

10 APPENDIX A – Requirements Analyses

10.1 Axiomatic Design Framework

Table 2, 3, 4, and 5 define the *Customer Attributes* (CA), *Constraints* (CS), *Functional Requirements* (FR), and *Design Parameters* (DP), respectively. Figure 17 shows the mapping of CA, FR, DP, and PV domains. Table 6 is a matrix of the FR in the rows, and the corresponding DP are represented in the columns. This assessment does not look at the *Process Variables* but will take the analysis of the process variables in to consideration when the standard operational procedures are in place.

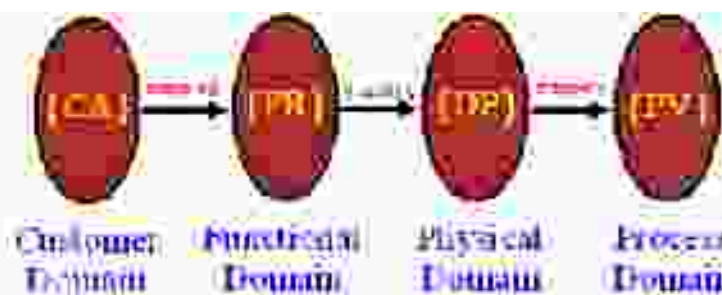


Figure 17: Domain mapping

Table 2: Customer Attributes

CA01 =	frequently and consistently report case information
CA02 =	rapidly detect disease outbreaks
CA03 =	automate weekly disease surveillance reports
CA03 =	Alert health authorities of potential diseases outbreaks

Table 3: Functional Requirements

FR01 =	collect patient visitation information from healthcare facilities	
FR02 =	digitize consolidate statistics of patient “case” information	
	FR021 =	use a mobile hand held computing device
	FR022 =	enter the information in the mobile device
FR03 =	submit consolidated visitation records	
	FR031 =	primary transport method
	FR032 =	secondary transport method
FR04 =	store visitation records in database	
	FR041 =	warehouse records
	FR042 =	fill the data voids

	FR043 =	commit records
FR05 =	update the base line information	
FR06 =	manual detection of disease outbreaks	
	FR061 =	query a subset of data
	FR062 =	view data
FR07 =	automated detection of disease outbreaks	
	FR071 =	initialize dataset and parameters (e.g. detection/decision cut-offs)
	FR072 =	execute data mining algorithms
	FR073 =	verify detected disease outbreaks
FR08 =	make decision to notify disease outbreaks	
FR09 =	communicate notification reports to healthcare workers	
	FR091 =	communications service provider
	FR092 =	disseminate weekly epidemiological report
	FR092 =	disseminate CAP messages

Table 4: Constraints

CS01 =	User must enter each record in less than 1 minute
CS02 =	Application should not be power hungry
CS03 =	Communications costs (terminal device and transmission) must be affordable
CS04 =	Frequency of record submission must adhere to the analysis requirements
CS05 =	notification reports and alerts must contain necessary and sufficient information
CS06 =	community must be notified before disease reaches epidemic states

Table 5: Design Parameters

DP01 =	Patient visitation registry	
DP02 =	Mobile Communication Terminal	
	DP021 =	Java enabled mobile phone
	DP022 =	“RTBI” J2ME application
DP03 =	GSM mobile service platform	
	DP031 =	GRPS primary transport
	DP032 =	SMS secondary transport
DP04 =	“Sahana” BSM MySQL relational database	

	DP041 =	staging tables
	DP042 =	procedures with KB
	DP043 =	transaction tables
DP05 =	Bayesian network	
DP06 =	PHP GUI Query Viewer	
	DP061 =	MYSQL queries analyzer
	DP062 =	Geo Temporal Trend GUIs
DP07 =	“Auton Lab” Statistical data mining algorithms	
	DP071 =	T-Cube
	DP072 =	WSARE, Spatial Scan, and Tipmon
	DP073 =	Healthcare Worker (Human intervention)
DP08 =	Epidemiologist (human intervention)	
DP09 =	“Sahana” Messaging Module	
	DP091 =	Email
	DP092 =	SMS

dependent on the DP. With respect to the independence axiom Table 6 shows characteristics of a lower triangular matrix with very few 'X' in the non-diagonal cells, implying that the system is a “decoupled” design but showing a stronger inclination to a “uncoupled” design. Therefore, we can expect the proposed design to poses less complexities or uncertainties due to interdependencies.

FR03: submission of the visitation records is dependent on DP022: the J2ME application. Thus, failure of the J2ME application will result in the inability to submit the correct information. Just as much as the J2ME application focus is on capturing the data, an equal prominence must be given to the transport of the data via GPRS or SMS. This is one reason for the design to not only rely on a single transport such as GPRS but also have a redundant transport working over an alternate service platform such as SMS. The design is also taking in to consideration the failure of the J2ME application, which will cripple the healthcare worker from submitting data. As a result the data submission process will incorporate an option independent of the J2ME application using an enumerated coding method; where the healthcare worker can text message, via SMS, the enumerated strings.

Table 6: Incidence matrix of functional requirements and design parameters

	DP	01	02	03	04	05	06	07	08	09					
FR		021	022	031	032	041	042	043	061	062	071	072	073	091	092
01		X													
02	021		X												

022		X	X														
03	031		X	X													
	032		X		X												
04	041					X											
	042					x	X										
	043					x	x	X									
05								X	X								
06	061							X		X							
	062							X		X	X						
07	071							X			X	X					
	072							X	X			X	X				
	073							x			X		X	X			
08										X					X		
09	091		x	x												X	
	092		x		x												X

Another strong dependency is the availability of data in the transaction tables, DP043. Without any data, the analysis, FR06 - FR07, cannot take place, and, as a result, detection of disease outbreaks cannot be predicted. Strong emphasis must be given to ensure data integrity and minimize on faulty records. A knowledge base with a series of procedures will be developed to validate the records as well as use intelligence to either flag or correct the faulty records.

DP062: Data visualization is empowered through a browser based (PHP) GUI; where data can be visualized over geographical and temporal dimensions. This GUI has other ways of visualizing the data besides over fore said dimensions such as filtered queries (cross tabs) in table form, which can be exported to generate other types of visual graphs using popular spreadsheets such as Excel. FR062, FR071, FR073, and FR08, which assists the user with system initialization for analysis, detection, and decision processes strongly depend on a good usable GUI based on Human Computer Interface (HCI) principals.

