements change.

6.7 Sub process – perform HL 7 integration with HIS



6.8 Sub process – Perform HL 7 integration with HIS Specifications

Specification	Description
Summary/Purpose	To establish process for HL7 integration with HIS
Scope	This is a Level 2 Process Specification.
Primary Reference	• NHS- National Health Services Standard • OSHA- Occupational Safety and Health Administration standard • CDC- Centers for Disease Control and Prevention standard • Lean six sigma- Quality Standard • JCI- Journal of Clinical Investigation standard
Related ESM Practices	Enterprise Information system integration, Finance Management integration, HR Management integration, Standard Management integration, Risk Management integration.
Related Business Driver	• Compatibility and interoperability
Related Operational Policies	OP-005(Ref 7.5)
Assumptions	Senior Management support is available throughout this process.
Voice of Customer	Hygiene, High and Consistent Quality of standards, Free of Infections, Timely Services, High Coordinating, Remove Waste, Excellent Ergonomic, Safety, Appearance, Excellent Worker Attitude. (Ref 7.10)
Customer Satisfaction Measure	Customer satisfaction index
COI Correlation	None
Raw Materials	None

6 Hospital Management System Process

Equipment & Accessories	Automated System for Executive Information System
MSD Management	Lifting/carrying, Disability, Force, Loaded motion, Physical ergonomics, Posture change, Excessive force, Scarceness, Noise, Concentration, Floor hazards, Clothing, Psychosocial factors. (Ref 7.12)
EBC Procedures	None
Timing Dimension	<table><tr><th>Type</th><th>Normal</th></tr><tr><td>Average</td><td>30 min</td></tr><tr><td>Std</td><td>12 min</td></tr></table>
Trigger	Business process re-engineering
Basic Course of Event	**Perform HL 7 integration** 1. Process integrator establishes HL 7 goals for integration with electronic health record, clinic information of hospital, patient record 2. Process integrator perform data model planning 3. Process integrator performs Message selection and specification validation. 4. Process integrator performs HL7 interface planning 5. Process integrator uses integration engine 6. Process integrator interface testing. 7. End.
Alternative Path	None
Exception Path	**System Down** 1. Keep paper track until system is up and running 2. Update the System and clear all logs. 3. End.
Extension points	Provide Process Integration management
Preconditions	All the requirements have been taken accurately.
Post –conditions	HL7 integration is completed.

6 Hospital Management System Process

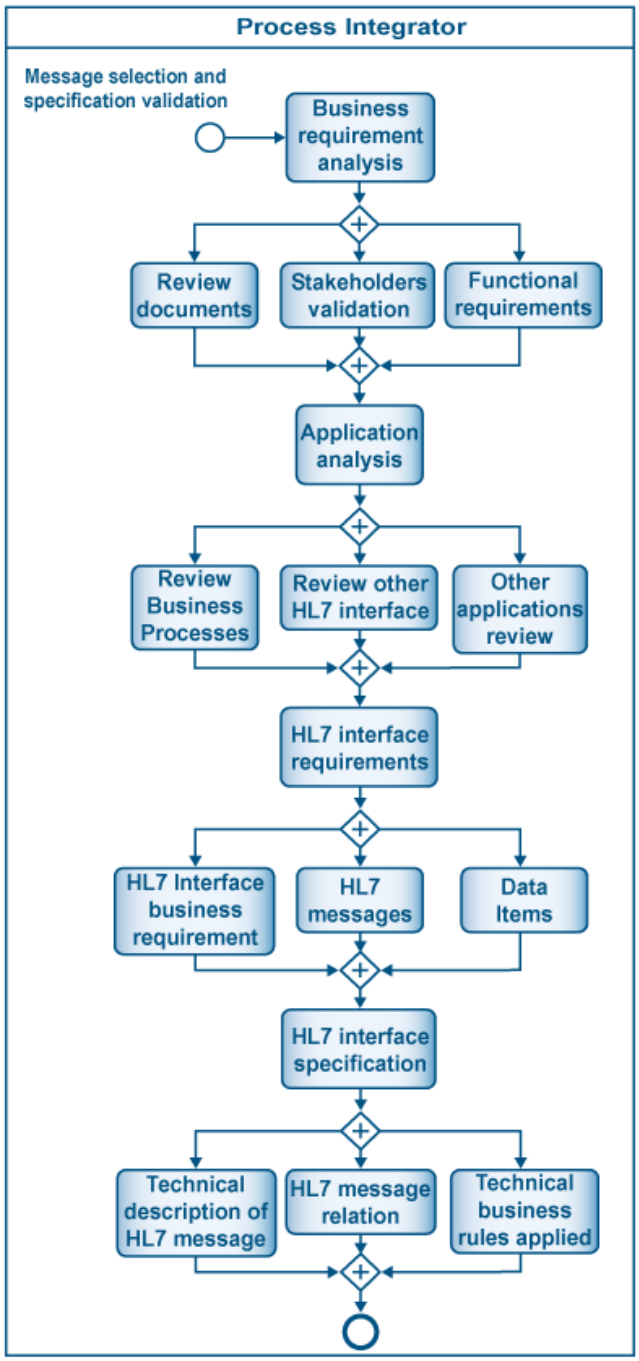
Related Business Rules	BR -005 (Ref 7.1)
Related Risks	RR-005 (Ref 7.2)
Related Quality Attributes	Reliability, Confidentiality, Authenticity, Data Integrity, Availability, Non-repudiation, Accountability, Security Integration, Performance, Scalability, Extensibility, Adaptability, Testability, Auditability, Operability and Deployability (Ref 7.3)
Related Data Quality Dimensions	Accuracy, Reputation, Objectivity, Free-of-Error, Relevance, Completeness, Timeliness, Appropriate Amount, Understandability, Interpretability, Concise Representation (Ref 7.4)
Related Primary SLA Terms	(Ref 7.9)
Related KPIs	HIE (Ref 7.6)
Related CTQs	HIEV (Ref 7.7)
Actors/Agents	Process integrator
Delegation	Delegation Rule -1: Agent Not Available 1. Delegate the task to the agent with same role 2. Update the task 3. Log the delegation Delegation Rule -2: Agent Overloaded 1. Delegate the task to the agent with same Role 2. Update the task 3. Log the delegation
Escalation	Rule 1: Performance, operational legal Issues 1. Escalate to environmental services department head. 2. Log Escalation
Process Map	Section 5.1
Process Model	Section 6.7

Other References	APPENDIX A: BUSINESS PROCESS MODELING NOTATION REFERENCE APPENDIX B: CHAIN OF INFECTION APPENDIX C: HL 7 PROTOCOL APPENDIX D: HL 7 ENCODING AND DECODING RULES

6.9 Sub process – Perform HL 7 integration with HIS Roles and Responsibilities

Roles	Responsibilities
Process integrator	• Process integrator establishes HL 7 goals for integration with electronic health record, clinic information of hospital, patient record • Process integrator perform data model planning • Process integrator performs Message selection and specification validation • Process integrator performs HL7 interface planning • Process integrator uses integration engine • Process integrator interface testing.

6.10 Sub process – HL7 interface planning



6.11 Sub process – HL 7 interface planning Specifications

Specification	Description
Summary/Purpose	To establish process for HL7 interface planning.
Scope	This is a Level 2 Process Specification.
Primary Reference	• NHS- National Health Services Standard • OSHA- Occupational Safety and Health Administration standard • CDC- Centers for Disease Control and Prevention standard • Lean six sigma- Quality Standard • JCI- Journal of Clinical Investigation standard
Related ESM Practices	Enterprise Information system integration, Finance Management integration, HR Management integration, Standard Management integration, Risk Management integration.
Related Business Driver	• Compatibility and interoperability
Related Operational Policies	OP-002 (Ref 7.5)
Assumptions	Senior Management support is available throughout this process.
Voice of Customer	Hygiene, High and Consistent Quality of standards, Free of Infections, Timely Services, High Coordinating, Remove Waste, Excellent Ergonomic, Safety, Appearance, Excellent Worker Attitude. (Ref 7.10)
Customer Satisfaction Measure	Customer satisfaction index
COI Correlation	None
Raw Materials	None

6 Hospital Management System Process

<table>
<tr><td>Equipment & Accessories</td><td>Automated System for Executive Information System</td></tr>
<tr><td>MSD Management</td><td>Lifting/carrying, Disability, Force, Loaded motion, Physical ergonomics, Posture change, Excessive force, Scarceness, Noise, Concentration, Floor hazards, Clothing, Psychosocial factors. (Ref 7.12)</td></tr>
<tr><td>EBC Procedures</td><td>None</td></tr>
<tr><td>Timing Dimension</td><td><table><tr><th>Type</th><th>Normal</th></tr><tr><td>Average</td><td>30 min</td></tr><tr><td>Std</td><td>12 min</td></tr></table></td></tr>
<tr><td>Trigger</td><td>Message selection and specification validation</td></tr>
<tr><td>Basic Course of Event</td><td>HL7 interface planning
1. Process integrator performs a business requirement analysis which comprises of review of documented business requirements, participation of stakeholders to validate and refine business requirement, and working with project business anlaysis to align with HL7 interface requirements.
2. Process integrator performs application analysis which comprises of review of business processes of applications, review of applications, review of existing HL7 interfaces used
3. Process integrator perform interface specification which comprises of technical description of HL7 messages (HL7 segment and HL7 field), relationship between application front end, database and code tables, and technical business rules required by interface.
4. End.</td></tr>
<tr><td>Alternative Path</td><td>None</td></tr>
<tr><td>Exception Path</td><td>System Down
1. Keep paper track until system is up and running
2. Update the System and clear all logs.
3. End.</td></tr>
</table>