10.2 Healthcare worker assessment of the ICT system

As a precursor, a group of healthcare workers was selected from village, divisional, and regional levels to evaluate the preliminary development of the proposed system. They were presented the concepts along with the opportunity to investigate the “demo” ICT system in person. Thereafter, through a questionnaire the healthcare workers provided feedback on the design.

The questionnaire focused on: quantity and frequency of data collection based on demographic information (number of facilities in area, population densities, and weekly visitation statistics), knowledge on disease surveillance (historic epidemiological incidences in area, national disease surveillance protocols, communicable vs. non-communicable disease definitions), technology readiness (frequency of use of mobile phone for personal and business, type of mobile phone technologies and applications used), and strengths and weaknesses of the proposed technology (recommendations in the choice of attributes and functionality).

10.3 User Requirement Specifications

10.3.1 Overview towards a URS

The Real-Time Biosurveillance Program¹⁴ (RTBP) is an m-Health pilot project aiming to answer the question: “Can software programs that analyze health statistics and mobile phone applications that collect and report health information potentially be effective in the early detection, intervention, and prevention of disease outbreaks?” This project is a pilot aiming to study the technology, human, and policy predicaments in introducing the RTBP to Sri Lanka and India.

The objective of this document is to consolidate the business analysis of the disease surveillance and notification systems in both Sri Lanka and India and derive the user requirements specifications for University of Alberta, University of Colombo School of Computing Lanka Software Foundation, Carnegie Mellon University’s Auton Lab, and Indian Institute of Technology – Madras’s Rural Technology and Business Incubator (RTBI) to use as a guideline to develop the Software Requirement Specifications and go forth with the adaptation, design and development of standards, database, mobile applications, and analytics software programs.

The document is structured in a way to, First, give a brief overview of both Sri Lanka and India’s healthcare system organizational structure and current practice for monitoring, detection, and reporting of diseases in the respective countries with a discussion of the inputs, outputs, and processes of the two individual systems. Second, discuss the expected inputs and outputs of the m-Health ICT system for gathering health information, analyzing, and reporting confined to the domain of disease surveillance and notification. Additional background information is provided in the Appendix for a comprehensive understanding of the details.

10.3.2 Present day disease surveillance and reporting

¹⁴ A synopsis of the RTBP including the research proposal can be found here - <http://limeasia.net/projects/2008-2010/evaluating-a-real-time-biosurveillance-program/>. You may also search for other articles related to this project by searching on the key words: m-Health, e-Health, disease, surveillance, biosurveillance, alerting, epidemiology,

10.3.2.1 SRI LANKA - epidemiological organizational structure

History of disease surveillance in Sri Lanka dates back to late 19th century. The *Quarantine and Prevention of Disease Ordinance* has been introduced in 1890 to implement the notification system on communicable disease in the country. Figure 18 shows the current Government Public Health organizational structure. Table 7 gives a brief description of the personnel and their roles.



Figure 18: Organizational structure of the Sri Lanka Government Healthcare Officials; integer in parenthesis is the number of each entity in the country

Table 7 Government health organizational structure actors with their roles and responsibilities

Actor	Role and Responsibilities
Director General of Health Services (DGHS)	Policy & decision
Provincial Director of Health Services (PDGS)	Policy & decision
Regional Director of Health Services (RDHS)	Policy & decision making
Chief Epidemiologist (CE)	Analysis of the surveillance data; Policy & decision; Action plans for each situations; Preparation of WER and other reports
Regional Epidemiologist (RE)	Regional level decision making Mediate surveillances
Medical Officer of Health (MOH)	Key role in surveillance and notification; Reporting to the higher levels; Launching the actions prescribed by higher levels
Public Health Inspector (PHI)	Assisting in the reporting; Investigating the cases; Assisting the preventive and curative measures in field level

According to the Quarantine and Prevention of Disease Surveillance Ordinance, all medical practitioners or person professing to treat diseases and attending to patients (In government and private medical institutions – Intern House Officers, Grade Medical Officers, other Medical Officers and Consultants, General Practitioners, Family Physicians) suspected of any “notifiable” disease (see table

2) should notify the case to the relevant public health authorities.

Group A diseases should be notified to Director General of Health Services, Deputy Director General (Public Health Services), Epidemiologist, RE, Divisional Director of Health Services/Medical Officer of Health using form I (H-544).

Group B diseases should be notified to Divisional Director of Health Services/Medical Officer of Health using form I (H-544).

Severe Acute Respiratory Syndrome (SARS) should be notified to Director General of Health Services, Deputy Director General Public Health Services (PHS), Director/Quarantine, Air Port Health Officer, Port Health Officer, Epidemiologist, RE, Divisional Director of Health Services/Medical Officer of Health using form I (H-544).

Tuberculosis should be notified to Director/National Program for Tuberculosis, Tuberculosis Control and Chest Diseases using form II (H- 816).

Table 8: List of notifiable diseases in Sri Lanka and the notification mode

<i>Disease</i>	<i>Authority</i>	<i>Mode of notification</i>
Group A : Cholera, Plague, Yellow Fever	DGHS, DDG(PHS) Epidemiologist, RE, MOH	Telephone, Fax, Telegram, H-544
Group B: - AFP /Poliomyelitis - Enteric Fever - Tetanus - Chicken pox - Food Poisoning - Typhus Fever - DHF/DF - Human Rabies - Whooping cough - Diphtheria - Leptospirosis - Tuberculosis - Dysentery - Malaria - Viral Hepatitis - Encephalitis - Measles - Mumps - Rubella /CRS - Meningitis - Simple cont. Fever > 7 Days - Any other disease occurring in epidemic proportion		MOH by H-544
SARS/Suspected SARS	DGHS, DDG(PHC) Epidemiologist, RE, MOH Director Quarantine Airport/port health officer	Telephone, Fax, Telegram, H-544

Sri Lanka facility types: Teaching Hospital, Provincial General Hospital, District General Hospital, Base Hospital Type A, Base Hospital Type B, District Hospital, Peripheral Unit, Rural Hospital, Prison Hospital, other Hospital (e.g. Police and Army Hospital), Special Campaign Hospital, Central Dispensary & Maternity Homes, Maternity Homes, and Central Dispensary. Table 3 specifies the facilities in Kurunegala District.