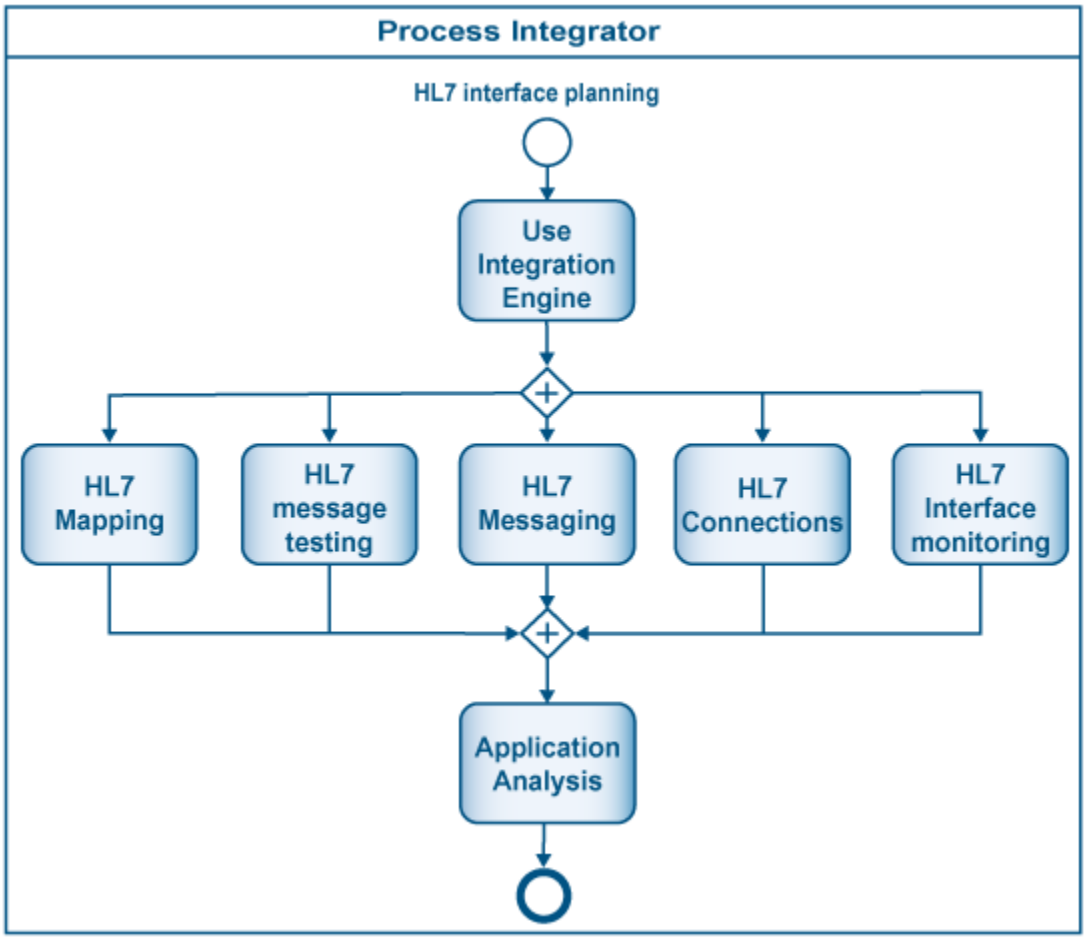
Extension points	Using integration engine
Preconditions	All the requirements have been taken accurately.
Post –conditions	HL7 interface planning is completed.
Related Business Rules	BR -001, (Ref 7.1)
Related Risks	RR- 001 (Ref 7.2)
Related Quality Attributes	Reliability, Confidentiality, Authenticity, Data Integrity, Availability, Non-repudiation, Accountability, Security Integration, Performance, Scalability, Extensibility, Adaptability, Testability, Auditability, Operability and Deployability (Ref 7.3)
Related Data Quality Dimensions	Accuracy, Reputation, Objectivity, Free-of-Error, Relevance, Completeness, Timeliness, Appropriate Amount, Understandability, Interpretability, Concise Representation (Ref 7.4)
Related Primary SLA Terms	(Ref 7.9)
Related KPIs	IGAR (Ref 7.6)
Related CTQs	IGARV (Ref 7.7)
Actors/Agents	Process integrator
Delegation	Delegation Rule -1: Agent Not Available 1. Delegate the task to the agent with same role 2. Update the task 3. Log the delegation Delegation Rule -2: Agent Overloaded 1. Delegate the task to the agent with same Role 2. Update the task 3. Log the delegation
Escalation	Rule 1: Performance, operational legal Issues 1. Escalate to environmental services department head.

	2. Log Escalation
Process Map	Section 5.1
Process Model	Section 6.10
Other References	Appendix A: Business Process Notation Reference

6.12 Sub process – HL 7 interface planning Roles and Responsibilities

Roles	Responsibilities
Process integrator	• Process integrator performs a business requirement analysis which comprises of review of documented business requirements, participation of stakeholders to validate and refine business requirement, and working with project business anlaysis to align with HL7 interface requirements. • Process integrator performs application analysis which comprises of review of business processes of applications, review of applications, review of existing HL7 interfaces used • Process integrator perform interface specification which comprises of technical description of HL7 messages (HL7 segment and HL7 field), relationship between application front end, database and code tables, and technical business rules required by interface.

6.13 Sub process – Using Integration Engine



6.14 Sub process – Using Integration Engine Specifications

Specification	Description
Summary/Purpose	To establish process for integration engine use.
Scope	This is a Level 2 Process Specification.
Primary Reference	• NHS- National Health Services Standard • OSHA- Occupational Safety and Health Administration standard • CDC- Centers for Disease Control and Prevention standard • Lean six sigma- Quality Standard • JCI- Journal of Clinical Investigation standard
Related ESM Practices	Enterprise Information system integration, Finance Management integration, HR Management integration, Standard Management integration, Risk Management integration.
Related Business Driver	• Compatibility and interoperability
Related Operational Policies	OP-006 (Ref 7.5)
Assumptions	Senior Management support is available throughout this process.
Voice of Customer	Hygiene, High and Consistent Quality of standards, Free of Infections, Timely Services, High Coordinating, Remove Waste, Excellent Ergonomic, Safety, Appearance, Excellent Worker Attitude. (Ref 7.10)
Customer Satisfaction Measure	Customer satisfaction index
COI Correlation	None
Raw Materials	None

6 Hospital Management System Process

<table>
<tr><td>Equipment & Accessories</td><td>Automated System for Executive Information System</td></tr>
<tr><td>MSD Management</td><td>Lifting/carrying, Disability, Force, Loaded motion, Physical ergonomics, Posture change, Excessive force, Scarceness, Noise, Concentration, Floor hazards, Clothing, Psychosocial factors. (Ref 7.12)</td></tr>
<tr><td>EBC Procedures</td><td>None</td></tr>
<tr><td>Timing Dimension</td><td><table><tr><th>Type</th><th>Normal</th></tr><tr><td>Average</td><td>30 min</td></tr><tr><td>Std</td><td>12 min</td></tr></table></td></tr>
<tr><td>Trigger</td><td>HL7 interface planning</td></tr>
<tr><td>Basic Course of Event</td><td>Using Integration Engine
1. Process integrator uses integration engine to perform HL7 mapping, HL7 message testing, HL 7 messaging, HL 7 connections, HL 7 interface monitoring.
2. End.</td></tr>
<tr><td>Alternative Path</td><td>None</td></tr>
<tr><td>Exception Path</td><td>System Down
1. Keep paper track until system is up and running
2. Update the System and clear all logs.
3. End.</td></tr>
<tr><td>Extension points</td><td>Testing integration.</td></tr>
<tr><td>Preconditions</td><td>All the requirements have been taken accurately.</td></tr>
<tr><td>Post –conditions</td><td>Integration engine is used for integration.</td></tr>
<tr><td>Related Business Rules</td><td>BR -006(Ref 7.1)</td></tr>
<tr><td>Related Risks</td><td>RR-006(Ref 7.2)</td></tr>
</table>

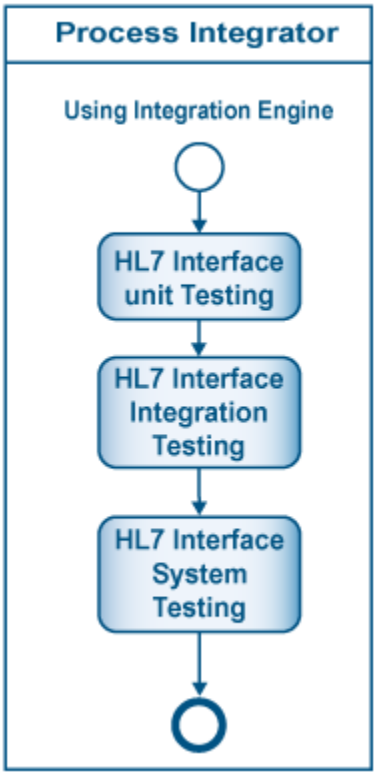
6 Hospital Management System Process

Related Quality Attributes	Reliability, Confidentiality, Authenticity, Data Integrity, Availability, Non-repudiation, Accountability, Security Integration, Performance, Scalability, Extensibility, Adaptability, Testability, Auditability, Operability and Deployability (Ref 7.3)
Related Data Quality Dimensions	Accuracy, Reputation, Objectivity, Free-of-Error, Relevance, Completeness, Timeliness, Appropriate Amount, Understandability, Interpretability, Concise Representation (Ref 7.4)
Related Primary SLA Terms	(Ref 7.9)
Related KPIs	HIE(Ref 7.6)
Related CTQs	HIEV (Ref 7.7)
Actors/Agents	Process integrator
Delegation	Delegation Rule -1: Agent Not Available 1. Delegate the task to the agent with same role 2. Update the task 3. Log the delegation Delegation Rule -2: Agent Overloaded 1. Delegate the task to the agent with same Role 2. Update the task 3. Log the delegation
Escalation	Rule 1: Performance, operational legal Issues 1. Escalate to environmental services department head. 2. Log Escalation
Process Map	Section 5.1
Process Model	Section 6.13
Other References	Appendix A: Business Process Notation Reference

6.15 Sub process – Using Integration Engine Roles and Responsibilities

Roles	Responsibilities
Process integrator	• Process integrator uses integration engine to perform HL7 mapping, HL7 message testing, HL 7 messaging, HL 7 connections, HL 7 interface monitoring.

6.16 Sub process – Interface testing



6.17 Sub process – Interface Testing Specifications

Specification	Description
Summary/Purpose	To establish process for interface testing.
Scope	This is a Level 2 Process Specification.
Primary Reference	• NHS- National Health Services Standard • OSHA- Occupational Safety and Health Administration standard • CDC- Centers for Disease Control and Prevention standard • Lean six sigma- Quality Standard • JCI- Journal of Clinical Investigation standard
Related ESM Practices	Enterprise Information system integration, Finance Management integration, HR Management integration, Standard Management integration, Risk Management integration.
Related Business Driver	• Compatibility and interoperability
Related Operational Policies	OP-007(Ref 7.5)
Assumptions	Senior Management support is available throughout this process.
Voice of Customer	Hygiene, High and Consistent Quality of standards, Free of Infections, Timely Services, High Coordinating, Remove Waste, Excellent Ergonomic, Safety, Appearance, Excellent Worker Attitude. (Ref 7.10)
Customer Satisfaction Measure	Customer satisfaction index
COI Correlation	None
Raw Materials	None

6 Hospital Management System Process

Equipment & Accessories	Automated System for Executive Information System
MSD Management	Lifting/carrying, Disability, Force, Loaded motion, Physical ergonomics, Posture change, Excessive force, Scarceness, Noise, Concentration, Floor hazards, Clothing, Psychosocial factors. (Ref 7.12)
EBC Procedures	None
Timing Dimension	**Type** / **Normal** **Average** / 30 min **Std** / 12 min
Trigger	**HL7 interface planning**
Basic Course of Event	**HL7 interface testing** 1. Process integrator performs interface unit testing 2. Process integrator performs HL7 interface integration testing 3. Process integrator performs HL7 interface system testing. 4. End.
Alternative Path	None
Exception Path	**System Down** 1. Keep paper track until system is up and running 2. Update the System and clear all logs. 3. End.
Extension points	Tracking and managing integration.
Preconditions	All the requirements have been taken accurately.
Post –conditions	Interfaces are tested.
Related Business Rules	BR 007-(Ref 7.1)
Related Risks	RR-007 Ref 7.2)

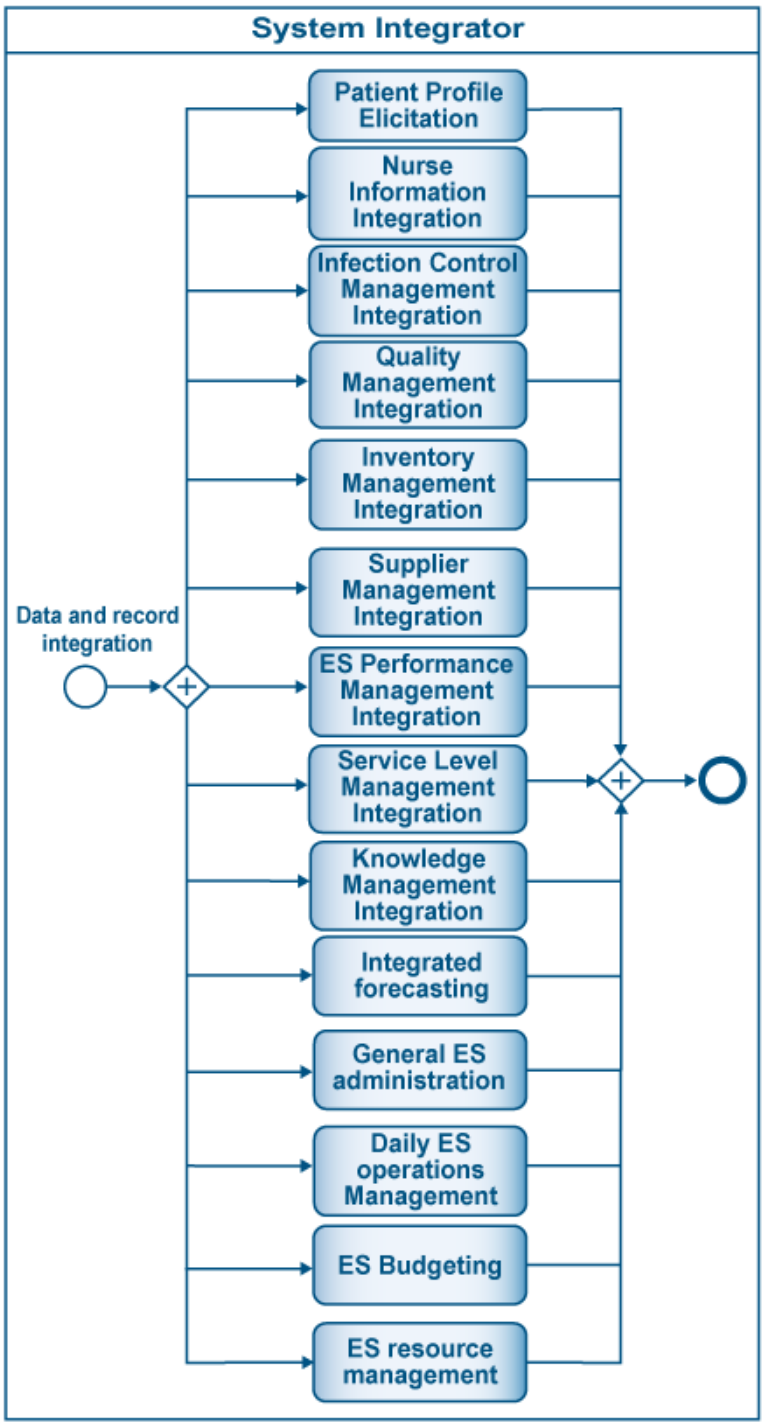
6 Hospital Management System Process

Related Quality Attributes	Reliability, Confidentiality, Authenticity, Data Integrity, Availability, Non-repudiation, Accountability, Security Integration, Performance, Scalability, Extensibility, Adaptability, Testability, Auditability, Operability and Deployability (Ref 7.3)
Related Data Quality Dimensions	Accuracy, Reputation, Objectivity, Free-of-Error, Relevance, Completeness, Timeliness, Appropriate Amount, Understandability, Interpretability, Concise Representation (Ref 7.4)
Related Primary SLA Terms	(Ref 7.9)
Related KPIs	HIE (Ref 7.6)
Related CTQs	HIEV (Ref 7.7)
Actors/Agents	Process integrator
Delegation	Delegation Rule -1: Agent Not Available 1. Delegate the task to the agent with same role 2. Update the task 3. Log the delegation Delegation Rule -2: Agent Overloaded 1. Delegate the task to the agent with same Role 2. Update the task 3. Log the delegation
Escalation	Rule 1: Performance, operational legal Issues 1. Escalate to environmental services department head. 2. Log Escalation
Process Map	Section 5.1
Process Model	Section 6.16
Other References	Appendix A: Business Process Notation Reference

6.18 Sub process – Interface Testing Roles and Responsibilities

Roles	Responsibilities
Process integrator	• Process integrator performs interface unit testing • Process integrator performs HL7 interface integration testing • Process integrator performs HL7 interface system testing.

6.19 Sub-Process – Provide Process Integration management



6.20 Sub-Process – Provide Process Integration Specifications

Specification	Description
Summary/Purpose	To establish process for integration
Scope	This is a Level 2Process Specification.
Primary Reference	• NHS- National Health Services Standard • OSHA- Occupational Safety and Health Administration standard • CDC- Centers for Disease Control and Prevention standard • Lean six sigma- Quality Standard • JCI- Journal of Clinical Investigation standard
Related ESM Practices	Enterprise Information system integration, Finance Management integration, HR Management integration, Standard Management integration, Risk Management integration.
Related Business Driver	• Seamless integration
Related Operational Policies	OP-002 (Ref 7.5)
Assumptions	Senior Management support is available throughout this process.
Voice of Customer	Hygiene, High and Consistent Quality of standards, Free of Infections, Timely Services, High Coordinating, Remove Waste, Excellent Ergonomic, Safety, Appearance, Excellent Worker Attitude. (Ref 7.10)
Customer Satisfaction Measure	Customer satisfaction index
COI Correlation	None
Raw Materials	None

6 Hospital Management System Process

<table>
<tr><td>Equipment & Accessories</td><td>Automated System for Hospital management.</td></tr>
<tr><td>MSD Management</td><td>Lifting/carrying, Disability, Force, Loaded motion, Physical ergonomics, Posture change, Excessive force, Scarceness, Noise, Concentration, Floor hazards, Clothing, Psychosocial factors. (Ref 7.12)</td></tr>
<tr><td>EBC Procedures</td><td>None</td></tr>
<tr><td>Timing Dimension</td><td><table><tr><th>Type</th><th>Normal</th></tr><tr><td>Average</td><td>30 min</td></tr><tr><td>Std</td><td>12 min</td></tr></table></td></tr>
<tr><td>Trigger</td><td>Data and record integration</td></tr>
<tr><td>Basic Course of Event</td><td>Process integration
1. System integrator performs patient profile elicitation, nurse information integration, infection control management integration, quality management integration, inventory management integration, supplier management integration, ES performance management integration, Service level management integration, knowledge management integration, integrated forecasting, general ES administration, general environmental services administration, daily environmental services operations management, environmental services budgeting, environmental services resource management.
2. End</td></tr>
<tr><td>Alternative Path</td><td>None</td></tr>
<tr><td>Exception Path</td><td>System Down
1. Keep paper track until system is up and running
2. Update the System and clear all logs.
3. End.</td></tr>
<tr><td>Extension points</td><td>Integration with hospital service modules</td></tr>
<tr><td>Preconditions</td><td>The parent records are accurate and free from error</td></tr>
</table>

Post –conditions	Integration of process happens.
Related Business Rules	BR-002 (Ref 7.1)
Related Risks	RR-002 (Ref 7.2)
Related Quality Attributes	Reliability, Confidentiality, Authenticity, Data Integrity, Availability, Non-repudiation, Accountability, Security Integration, Performance, Extensibility, Adaptability, Testability, Auditability, Operability and Deployability (Ref 7.3)
Related Data Quality Dimensions	Accuracy, Reputation, Objectivity, Free-of-Error, Relevance, Completeness, Timeliness, Appropriate Amount, Understandability, Interpretability, Concise Representation (Ref 7.4)
Related Primary SLA Terms	(Ref 7.9)
Related KPIs	IRAR (Ref 7.6)
Related CTQs	IRARV (Ref 7.7)
Actors/Agents	System Integrator
Delegation	Delegation Rule -1: Agent Not Available 1. Delegate the task to the agent with same role 2. Update the task 3. Log the delegation Delegation Rule -2: Agent Overloaded 1. Delegate the task to the agent with same Role 2. Update the task 3. Log the delegation
Escalation	Rule 1: Performance, operational legal Issues 1. Escalate to environmental services department head. 2. Log Escalation