New policies are being implemented to rename these facilities. Table 3 introduces the new names of health facilities available in the Kurunegala district and brief descriptions of their services and roles. A

more detailed description of the facilities and their services are in Appendix 7.

Table 9: Healthcare facilities governed by the MOH in Kurunegala District

Healthcare Provider	Brief description
Teaching/Provincial General Hospital	Teaching Hospitals are those hospitals where Professorial Wards are established and are engaged in under-graduate and/or post-graduate training. In provinces, which does not have a teaching Hospital will be developed with similar facilities. (Kurunagala is a Teaching Hospital)
District/Base Hospital	All existing District General Hospitals & Base Hospitals will be renamed as District Base Hospitals. Each District will have 1 District General Hospital & 1-2 District Base Hospitals to fulfill the needs of the population. Kuliyaipitiya and Nikawaretiya have a district/base hospital each.
Divisional Hospital Type A, B, C	All District Hospitals, Rural Hospitals, and Peripheral Units will be re-named as Divisional Hospitals, irrespective of the number of beds. Type A – divisional hospitals with more than 100 patient beds, Type B – divisional hospitals with between 50-100 patient beds, and Type C divisional hospitals with Less than 50 patient beds
Primary Medical Care Units	Central dispensaries and maternity homes will be renamed as primary medical care units and shall provide - out patient care, limited emergency care: facilities for stabilization of patients before referring, to secondary or tertiary care medical institutions, facilities for a poly-clinic including Ante – Natal, Post – Natal, Family Planning, Child Health, Well Women
Suwadana Centers	There are over 450 Sarvodaya initiated Suwadana Centers that are functioning in the Island of which 53 are established in the Kurunergala District. The centers are run by trained volunteers; namely the Suwadana Center Volunteers (abbreviated as Suwacevo). Suwadana Center activities - focal point for health education on an on-going basis, monitoring of health status of the community (community surveillance), liaison with government health services, first-aid and treatment of minor ailments, youth participation in health promotion, focal point for community disaster preparedness and management, organizing periodic health clinics for specific target groups, pre and post maternal care, small scale laboratory tests.

10.3.2.2 Disease surveillance and notification processes

Document flow and processes

The disease should be notified immediately at the time of first suspicion without waiting for laboratory test results or confirmatory tests. Making the notification at the earliest possible is of paramount importance thus enabling the field public health staff to start the necessary preventive and control measures immediately.

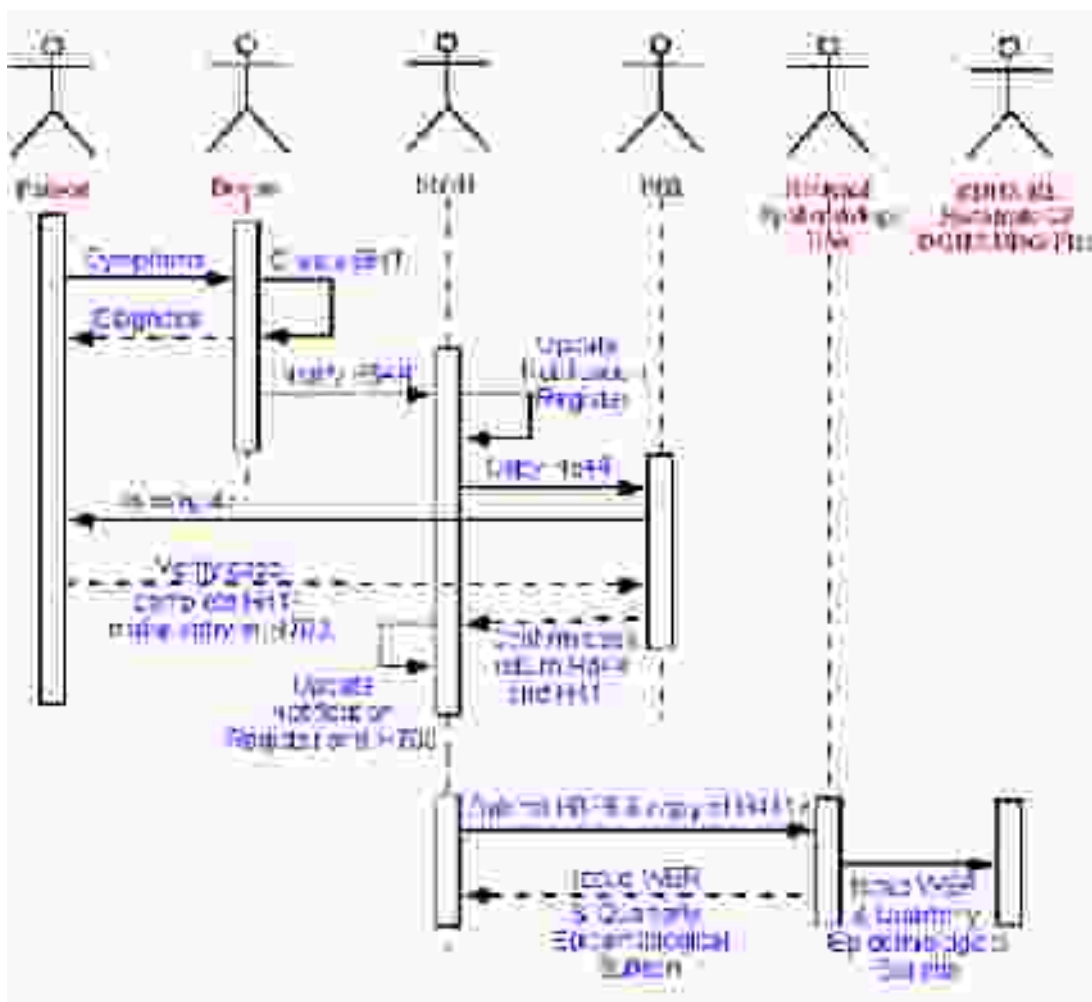


Figure 19: Sri Lanka epidemiological information reporting sequence of functions

As shown in Figure 19, the notification card (Notification of a communicable disease – H-544) should be filled with especial emphasis on writing the patient’s residential address (where it is suspected the patient contacted the disease) so that the range PHI can trace the residence easily. The notification card should be addressed and sent via post to the MOH of the area where the patient is residing in.