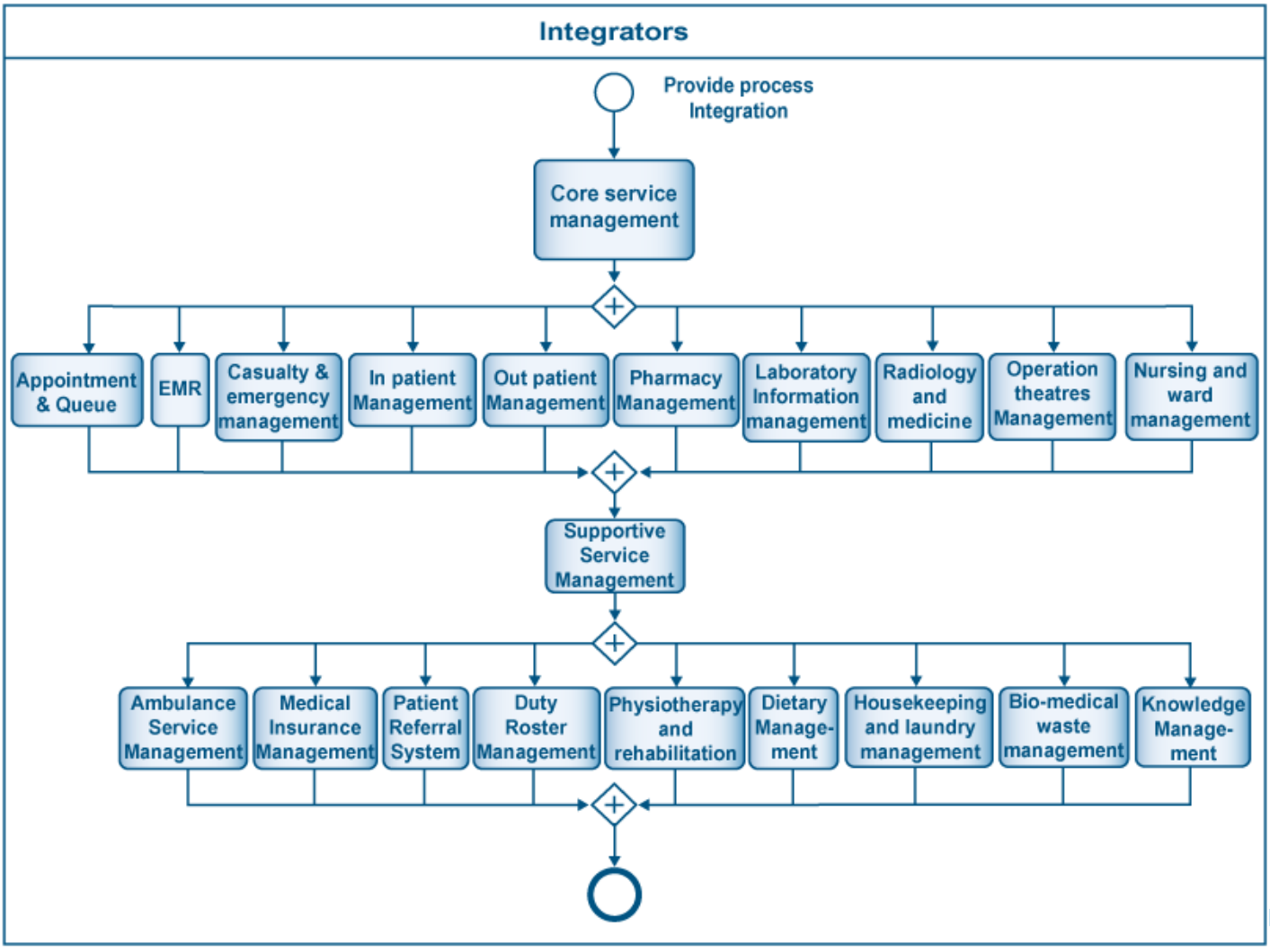
Process Map	Section 5.1
Process Model	Section 6.19
Other References	Appendix A: Business Process Notation Reference

6.21 Sub Process – Provide Process Integration Roles and Responsibilities

Roles	Responsibilities
System integrator	System integrator performs patient profile elicitation, nurse information integration, infection control management integration, quality management integration, inventory management integration, supplier management integration, ES performance management integration, Service level management integration, knowledge management integration, integrated forecasting, general ES administration, general environmental services administration, daily environmental services operations management, environmental services budgeting, environmental services resource management.

6 Hospital Management System Process

6.22 Sub process – Integrate with Hospital Service Modules



6.23 Sub process – Integrate with Hospital Services Modules Specifications

Specification	Description
Summary/Purpose	To establish a process for integration with hospital service module.
Scope	This is a Level 2 Process Specification.
Primary Reference	• NHS- National Health Services Standard • OSHA- Occupational Safety and Health Administration standard • CDC- Centers for Disease Control and Prevention standard • Lean six sigma- Quality Standard • JCI- Journal of Clinical Investigation standard
Related ESM Practices	Enterprise Information system integration, Finance Management integration, HR Management integration, Standard Management integration, Risk Management integration.
Related Business Driver	• Efficient integration hospital management modules
Related Operational Policies	OP-003 (Ref 7.5)
Assumptions	Senior Management support is available throughout this process.
Voice of Customer	Hygiene, High and Consistent Quality of standards, Free of Infections, Timely Services, High Coordinating, Remove Waste, Excellent Ergonomic, Safety, Appearance, Excellent Worker Attitude. (Ref 7.10)
Customer Satisfaction Measure	Customer satisfaction index
COI Correlation	None

6 Hospital Management System Process

<table>
<tr><td>Raw Materials</td><td>None</td></tr>
<tr><td>Equipment & Accessories</td><td>Automated System for Hospital management.</td></tr>
<tr><td>MSD Management</td><td>Lifting/carrying, Disability, Force, Loaded motion, Physical ergonomics, Posture change, Excessive force, Scarceness, Noise, Concentration, Floor hazards, Clothing, Psychosocial factors. (Ref 7.12)</td></tr>
<tr><td>EBC Procedures</td><td>None</td></tr>
<tr><td>Timing Dimension</td><td><table><tr><th>Type</th><th>Normal</th></tr><tr><td>Average</td><td>30 min</td></tr><tr><td>Std</td><td>12 min</td></tr></table></td></tr>
<tr><td>Trigger</td><td>Process integration</td></tr>
<tr><td>Basic Course of Event</td><td>Integration with Hospital Service Modules
1. Hospital Management system performs core service management (appointment and queue, EMR, causality and emergency management, in patient management, out patient management, pharmacy management, laboratory information management, radiology and medicine, operation theatre management, nursing and ward management
2. Hospital management system performs supportive service management ambulance service management, medical insurance management, patient referral system, duty roster management, physiotherapy and rehabilitation, dietary management, housekeeping and laundry management, bio-medical waste management, knowledge management.
3. End.</td></tr>
<tr><td>Alternative Path</td><td>None</td></tr>
<tr><td>Exception Path</td><td>System Down
1. Keep paper track until system is up and running
2. Update the System and clear all logs.
3. End.</td></tr>
</table>

6 Hospital Management System Process

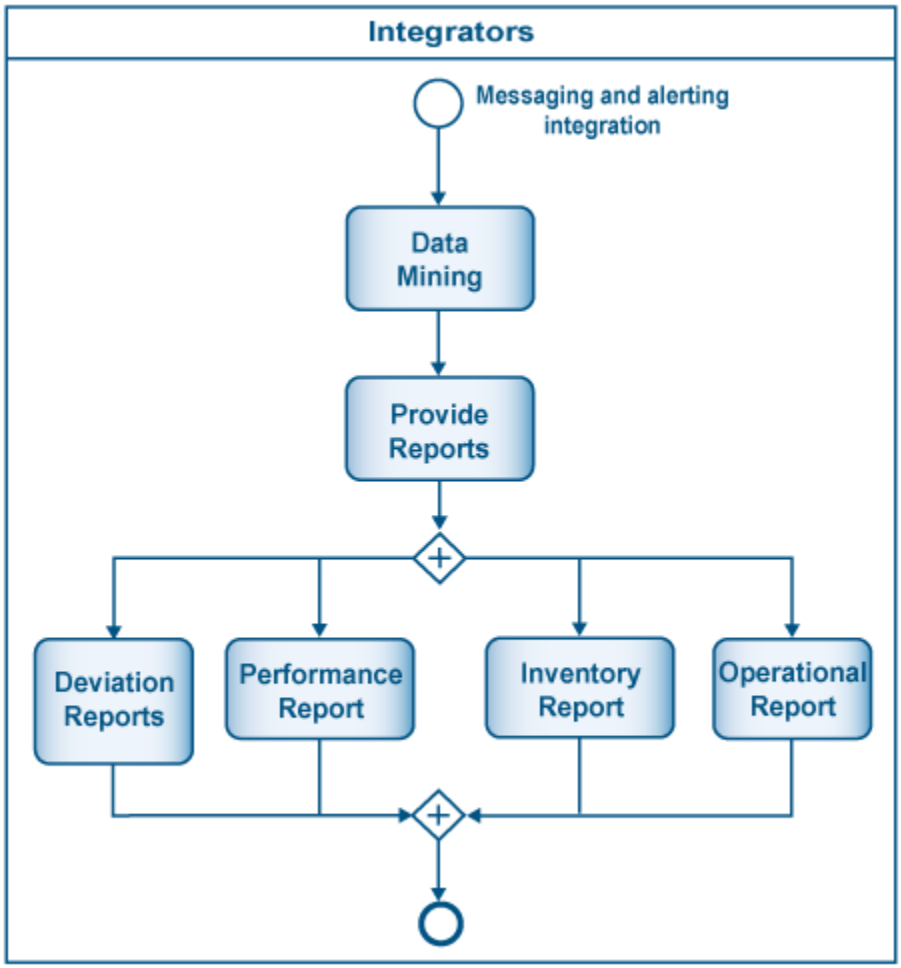
Extension points	Message and alerting integration
Preconditions	All the information stored in the system is accurate and free from error.
Post –conditions	Hospital service modules get integrated with environmental service process.
Related Business Rules	BR-003 (Ref 7.1)
Related Risks	RR-003 (Ref 7.2)
Related Quality Attributes	Reliability, Confidentiality, Authenticity, Data Integrity, Availability, Non-repudiation, Accountability, Security Integration, Performance, Scalability, Extensibility, Adaptability, Testability, Auditability, Operability and Deployability (Ref 7.3)
Related Data Quality Dimensions	Accuracy, Reputation, Objectivity, Free-of-Error, Relevance, Completeness, Timeliness, Appropriate Amount, Understandability, Interpretability, Concise Representation (Ref 7.4)
Related Primary SLA Terms	(Ref 7.9)
Related KPIs	IC(Ref 7.6)
Related CTQs	ICV (Ref 7.7)
Actors/Agents	System integrator
Delegation	Delegation Rule -1: Agent Not Available 1. Delegate the task to the agent with same role 2. Update the task 3. Log the delegation Delegation Rule -2: Agent Overloaded 1. Delegate the task to the agent with same Role 2. Update the task 3. Log the delegation
Escalation	Rule 1: Performance, operational legal Issues 1. Escalate to environmental services department head.

	2. Log Escalation
Process Map	Section 5.1
Process Model	Section 6.22
Other References	Appendix A: Business Process Notation Reference

6.24 Sub process – Integrate with hospital service module Roles and Responsibilities

Roles	Responsibilities
System integrator	• System integrator performs core service management integration (appointment and queue, EMR, causality and emergency management, in patient management, out patient management, pharmacy management, laboratory information management, radiology and medicine, operation theatre management, nursing and ward management • System integrator performs supportive service management integration ambulance service management, medical insurance management, patient referral system, duty roster management, physiotherapy and rehabilitation, dietary management, housekeeping and laundry management, bio-medical waste management, knowledge management.

6.25 Sub process – Integrated Reporting



6.26 Sub process – Integrated Reporting Specifications

Specification	Description
Summary/Purpose	To establish Hospital management integrated reports
Scope	This is a Level 2Process Specification.
Primary Reference	• NHS- National Health Services Standard • OSHA- Occupational Safety and Health Administration standard • CDC- Centers for Disease Control and Prevention standard • Lean six sigma- Quality Standard • JCI- Journal of Clinical Investigation standard
Related ESM Practices	Enterprise Information system integration, Finance Management integration, HR Management integration, Standard Management integration, Risk Management integration.
Related Business Driver	• Better and comprehensive reporting
Related Operational Policies	OP-004 (Ref 7.5)
Assumptions	Senior Management support is available throughout this process.
Voice of Customer	Hygiene, High and Consistent Quality of standards, Free of Infections, Timely Services, High Coordinating, Remove Waste, Excellent Ergonomic, Safety, Appearance, Excellent Worker Attitude. (Ref 7.10)
Customer Satisfaction Measure	Customer satisfaction index
COI Correlation	None
Raw Materials	None

6 Hospital Management System Process

<table>
<tr><td>Equipment & Accessories</td><td>Automated System for Hospital management.</td></tr>
<tr><td>MSD Management</td><td>Lifting/carrying, Disability, Force, Loaded motion, Physical ergonomics, Posture change, Excessive force, Scarceness, Noise, Concentration, Floor hazards, Clothing, Psychosocial factors. (Ref 7.12)</td></tr>
<tr><td>EBC Procedures</td><td>None</td></tr>
<tr><td>Timing Dimension</td><td><table><tr><th>Type</th><th>Normal</th></tr><tr><td>Average</td><td>30 min</td></tr><tr><td>Std</td><td>12 min</td></tr></table></td></tr>
<tr><td>Trigger</td><td>Message and alerting integration</td></tr>
<tr><td>Basic Course of Event</td><td>Integrated report Reporting Process
1. System integrator performs data mining
2. System integrator provides deviation reports, performance report, operational report, bed occupancy report, inventory report.
3. End</td></tr>
<tr><td>Alternative Path</td><td>None</td></tr>
<tr><td>Exception Path</td><td>System Down
1. Keep paper track until system is up and running
2. Update the System and clear all logs.
3. End.</td></tr>
<tr><td>Extension points</td><td>Enterprise Information system integration, Finance Management integration, HR Management integration, Standard Management integration, Risk Management integration.</td></tr>
<tr><td>Preconditions</td><td>The data stored in system is accurate and free from error.</td></tr>
<tr><td>Post –conditions</td><td>Reports are established.</td></tr>
</table>

6 Hospital Management System Process

Related Business Rules	BR-004 (Ref 7.1)
Related Risks	RR-004 (Ref 7.2)
Related Quality Attributes	Reliability, Confidentiality, Authenticity, Data Integrity, Availability, Non-repudiation, Accountability, , Performance, Scalability, Extensibility, Adaptability, Testability, Auditability, (Ref 7.3)
Related Data Quality Dimensions	Accuracy, Reputation, Objectivity, Free-of-Error, Relevance, Completeness, Timeliness, Appropriate Amount, Understandability, Interpretability, Concise Representation (Ref 7.4)
Related Primary SLA Terms	(Ref 7.5)
Related KPIs	MRI, ESER (Ref 7.6)
Related CTQs	MRIV, ESER (Ref 7.7)
Actors/Agents	System integrator
Delegation	Delegation Rule -1: Agent Not Available 1. Delegate the task to the agent with same role 2. Update the task 3. Log the delegation Delegation Rule -2: Agent Overloaded 1. Delegate the task to the agent with same Role 2. Update the task 3. Log the delegation
Escalation	Rule 1: Performance, operational legal Issues 1. Escalate to environmental services department head. 2. Log Escalation
Process Map	Section 5.1
Process Model	Section 6.25

Other References	Appendix A: Business Process Notation Reference

6.27 Sub Process – Reporting Roles and Responsibilities

Roles	Responsibilities
System integrator	System integrator provides deviation reports, performance report, operational report, bed occupancy report, inventory report.

7

Hospital Management System Integration

Reference

7 Reference

This chapter serves as a prime reference to Chapter 6 and presents the details supporting Chapter 6 in tabular formats. This chapter consists of various variable values which would frequently evolve or change as organization's financial process matures or changes.

At minimal this document should be updated biannually. However, if need arises this document may be updated earlier than its prescribed revision period

7.1 Business Rules

BR ID	Description	Context	Rule	Source
BR-001	All change done to business processes would be thoroughly considered.	NA	NA	NA
BR-002	Integration should not result into detoration of services.	NA	NA	NA
BR-003	All the integration with hospital management modules should be automated	NA	NA	NA
BR-004	All the critical reports would be escalated to the senior management	NA	NA	NA
BR-005	All integration activities should be approved by senior management	NA	NA	NA
BR-006	Integration engine should be robust enough to handle the entire HL7 integration	NA	NA	NA
BR-007	All integration activities would be thoroughly tested	NA	NA	NA

7 Reference

7.2 Risk

Risk ID	Description	Source	Severity Level	Status	Resolution
RR-001	Strong resistance from staff for changes	TBD	High	TBD	Have a plan for organizational culture change which would start before re-engineering process
RR-002	Integrated Records might has errors	TBD	High	TBD	Use of automated reviews tools and multiple reviews would reduce errors
RR-003	The models in the system are not integrate able.	TBD	medium	TBD	The modules should be custom made to ensure comprehensive integration.
RR-004	The reports are not comprehensive and focused	TBD	High	TBD	The reports should be customized to meet the intended audience.
RR-005	The integrators are not well trained in HL7	TBD	High	TBD	The integrators should be trained prior implementation.
RR-006	Integration engine is not compatible	TBD	High	TBD	Requirements which the integration engine should be able to match, should be identified prior its use.
RR-007	The entire integration process is not properly tested.	TBD	High	TBD	Comprehensive testing methodology should be adopted.

7 Reference

7.3 Quality Attribute

QA ID	Description	Threshold
QA-001	Interoperability	TBD
QA-002	Reliability	TBD
QA-003	Service Reliability	TBD
QA-004	Availability	TBD
QA-005	Usability	TBD
QA-006	Normal Usability Operations	TBD
QA-007	Confidentiality	TBD
QA-008	Authenticity	TBD
QA-009	Data Integrity	TBD
QA-010	Availability	TBD
QA-011	Non-repudiation	TBD
QA-012	Accountability	TBD
QA-013	Security Integration	TBD
QA-014	Performance	TBD
QA-015	Scalability	TBD
QA-016	Extensibility	TBD
QA-017	Adaptability	TBD
QA-018	Testability	TBD
QA-019	Auditability	TBD
QA-020	Operability and Deployability	TBD

7 Reference

7.4 Data Quality Dimension

DQ ID	Description	Threshold
DQ-001	Accuracy	TBD
DQ-002	Believability	TBD
DQ-003	Reputation	TBD
DQ-004	Objectivity	TBD
DQ-005	Free-of-Error	TBD
DQ-006	Value Added	TBD
DQ-007	Relevance	TBD
DQ-008	Completeness	TBD
DQ-009	Timeliness	TBD
DQ-010	Appropriate Amount	TBD
DQ-011	Understandability	TBD
DQ-012	Interpretability	TBD
DQ-013	Concise Representation	TBD

7.5 Operation Policy

Policy ID	Description	Context	Importance (1-5)
OP-001	All changes to the business processes would be approved by senior management	TBD	TBD
OP-002	Integration should ensure that the data remains free from error and accurate	TBD	TBD

OP-003	All the hospital information modules should be comprehensive to provide rich resource to other processes.	TBD	TBD
OP-004	The reports should be printed 2 days earlier of management meetings	TBD	TBD
OP-005	Latest HL7 version 3 would be used for integration	TBD	TBD
OP-006	Integration engine should be vetted before its use.	TBD	TBD
OP-007	Interface testing should comprise of unit testing, interface integration and interface system testing	TBD	TBD

7.6 KPI

Name	Acronym	Description	Context	Importance	Soft Threshold	Hard Threshold
Re-engineering performance rate	**RPR**	The time consumed for re-engineering the process	NA	TBD	TBD	TBD
Integration Record accuracy rate	**IRAR**	The percentage of accuracy in the Integrated record	NA	TBD	TBD	TBD
Integration Comprehensiveness	**IC**	The integration	NA	TBD	TBD	TBD

		capability per module				
Mortality rate due to infection	**MRI**	Number of deaths dues to infection per month	NA	TBD	TBD	TBD
Environmental services Expense rate	**ESER**	Amount of expenses per month	NA	TBD	TBD	TBD
HL7 integration errors	**HIE**	Number of errors per integration	NA	TBD	TBD	TBD

7.7 CTQ

Name	Acronym	Description	Context	Importance	Soft Threshold	Hard threshold
Re-engineering performance rate variation	**RPRV**	Standard deviation of RPR	NA	TBD	TBD	TBD
Integration Record accuracy rate variation	**IRARV**	Standard deviation of AR	NA	TBD	TBD	TBD
Integration Comprehensiveness variation	**ICV**	Standard deviation of IC	NA	TBD	TBD	TBD

7 Reference

Mortality rate due to infection variation	**MRIV**	Standard deviation of MRI	NA	TBD	TBD	TBD
Motion Optimization Measure	**MOM**	Management of motion optimization measure	NA	TBD	TBD	TBD
Paper work Optimization Measure	**PWOM**	Management of Paper work Optimization Measure	NA	TBD	TBD	TBD
Correction reduction measure	**CRM**	Management of Correction reduction measure	NA	TBD	TBD	TBD
Inventory Optimization Measure	**IOM**	Management of Inventory Optimization Measure	NA	TBD	TBD	TBD
Transportation Optimization Measure	**TOM**	Management of Transportation Optimization Measure	NA	TBD	TBD	TBD
Waiting Reduction Measure	**WRM**	Management of Waiting reduction Measure	NA	TBD	TBD	TBD