A medical officer notifying a case suspected with a notifiable disease should complete a *Notification of a Communicable Disease Form (H-544)*. All such cases notified are entered in the *Ward Notification Register*. All wards should have *Ward Notification Register*. Correct name and address of the patient, age and sex of the patient, the disease suspected, the date of notification, to whom the case is referred and special remarks are included in these ward notification registers.

The completed notifications should be sent to the Director/Medical Superintendent/ District Medical Officer of the institution daily where data are entered in an “*Institutional Notification Register*” and posted to the MOH of the relevant area.

The MOH on receipt of the Notification will enter the data in “Notification Register” of the MOH office and forward it to the relevant PHI in whose area the patient is a resident presumably contracted the disease. The notification register contains the following data in a table format

- | | |
|-------------------------|--|
| 1. Serial Number | 8. Notified by whom |
| 2. Name of Patient | 9. Date notification card received |
| 3. Address | 10. PHI area |
| 4. Age | 11. Date notification card sent to PHI |
| 5. Sex | 12. Date notification card received from PHI |
| 6. Disease | 13. Remarks |
| 7. Date of Notification | |

On receipt of H-544, the PHI enters the data in his letter inward register and will visit the household of the patient. During his visit, he carries out a basic public health investigation into the reported case and confirms or refutes the disease. He also carries out necessary and relevant health education and preventive measures aimed at arresting any further cases and spreading of the disease. Then the PHI will complete the form H-411 (communicable disease report part 1) and enter the relevant data in his outward register. The data of all confirmed cases are also entered in the Infectious Diseases register (H-700) at the PHI office. The PHI will then return the completed H- 411 and H-544 to the MOH office.

At the MOH office on receiving the H-544 and H-411 forms from the PHI, the MOH updates the notification register and then enters data of confirmed cases in the Infectious Diseases register – H-700. For each confirmed case the form H-411a is completed using the data on the form H-411 sent by the PHI.

Every week the MOH completes the weekly return of communicable disease (WRCD– H-399) based on notification register and Infectious diseases register. The WRCD and H-411a forms for the particular week are sent to the Epidemiological Unit, Colombo with copy to the Regional Epidemiologist. A third copy should be retained in the MOH office for future reference. This is the most important activity of the MOH in the notification system for which he/she is personally responsible. The MOH has to fill in the WRCD and post it on Saturday, every week.

The MOH/DDHS is also responsible for updating the Maps and Charts in the office according to the instructions given in the divisional circular pub 110 of 1st November 1973.

For selected diseases that are under special surveillance, the MOH has to complete the special investigation forms and send same to the Epidemiology Unit. Every week the Epidemiology Unit prepares a consolidated return of all WRCD. This Weekly Epidemiological Return (WER) is sent to all health institutions in the country including the MOH offices, thus completing the data flow cycle. WER contains the consolidated data on notifications by district, from all reporting 270 MOH areas of the country.

Table 10 Average time taken to complete each leg of the information flow

Functions in Figure 19	Source	Sink	Duration (days)
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Create BHT	Patient	Doctor	1 (Immediate and continue till discharge)
Notify H-544	Doctor	MOH	7 (usually weekly)
Update Notification Register	MOH	MOH	1-2 (immediate)
Copy H-544	MOH	PHI	1 to 7 days
Investigate (visit patient to confirm syndrome)	PHI	Patient	1 – 10 days
Verify, complete H-411, make entry in H-700	Patient	PHI	1 to 3
Confirm case, return H-411 & H-544	PHI	MOH	1 to 2
Update Notification Register and H-700	MOH	MOH	1 to 2
Submit H-399 & Copy of H-411a	MOH	EPID Unit	1 -7 (urgent vs. weekly)
Issue WER	EPID Unit	MOH	7 (weekly)
Issue WER	EPID Unit	RDHS, RE, Hospitals, GP, DGHS, DDG, PHI	7 – variable

10.3.2.3 Input and Output Documents

This section documents the attributes of the paper base inputs and outputs (forms) that are exchanged between the various healthcare officials for communicating disease information.

Table 11: H-544 from data entry Completed by General Practitioner/House officer/Senior Health Officer/Consultant and sent to MOH

Document Name -->	Notification of a Communicable Disease (H-544)
Attribute Name	Description of attributes
Institute	Name of the institute notification is attached to
Name of Patient	Name of the patient
Name of the Guardian	If it is a pediatric patient
Disease	Tentative diagnosis
Date of Onset	The date patient noticed the ailment
Date of Admission	Date, patient was admitted to the institute
BHT number	Bed Head Ticket Number
Ward	Ward patient was referred to
Age	Age of patient
Sex	Sex of the patient (gender)
Laboratory results	Laboratory results pertaining to the disease (if any)

Home address	Home address of the patient
Telephone number	Phone number of the patient (if available)
Signature of Notifier	Signature of the doctor
Name	Name of the doctor
Status	General Practitioner/House officer/Senior Health Officer/Consultant
Date	data entry date

Table 12: H-411 form data entry completed by PHI and sent to MOH

Document Name -->	Communicable Disease Report – Part I (H-411)
<i>Attribute Name</i>	<i>Description of attributes</i>
PHI Reference no	
MOH notification no.	
MOH register no	
PHI range	PHI area
MOH/HO area	
Disease as notified	Disease notified /tentative diagnosis
Date	
Disease confirmed	Definitive diagnosis
Date	
Age	Age of the patient
Sex	Gender: Male/Female
Ethnic group S/T/M/B/Other	Sinhala/Tamil/Muslim/Burger/Other
Patient's movement during three weeks prior to onset	Patient's travel and contacts within last three weeks duration
Date of hospitalization	
Date of discharge	
Name of hospital	
Outcome Recovered/Died	Whether patient was recovered or deceased
Where isolated Home/Hospital/Not isolated	The place patient was kept during the period of isolation

Nature of case Isolated case	Behavior of the patient in isolation
Laboratory findings	Laboratory findings (if any)
Contacts investigated	Details of the contacts of the patient
Name	
Age	
Date seen	
Observation	
Patient's household	
Other contacts	