HL7 integration errors variance	**HIEV**	Standard deviation of HIE	NA	TBD	TBD	TBD

7.8 Abstract Time – Scale

Name	Acronym	Description	Quantification
TBD	TBD	TBD	TBD

7.9 SLA Terms

SLA ID	Description	Context	KPI	CTQ
TBD	TBD	TBD	TBD	TBD

7.10 Voice of Customer

VOC	Customer	Description	Perceived Value
Hygiene	Doctors, Patients, Nurses, Housekeeping Supervisors, Housekeepers, Clerks, Visitors, Environmental Services Management, Laundry worker, Transportation worker, Maintenance worker, Waste management worker.	The environment should be attributing with great hygiene level.	• High quality healthcare services • Safe environment • Low infection rate • Low risk

7 Reference

High and Consistent Quality of standards	Doctors, Patients, Nurses, Housekeeping Supervisors, Clerks, Environmental Services Management, Laundry worker, Transportation worker, Maintenance worker, Waste management worker, Housekeepers	High and Consistent Quality of standards.	• Reputation of organization or hospital • Professionalism • Trust • Positive psychological bias
Free of Infections	Doctors, Patients, Nurses, Housekeeping Supervisors, Clerks, Visitors, Environmental Services Management, Laundry worker, Transportation worker, Maintenance worker, Waste management worker, Housekeepers	Infections free and healthy environment.	• Safe environment • Reputation of hospital or organization • Trust • Quick healing • Positive psychological bias • Low risk
Timely Services	Doctors, Patients, Nurses, Housekeeping Supervisors, Visitors, Environmental Services Management, Laundry worker, Transportation worker, Maintenance worker, Waste management worker, Housekeepers	The response time for any request should be very short.	• Professionalism • Trust • Positive psychological bias • Reputation of hospital or organization • Safe environment
High Coordinating	Doctors, Patients, Nurses, Housekeeping Supervisors, Clerks, Environmental Services Management,	There should be high level of coordination between hospital	• Professionalism • Trust • Low risk • Excellent Ergonomic

	Laundry worker, Transportation worker, Maintenance worker, Waste management worker, Housekeepers	employees and departments.	
Remove Waste	Patients, Nurses, Housekeeping Supervisors, Clerks, Visitors, Environmental Services Management, Laundry worker, Transportation worker, Maintenance worker, Waste management worker, Housekeepers	Wastes should be either removed or minimized.	• Safe environment • Low infection rate • Low risk • Reputation of hospital or organization • Low cost • Timely response • High quality
Excellent Ergonomic	Doctors, Patients, Nurses, Housekeeping Supervisors, Clerks, Visitors, Environmental Services Management, Laundry worker, Transportation worker, Maintenance worker, Waste management worker, Housekeepers	The hospital environment and policy should comply with physical, organization and cognitive ergonomics.	• Professionalism • Trust • Job accuracy • Excellent communication • Low risk • Reputation of hospital or organization
Safety	Doctors, Patients, Nurses, Housekeeping Supervisors, Clerks, Visitors, Environmental Services Management, Laundry worker, Transportation worker, Maintenance worker,	Hospital environment should comply with occupational health and safety procedures.	• Safe environment • Professionalism • Low risk

	Waste management worker, Housekeepers		
Appearance	Housekeeping Supervisors, Environmental Services Management, Laundry worker, Transportation worker, Maintenance worker, Waste management worker, Housekeepers	The appearance of the workers, supervisors and manager should induce positive biases.	• Professionalism • Reputation of hospital or organization • Trust • Positive psychological bias
Excellent Worker Attitude	Housekeeping Supervisors, Environmental Services Management, Laundry worker, Transportation worker, Maintenance worker, Waste management worker, Housekeepers	The environment service employee should be free from negative attitudes.	• Professionalism • Reputation of hospital or organization • Trust • Positive psychological bias • Minimum disputes • Less employee turn over

7.11 Customer Context Matrix

Name of Customer	Acronym	Context of Customer	Coordination Process Area
Doctors	**DOC**	Direct	HIS Coordination
Patients	**PAT**	Direct	HIS Coordination
Nurses	**NUR**	Direct	HIS Coordination, Nurse Coordination
Housekeeping Supervisors	**HKS**	Direct	Quality Coordination, Nurse Coordination, infection control coordination
Clerks	**CLR**	Direct	HIS Coordination
Visitors	**VIS**	Indirect	HIS Coordination

Environmental Services Management	**ESM**	Direct	Nurse Coordination, infection control coordination
Other hospital workers	**OHW**	Indirect	Security coordination
Laundry worker	**LDW**	Direct	Nurse Coordination, HIS Coordination
Transportation worker	**TRW**	Direct	Quality Coordination, HIS Coordination
Maintenance worker	**MAW**	Direct	Quality Coordination, HIS Coordination
Waste management worker	**WMW**	Direct	Quality Coordination, HIS Coordination
Infection control professional	**ICP**	Indirect	infection control coordination
Housekeepers	**HK**	Direct	HIS Coordination, Nurse Coordination

7.12 MSD Attributes

MSD Attribute	Description
Lifting/carrying	Large vertical movements, long carry distances.
Disability	Pose a risk to those with a health problem or a physical or learning disability.
Force	High initial forces to get the load moving.
Loaded motion	High forces to keep the load in motion.

7 Reference

Physical ergonomics	Constraints on body posture/positioning, confined spaces/narrow doorways.
Posture change	Strong force and awkward movement/posture. E.g. bent wrists.
Excessive force	Excessive force to grip raw materials, product or tools
Scarceness	Inadequate tools for repetitive use screwdrivers, pliers, hammers.
Noise	Noise which cause stress and muscle tension.
Concentration	Tasks require high levels of attention/concentration especially where the worker has little control over allocation of effect to the task.
Floor hazards	Remove slip and trip hazards through provision of appropriate floor surfaces and good keeping.
Clothing	Clothing/PPE may prevent sufficient movement for the task or reduce capability. E.g. to grip consider handling needs when selecting work wear/gloves.
Psychosocial factors	Adverse psychosocial factors can increase the potential for manual handling injuries. A workers psychosocial response to work and the workplace conditions can affect their health in general and MSDs in particular. The factors include the content, design, organization and management of the work

8

Hospital Management System Integration

Glossary / Acronyms

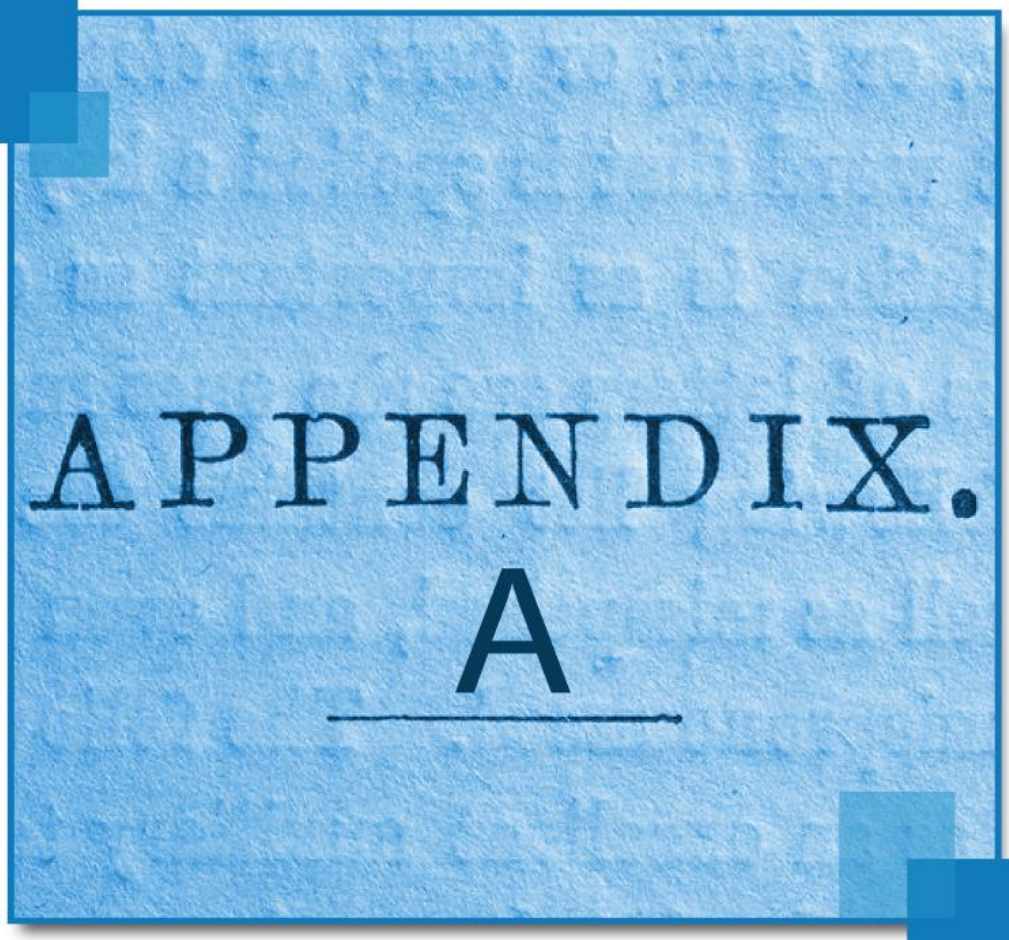
8 Glossary / Acronyms

Terminology	Description
Abstract Time Scale	Time Scale that will be quantified both during operations and continuous process improvement. These time identifiers are correlated with the soft thresholds that are dynamically specified during life span of the process.
BPMN	**Business Process Modelling Notation** Business Process Modelling Notation is the practice of documenting an organisation's key business processes in a graphical format.
Business Rules	Business Rules are intended to assert business structure or to control or influence the behaviour of the Business. Business rules describe the operations, definitions and constraints that apply to an organization
CRR	Contract Review Rate
CRRV	Contract Review rate Variation.
CTQ	**Critical to Quality** Critical To Quality (CTQ) is continuous measuring and monitoring tool agreed between the internal processes to achieve greater customer satisfaction.
COI	Chain of infection
Data Quality Dimensions	The totality of features and characteristics of data that bears on their ability to satisfy a given purpose
EBC	Evidence Based Cleaning
ESM	Environmental services Map
KPI	**Key Performance Indicator** A metric that is used to help manage a process, IT service or activity. Many metrics may be measured, but only the most important of these are defined as KPIs and used to actively manage and report on the process, IT service or activity. KPIs should be selected to ensure that efficiency, effectiveness, and cost effectiveness are all managed.
MSD	Macro Skeleton Disorder

8 Glossary / Acronyms

OLA	**Organization level Agreement** An Agreement between an IT Service Provider and another part of the same Organization
Operational Policy	Rules defined to operate the process.
Quality Attributes	Quality attributes are non-functional requirements used to evaluate the performance of a process.
Risk	A possible event that could cause harm or loss, or affect the ability to achieve Objectives. A risk is measured by the probability of a threat, the vulnerability of the asset to that threat, and the impact it would have if it occurred.
SLA	**Service Level Agreement** An Agreement between an IT Service Provider and a Customer. The SLA describes the IT Service, documents Service Level Targets, and specifies the responsibilities of the IT Service Provider and the Customer
VOC	**Voice of Customer**

Appendix A: Business Process Modeling Notation Reference



9 Appendix A: Business Process Modeling Notation Reference

INTRODUCTION

Business Process Modelling ("BPM") is the practice of documenting an organisation's key business processes in a manner which:

- Is highly graphical
- Focuses on business terminology rather than technical
- Allows all business steps/tasks to be included, not just those which involve a computer system

Mentioned below are the various core concepts of BPMN with the relevant definition and graphic notation.