Table 13: H-411a form data entry completed by MOH/OIC sent to Director of Health Services, with WRCD

Document Name -->	Communicable Disease Report – Part II (H-411a)
<i>Attribute Name</i>	<i>Description of attributes</i>
RDHS division	Regional Director of health services division
MOH area	
MOH register no	
Age of patient	
Sex	Gender: Male/Female
Occupation	hospital/ dispensary/ PHI/ Gramasewa niladhari/ school teacher/ private practitioner/ Ayurvedic physician/ estate superintendent/ other
Source of Notification 1-9	
Specify	
Disease as notified	
Disease as confirmed	Hospital MO/ MOH/ Other Gov MO/ RMO/ Practitioner
Confirmed by 1-5	clinical only/ clinical and epidemiological/ clinical and bacteriological/ clinical and serological/ clinical, bacteriological and serological/ clinical and direct microscopy

Nature of confirmation 1-6	
Date of onset	
Date of notification	
Date of confirmation	MOH/ OIC
Signature	

Table 14 Notification registry data entered and maintained by MOH

Document Name -->	Notification Register
Attribute Name	Description of attributes
Serial Number	
Name of Patient	
Address	Patient’s resident address
Age	Age of patient in years
Sex	Gender: Male/Female
Disease	
Date of Notification	Date H-544 was produced
Notified by whom	Name of GP/Hospital/Clinician who created the H-544
Date notification card received	
PHI area	
Date notification card sent to PHI	
Date notification card received from PHI	
Remarks	

Table 15: H-399 form data entry completed by MOH/OIC and sent to DHS, with Communicable Disease Report

Document Name -->	Weekly Return of Communicable Diseases (H-399) – Part I & II Part I – Cases Notified during the week
Attribute Name	Description of attributes

Province	
District	
RDHS Division	Regional Director of Health Services Division
MOH area	
Weekly ending	
PHI area	Space for up to 10 PHI areas
Internationally notifiable diseases	Cholera, Plague, Yellow Fever – counts
Acute Poliomyelitis/Acute flaccid paralysis	Counts
Chicken Pox	Counts (number of cases)
Dengue fever/Dengue hemorrhagic fever	Counts (number of cases)
Diphtheria	Counts (number of cases)
Dysentery	Counts (number of cases)
Encephalitis	Counts (number of cases)
Enteric fever	Counts (number of cases)
Food poisoning	Counts (number of cases)
Rabies	Counts (number of cases)
Leptospirosis	Counts (number of cases)
Malaria	Counts (number of cases)
Measles	Counts (number of cases)
Meningitis	Counts (number of cases)
Mumps	Counts (number of cases)
Rubella	Counts (number of cases)
Congenital Rubella Syndrome	Counts (number of cases)
Simple continued fever	Counts (number of cases)
Tetanus	Counts (number of cases)
Neonatal tetanus	Counts (number of cases)
Typhus fever	Counts (number of cases)
Viral Hepatitis	Counts (number of cases)

Whooping cough	Counts (number of cases)
Tuberculosis	Counts (number of cases)
Total	weekly total of above counts of all the diseases from list above
Document Name -->	Part II – Weekly summary
new cases notified during the week	
cases notified earlier and await investigations at beginning of the week	
cases decided as untraceable during the week	
cases decided as belonging to other MOH areas during the week	
cases confirmed as a non-notifiable disease during the week	
cases confirmed as a notifiable disease during the week	
cases awaiting investigations at the end of the week	
Signature - MOH	
Date	

10.3.2.4 Strengths and weaknesses of current system

Strengths

- This provides us the basis for control and prevention of any disease which has a potential to become a threat to the health of the public
- National network covering whole island at all 290 MOH divisions
- Availability of technical experts at each levels
- Close monitoring and evaluation: WRCD screened for clarity, timeliness, and completeness at divisional, regional, and national levels
- Data collection at national level with inbuilt monitoring at divisional, district, and national levels

- Feedback (WER, Quarterly Bulletin)

Weaknesses

- No active Surveillance: Only Activated-passive and Passive Surveillance
- Timeliness is not very satisfactory, 70% of the WRDC is received within 10 days
- Lack of Laboratory Surveillance
- Limited to inward cases; minimum contribution from OPD / Private sector
- Requires quality review

10.3.2.5 INDIA – health sector organizational structure

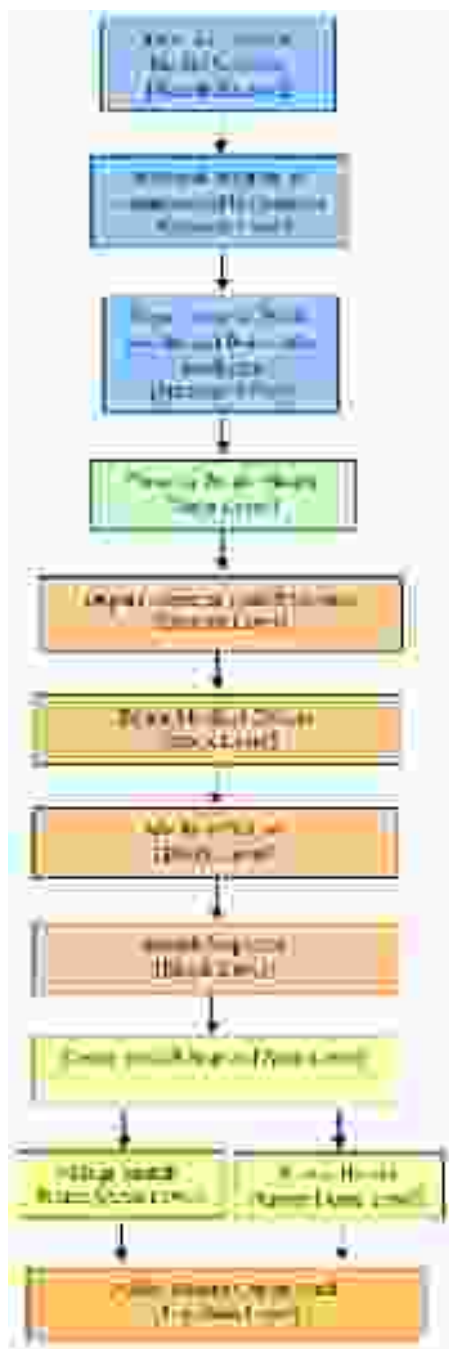


Figure 20: Organizational structure of the Indian Government Healthcare Officials