PROCESS START

All processes have to start somehow, general notation for a process models commence with the START event, is a circle.	
One can use simply the *basic unmarked* start event as above, or one of the different types of start event, to provide more detail as described below.	
If a process starts when some sort of message arrives, mail, email, text. Following notation can be used	**Message start** 
If a process starts by virtue of the passage of time – e.g. 1st Jan review or 4 days after the purchase order is sent, following notation can be used	**TIMER Start** 
If the process starts when a rule/condition is met – e.g. when Incident Impact is more than 100,000.	**RULE Start** 
If a process starts when another process finishes. Following notation can be used	**LINK Start** 
If there is more than one 'trigger' for a process to start. Following notation can be used	**MULTIPLE Start** 

9 Appendix A: Business Process Modeling Notation Reference

TASK AND SUB PROCESS

Task	Task is a lowest level activity in a process map. A task is used when the work is not broken down to a finer level of detail	
Sub Process	A Sub-process is a compound activity which can be broken down into finer details.	
Loops	Loops task or sub process continues to iterate until the loop condition is true.	

INTERMEDIATE EVENTS

Following notation can be used to display the intermediate event, similar to start and end events.	**BASIC**	**MESSAGE**	**TIMER**	**RULE**	**LINK**	**MULTIPLE**
						

PROCESS END

All processes have to end somehow, general notation for a process models end will be a circle with a solid line.	
One can use simply use the *basic* end event as above, or you can use one of the different types of end event, to provide more detail, as described below:	
If a process ends by something being sent via a message of some sort e.g., mail, email, document, following notation can be used.	MESSAGE End 

9 Appendix A: Business Process Modeling Notation Reference

If the end of this process causes the start of another, following notation can be used.	LINK End 
If more than one consequence of the process ending, following notation can be used.	MULTIPLE End 

SWIMLANES

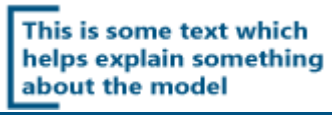
Pool	A *Pool* represents a participant in a Process. It is also acts as a "swimlane" and a graphical container for partitioning a set of activities from other Pools	
Lane	A *Lane* is a sub-partition within a Pool and will extend the entire length of the Pool, either vertically or horizontally. Lanes are used to organize and categorize activities.	

CONNECTORS

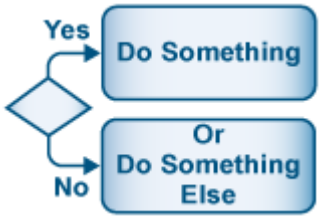
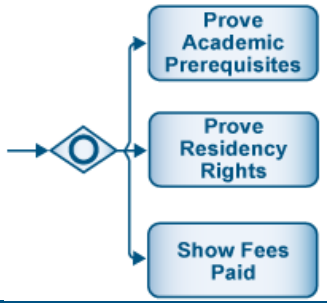
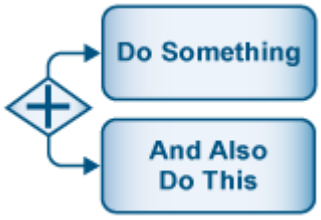
Sequence Flow	A *Sequence Flow* is represented by a solid line with a solid arrowhead (see the figure to the right) and is used to show the order (the sequence) that activities will be performed in a Process.	
Message Flow	A *Message Flow* is represented by a dashed line with an open arrowhead (see the figure to the right) and is used to show the flow of messages between two separate Process Participants. In BPMN, two separate Pools in the Diagram will represent the two Participants.	

9 Appendix A: Business Process Modeling Notation Reference

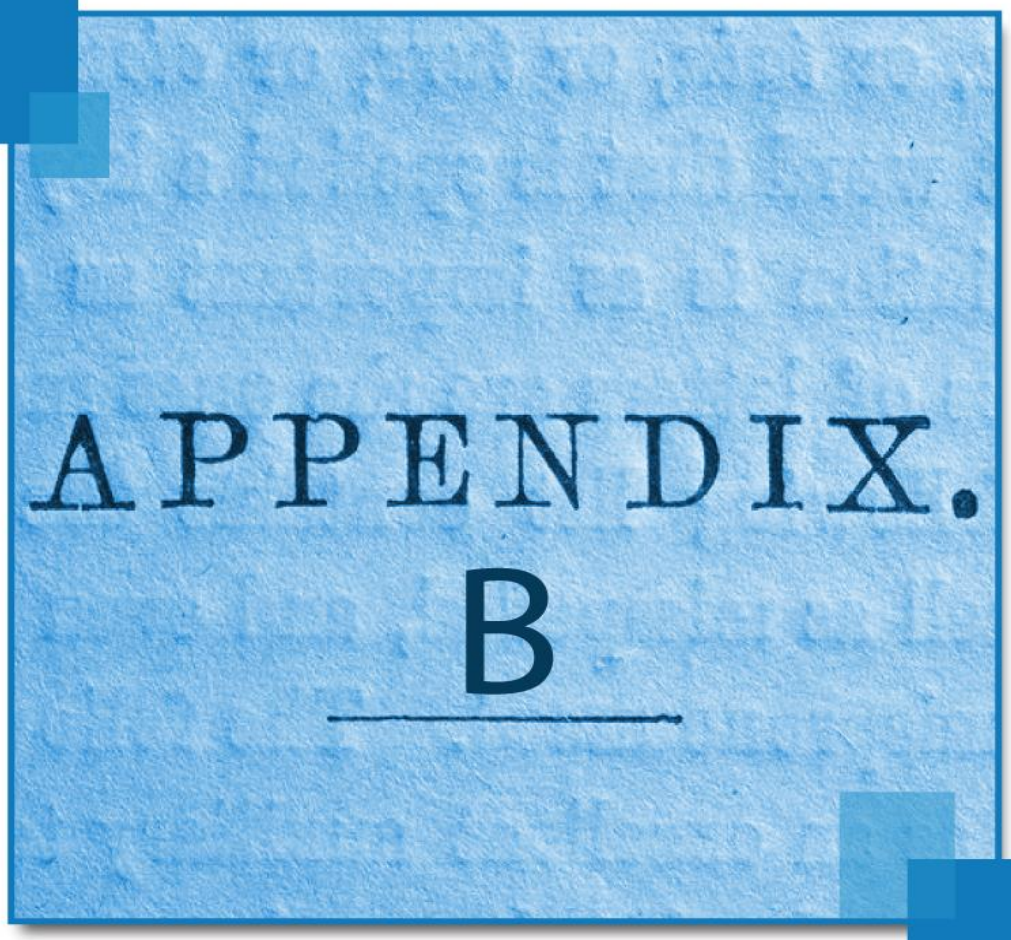
ARTIFACTS

Annotation	The ANNOTATION shape is used to add comments to a process model. It consists of text in a square left bracket	
Data Object	A data object represents a piece of data which is required or produced by the process eg. Customer details, output.	
Group	A grouping is purely for documentation or explanatory purposes. It has no impact on the model. It consists of a rectangle with dashed lines and rounded corners, usually enclosing other objects.	

GATEWAYS

Exclusive	The values of the process are examined to determine which path to take	
Inclusive	Each branch will be evaluated and will not stop when one branch condition becomes true.	
Parallel	Provides a mechanism to synchronise parallel flow and to create parallel flow.	

Appendix B: Chain of Infection



10 Appendix B: Chain of Infection

In order to control or prevent infection it is essential to understand that transmission stages of a pathogen resulting in infection requires the six vital links (Refer to the table below).

Each link mentioned below must be present for infection or colonization to proceed, and breaking any of the links can prevent the infection.

The section below details out the six stages:

Stage	Link	Description
1	Infectious Agent	Any disease-causing microorganism (pathogen)
2	The Reservoir Host	The organism in which the infectious microbes reside
3	The Portal of Exit	Route of escape of the pathogen from the reservoir.
4	The Route of Transmission	Method by which the pathogen gets from the reservoir to the new host
5	The Portal of Entry	Route through which the pathogen enters its new host
6	The Susceptible Host	The organism that accepts the pathogen

Link 1: Infectious Agent

The causative agent for infection is any microorganism capable of producing disease. Microorganisms responsible for infectious diseases include bacteria, viruses, rickettsiae, fungi, and protozoa. Sometimes, microorganisms are part of patient's own body flora and can cause infection in the immunocompromised host. These infections are called endogenous infections. Infections which are acquired from external sources are called exogenous infections.

Link 2: Reservoir Host

The second link in the chain of infection is the reservoir, i.e. the environment or object in or on which a microorganism can survive and, in some cases, multiply. Inanimate objects, human beings, and animals can all serve as reservoirs, providing the essential requirements for a microorganism to survive at specific stages in its life cycle.

10 Appendix B: Chain of Infection

Infectious reservoirs abound in health care settings, and may include everything from patients, visitors, and staff members to furniture, medical equipment, medications, food, water, and blood.

Link 3: Portal of Exit

The portal of exit is the path by which an infectious agent leaves its reservoir. Usually, this portal is the site where the microorganism grows. Common portals of exit associated with human reservoirs include the respiratory, genitourinary, and gastrointestinal tracts, the skin and mucous membranes and the placenta (transmission from mother to fetus)

Link 4: Route of Transmission

The microorganism can be acquired by inhalation (through respiratory tract), ingestion (through gastrointestinal tract), inoculation (through accidental sharp injury or bites), contact (during sexual intercourse) and transplacental transmission (microbes may cross placenta from the mother to fetus). It is important to remember that some microorganisms use more than one transmission route to get from the reservoir to a new host.