National Surveillance Program for Communicable Diseases (NSPCD) was initiated in 1998 as a pilot project under the hood of the National Institute for Communicable Diseases¹⁵ (NICD), which is the body that supervises the districts and analyses the data for outbreaks in India. NICD was established on in 1963, to expand and reorganize the activities of the Malaria Institute of India (MII) which remained in existence under different names since its inception in 1909. The reorganized Institute was established to develop a national center for teaching and research in various disciplines of epidemiology and control of communicable diseases. The Institute was envisaged to act as a center par excellence for providing multi-disciplinary and integrated expertise in the control of communicable disease. The Institute was also entrusted the task of developing reliable rapid economic epidemiological tools that could be effectively applied in the field for the control of communicable diseases. The experience from the pilot is subsequently being expanded to build the Integrated Disease Surveillance Program (ISDP) for India.

NSPCD has been launched to strengthen the disease surveillance system so that early warning signals are recognized and appropriate timely follow-up action is initiated. The main objective of the program is capacity building at district and state levels. “WHO is in the process of computerizing the surveillance system in the states of Tamil Nadu and Maharashtra. Computers have been provided to the districts and the relevant staff trained in computer applications vis-à-vis surveillance. This will result in faster transmission of information in both directions and prompt action in the management of outbreaks.”¹⁶

¹⁵ A full description of the NIDC objectives are discussed here -- <http://nicd.org/NICDObjectives.asp>

¹⁶ WHO instigated initiative can be found here -- <http://www.whoindia.org/EN/Section3/Section108.htm>

Table 16: Government health system actors with their roles and responsibilities

Actor	Role and Responsibilities
Department of Public Health and Preventive Medicine	Implements of various National and State Health programs. This Department also plans and implements measures to prevent the occurrence of communicable diseases thereby reducing the burden of morbidity mortality and disability in the state. provisions of primary health care, which includes Maternity and Child Health Services, Immunization of children against vaccine preventable diseases, control of communicable diseases, control of malaria, filarial, Japanese encephalitis, elimination of leprosy, iodine deficiency disorder control program, prevention of food adulteration, health checkup of school children, health education of the community and collection of vital statistics under birth and death registration system and environmental sanitation. Prevention and control of waterborne diseases like Acute Diarrhea Diseases, Typhoid, Dysentery prevention and control of sexually transmitted diseases including HIV / AIDS.
Deputy Director Health Service (DDHS)	The DDHS does the groundwork and takes immediate action if necessary, but always keeps the NICD updated on the statistics with periodic reports and seeks help whenever necessary.
Block Medical Officer (BMO)	A lead medical officer who can be consulted at several PHC facilities. This medical officer oversees the PHC medical officers.
Medical Officer (MO)	Each PHC has at least one Medical Doctor who are mostly fresh graduates working as interns.
Health Inspector (HI)	HI who is part of the DDHS assists the VHN in various activities such as conducting school health camps.
Center Health Nurse (CHN)	
Sector Health Nurse (SHN)	The SHN report to the DDHS
Village Health Nurse (VHN)	VHNs report to the DDHS - Any alert with high priority, the VHN will immediately bring it to the notice of the PHC and then health inspector, again after the analysis, the flow will reverse through the Medical officers, CHN, SHN, and ultimate implementation by the VHN.

Table 17: Healthcare facilities governed by the DDHS in Thirupathur Block

Healthcare Provider	Description
Block level Public Health Center (B-PHC)	There are 12 Block PHC; Scans are usually done at block PHC. each block PHC has 3 – 4 Additional PHC; On an average 5 – 7 deliveries are done per month
Additional Public Health Center (A-PHC)	44 Additional PHC; each additional PHC has 3-4 sub centers (SC). Besides the block level PHC in Chembanur there is an additional PHC,

	<p>which has been functional since last 6 years. This PHC has 2 doctors, 3 staff nurses, 1 ANM, 1 pharmacist, 1 Health Worker and 1 Sanitary Worker. The usual conditions observed were upper respiratory tract infections, old age and immunizations. The referral hospital is a GH at Karriakudi. In general, A-PHC conducts tests for hemoglobin, blood sugar, albumin and HIV/AIDS.</p>
<p>Sub Center (SC)</p>	<p>Doctors are required to make field visit to the SCs, provided there is vehicle allocated.</p>