Of the six links in the chain of infection, the mode of transmission is the easiest link to break and is key to control of cross-infection in hospitals.

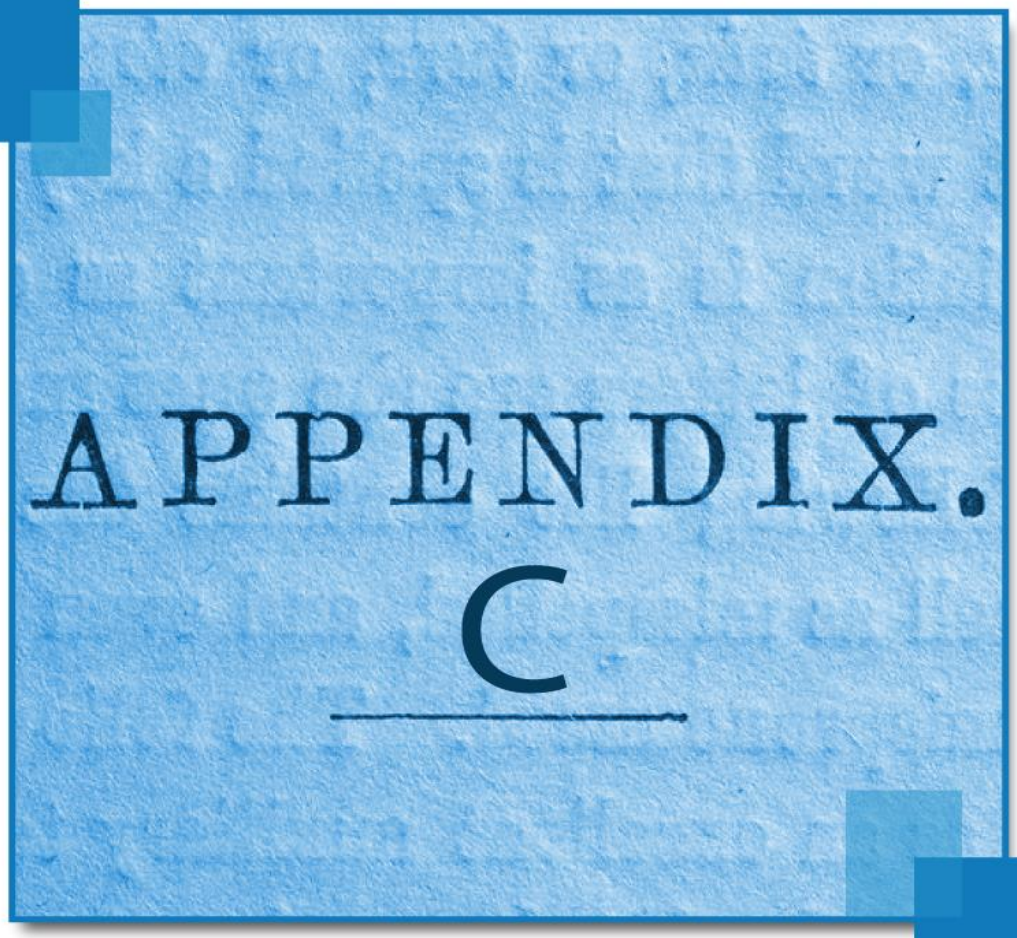
Link 5: The Portal of Entry

The portal of entry is the path by which an infectious agent invades a susceptible host. Usually, this path is the same as the portal of exit. For example, the portal of entry for tuberculosis and diphtheria is through the respiratory tract, hepatitis B and Human Immunodeficiency Virus enter through the bloodstream or body fluids and Salmonella enters through the gastrointestinal tract. In addition, each invasive device, e.g. intravenous line, creates an additional portal of entry into a patient's body thus increasing the chance of developing an infection.

Link 6: The Susceptible host

The final link in the chain of infection is the susceptible host. The human body has many defense mechanisms for resisting the entry and multiplication of pathogens. When these mechanisms function normally, infection does not occur. However, in immunocompromised patients, where the body defenses are weakened, infectious agents are more likely to invade the body and cause an infectious disease. In addition, the very young and the very old are at higher risk for infection because in the very young the immune system does not fully develop until about age 6 months, while old age is associated with declining immune system function as well as with chronic diseases that weaken host defenses.

Appendix C: HL 7 Protocol



11 Appendix C: HL 7 Protocol

PROTOCOL DESCRIPTION

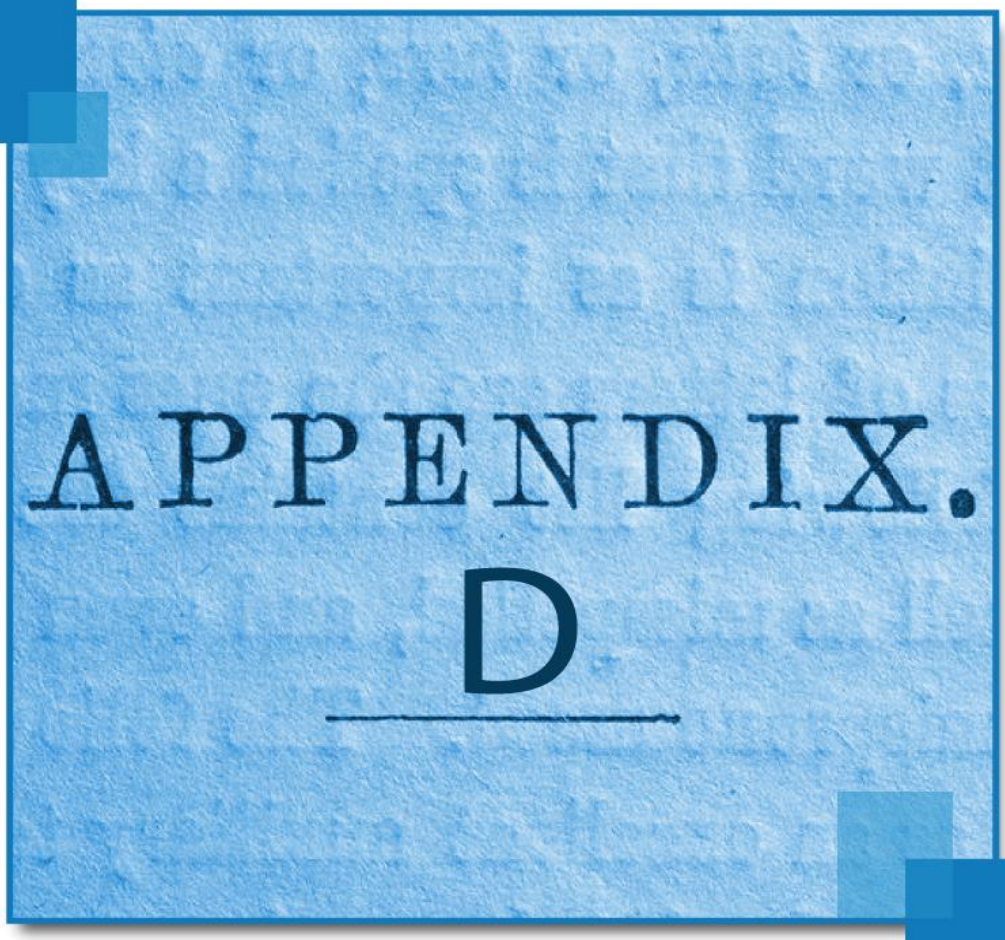
HL7 is a structured, message-oriented protocol framework for computer communication between healthcare application systems. The protocol architecture is hierarchical, moving from high-level groupings and structures to a set of several hundred data fields. Each level of the hierarchy serves a different organizing purpose.

Functional Group	Areas of the protocol are grouped according to common application function; for example, ADT, Order Entry, Finance, Control, and Ancillary Reporting all represent groups described in the standard. Different functional groups are typically given individual chapters in the HL7 specification document.
Message Type	Within a functional group are defined one or more message types that can be implemented in various combinations to support high-level business rules for the applications involved. For example, ADT only specifies one message type while Order Entry describes more than a dozen.
Message Definition	Within each message type, one or more message definitions describe the specific set or combination of segments that make up a properly formed message. For example, ADT distinguishes among more than thirty separate message definitions based on "trigger events" or more detailed business rules. Each message definition includes one or more segments.
Segment Definition	Segments provide a logical grouping for data elements. For example, the Patient Identification segment (PID) includes fields for such identifying information as patient name, Social Security number, medical record number, account number, and miscellaneous demographic details. How fields are grouped in segments forms part of the HL7 implied data model. Segments can be required or optional, can be nested, and can repeat. A parsed message, then, can take on a relatively arbitrary yet unambiguous form. This is an important characteristic in the context of decoding and encoding messages.
Field	The standard identifies several hundred data elements for communicating patient demographic, clinical, and financial information. HL7 uses more than a dozen abstract data types to define the nature of the fields. (A consequence is that some fields may hold more than one data element.) For example, a field that holds a time stamp (TS) follows a prescribed format. In addition many

11 Appendix C: HL 7 Protocol

fields are (or can be) coded, and the standard includes a variety of code tables to define acceptable contents. While each field is defined with a maximum length, the standard really doesn't intend to prescribe format to that level of detail. In merely includes lengths "because it helps readers understand the purpose of the field and it may have pragmatic importance in specific implementations."

Appendix D: HL 7 Encoding and Decoding Rules



12 Appendix D: HL 7 Encoding and Decoding Rules

ENCODING RULES FOR SENDING

1. Encode each segment in the order specified in the abstract message format.
2. Place the Segment ID first in the segment.
3. Precede each data field with the field separator.
4. Encode the data fields in the order and data type specified in the segment definition table.
5. End each segment with the segment terminator.
6. Components, subcomponents, or repetitions that are not valued at the end of a field need not be represented by component separators. The data fields below, for example, are equivalent:
   |^XXX&YYY&&^| is equal to |^XXX&YYY^|
   |ABC^DEF^^| is equal to |ABC^DEF|
7. Components, subcomponents, or repetitions that are not valued, but precede components, subcomponents or repetitions that are valued must be represented by appropriate separators. For example, the following CE data type element has the first triplicate empty and a populated second triplicate:
   |^^^ABC^Text^Codesystem|
8. If a field allows repetition (Cardinality maximum > 1), then the length of the field applies to EACH repetition.

ENCODING RULES FOR RECEIVING

- If a data segment that is expected is not included, treat it as if all data fields within were not present.
- If a data segment is included that is not expected, ignore it; this is not an error.

If data fields are found at the end of a data segment that are not expected, ignore them;