10.3.2.6 Rural health data communication processes

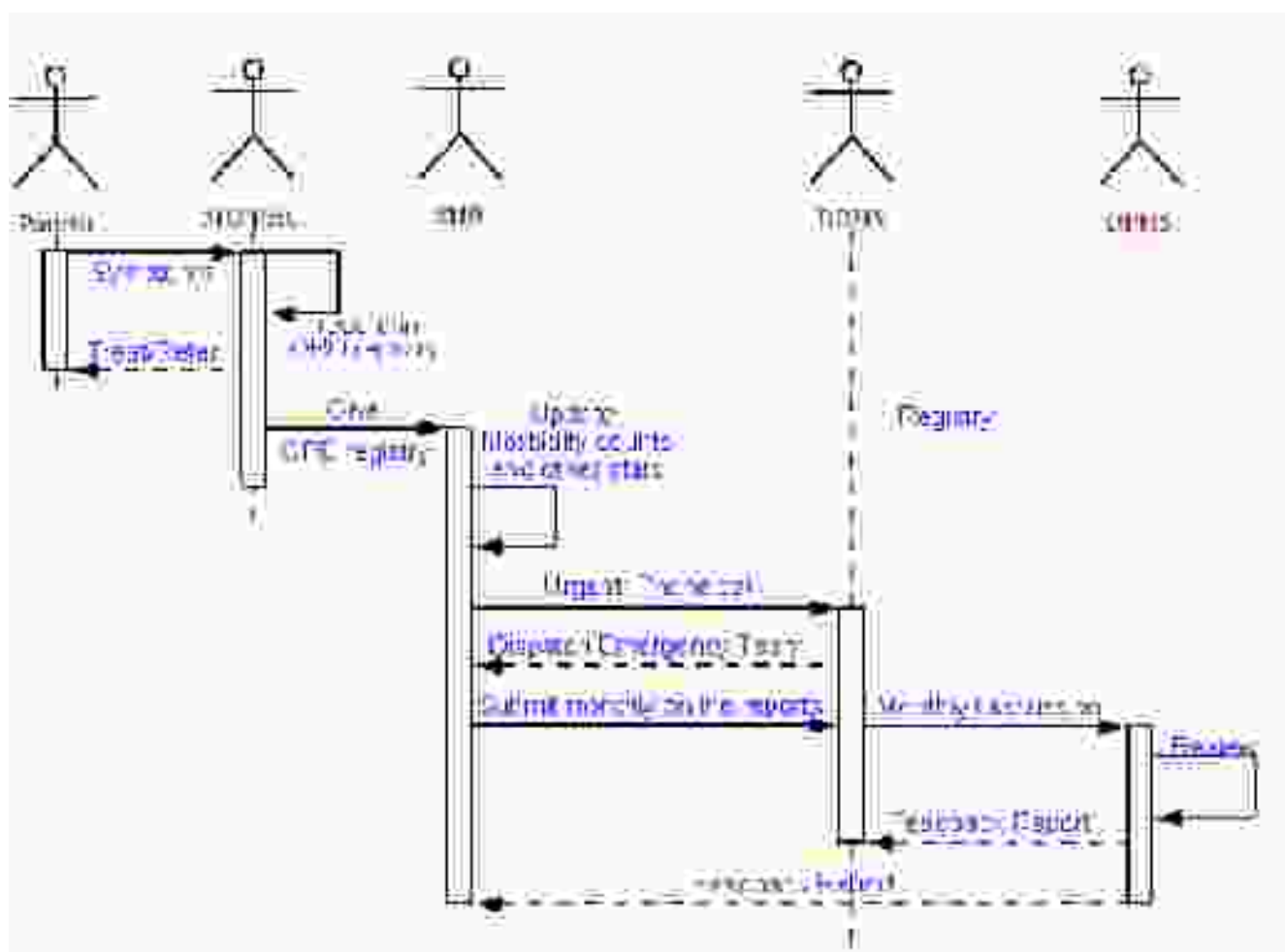


Figure 21: General State level notification process

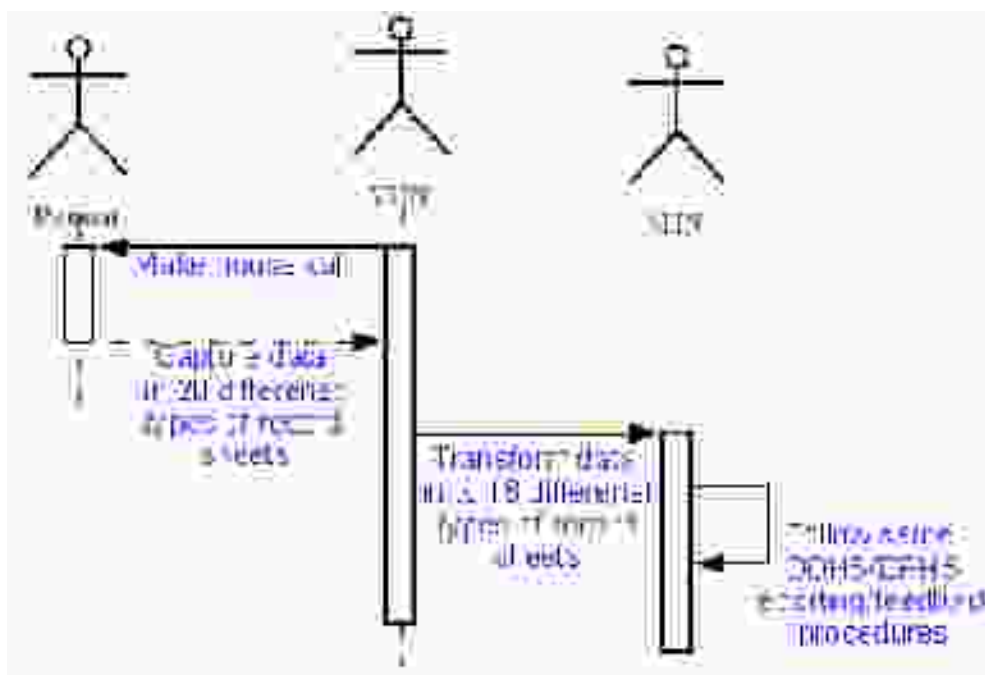


Figure 22: Village health nurse capture of village data

The various reports are - Family Welfare, Morbidity (currently done online), Acute Direct Diseases*, Fever*, Immunization Report (by phone), Deliveries, Minor Surgeries and Institution Report. Almost all of them are done by paper and fax except for Morbidity, which was recently launched online.

If a cluster of common symptoms is observed, the PHC notifies its Health Inspector and VHN who in turn does a Survey in the concerned villages. A communicable disease verified by a Government VHN, SHN is informed to the DDHS designated to the area. The DDHS communicates the case to the DPHS designated to the state of Tamil Nadu. The information is then entered in to a computerized database, which is shared with the NICD.

Table 18: Average time taken to complete each leg of the information flow

Functions in Figures 21	Source	Sink	Duration (days)
Record in OPD registry	Doctor	OPD Registry	Immediate
Give OPD registry	OPD Registry	SHN	1
Update morbidity counts and other stats	SHN	Reports	7
Urgent: Phone call	SHN	DDHS	Immediate
Dispatch emergency team	DDHS	Block	Immediate
Submit monthly online report	SHN	DDHS	30
Monthly discussion	DDHS	DPHS	30
Review	DPHS	DPHS	30
Feedback reports	DPHS	DDHS	30
	DPHS	SHN	30

Functions in Figure 22	Source	Sink	Duration (days)
Make house call	Doctor	Doctor	7
Capture data	Doctor	PHC	7
Transform data	PHC	PHC	15
Follow functions in figure 21 on feedback	PHC	VHN/SHN/DDHS	30

10.3.2.7 Inputs and Outputs

Table 19 Public Health Center morbidity report entry input attributes

Document Name -->	PHC Morbidity Report Entry (on the web)
Attribute Name	Description of attributes
Name of the PHC	A drop down list to select the PHC name
Report Date	Date object to select the date
PHC OP Abstract	Enter the counts for PHC outpatients by Male, Female for Adults, Children, and Total
<i>1. Respiratory System</i>	
Bronchial Asthma	PHC OP Morbidity separated by Male Female for Adults, Children, and Total
COPD	PHC OP Morbidity separated by Male Female for Adults, Children, and Total
Allergic Bronchitis	PHC OP Morbidity separated by Male Female for Adults, Children, and Total
LRI including Pneumonia	PHC OP Morbidity separated by Male Female for Adults, Children, and Total
URI	PHC OP Morbidity separated by Male Female for Adults, Children, and Total
Tuberculosis	PHC OP Morbidity separated by Male Female for Adults, Children, and Total
Other respiratory disease	PHC OP Morbidity separated by Male Female for Adults, Children, and Total
<i>2. Cardiovascular system</i>	
Congenital Heart Disease	PHC OP Morbidity separated by Male Female for Adults, Children, and Total
Rheumatic Heart Disease	PHC OP Morbidity separated by Male Female for Adults, Children, and Total
	PHC OP Morbidity separated by Male Female for Adults, Children, and Total
Hypertension	PHC OP Morbidity separated by Male Female for Adults, Children, and Total
Ischemia including LI	PHC OP Morbidity separated by Male Female for Adults, Children, and Total
Other diseases related cardiovascular	PHC OP Morbidity separated by Male Female for Adults, Children, and Total

<i>3. Pyrexia related diseases</i>	
PUO	PHC OP Morbidity separated by Male Female for Adults, Children, and Total
Viral Fever	PHC OP Morbidity separated by Male Female for Adults, Children, and Total
Typhoid Fever	PHC OP Morbidity separated by Male Female for Adults, Children, and Total
Measles	PHC OP Morbidity separated by Male Female for Adults, Children, and Total
Chicken Pox	PHC OP Morbidity separated by Male Female for Adults, Children, and Total
Malaria	PHC OP Morbidity separated by Male Female for Adults, Children, and Total
Others	PHC OP Morbidity separated by Male Female for Adults, Children, and Total
<i>4. Connective Tissue Disorder</i>	
Osteo Arthritis	PHC OP Morbidity separated by Male Female for Adults, Children, and Total
Rheumatoid Arthritis	PHC OP Morbidity separated by Male Female for Adults, Children, and Total
Other connective tissue disorders	PHC OP Morbidity separated by Male Female for Adults, Children, and Total
<i>5. Pregnancy related disorders</i>	
Pregnancy induced hypertension	PHC OP Morbidity separated by Male Female for Adults, Children, and Total
Gestation Diabetes Mellitus	PHC OP Morbidity separated by Male Female for Adults, Children, and Total
Malnutrition	PHC OP Morbidity separated by Male Female for Adults, Children, and Total
Anemia	PHC OP Morbidity separated by Male Female for Adults, Children, and Total
Other related disorders	PHC OP Morbidity separated by Male Female for Adults, Children, and Total
<i>6. Skin</i>	
Eczema	PHC OP Morbidity separated by Male Female for Adults, Children, and Total
Tine infection	PHC OP Morbidity separated by Male Female for Adults, Children, and Total
Scabies	PHC OP Morbidity separated by Male Female for Adults, Children, and Total
Leprosy	PHC OP Morbidity separated by Male Female for Adults, Children, and Total
Other related skin diseases	PHC OP Morbidity separated by Male Female for Adults, Children, and Total
<i>7. Insect/Animal Bite</i>	
Dog bite	PHC OP Morbidity separated by Male Female for Adults, Children, and Total
Scorpion bite	PHC OP Morbidity separated by Male Female for Adults, Children, and Total
Snake bite	PHC OP Morbidity separated by Male Female for Adults, Children, and Total

Other insect and animal bites	PHC OP Morbidity separated by Male Female for Adults, Children, and Total
<i>8. Gastro Intestinal System</i>	
Acute diarrheal disease	PHC OP Morbidity separated by Male Female for Adults, Children, and Total
Abdominal colic	PHC OP Morbidity separated by Male Female for Adults, Children, and Total
Jaundice	PHC OP Morbidity separated by Male Female for Adults, Children, and Total
Worm infection	PHC OP Morbidity separated by Male Female for Adults, Children, and Total
Amoebiasis	PHC OP Morbidity separated by Male Female for Adults, Children, and Total
Acid peptic disease	PHC OP Morbidity separated by Male Female for Adults, Children, and Total
Food poisoning	PHC OP Morbidity separated by Male Female for Adults, Children, and Total
Apthus ulcer	PHC OP Morbidity separated by Male Female for Adults, Children, and Total
Other related GIT system	PHC OP Morbidity separated by Male Female for Adults, Children, and Total
<i>9. Genito urinary system</i>	
Urinary tract infection	PHC OP Morbidity separated by Male Female for Adults, Children, and Total
Menstrual disorder	PHC OP Morbidity separated by Male Female for Adults, Children, and Total
RTI	PHC OP Morbidity separated by Male Female for Adults, Children, and Total
Malignancy	PHC OP Morbidity separated by Male Female for Adults, Children, and Total
Other related diseases including nephritic disease	PHC OP Morbidity separated by Male Female for Adults, Children, and Total
<i>10. Neurological disorder</i>	
Epilepsy	PHC OP Morbidity separated by Male Female for Adults, Children, and Total
CVA	PHC OP Morbidity separated by Male Female for Adults, Children, and Total
Meningitis	PHC OP Morbidity separated by Male Female for Adults, Children, and Total
Other neurological disorders	PHC OP Morbidity separated by Male Female for Adults, Children, and Total
<i>11. ENT</i>	
Sinusitis	PHC OP Morbidity separated by Male Female for Adults, Children, and Total
ASOM CSOM- middle ear infections	PHC OP Morbidity separated by Male Female for Adults, Children, and Total
Hearing defect	PHC OP Morbidity separated by Male Female for Adults, Children, and Total

Foreign body ear	PHC OP Morbidity separated by Male Female for Adults, Children, and Total
Foreign body nose	PHC OP Morbidity separated by Male Female for Adults, Children, and Total
Others	PHC OP Morbidity separated by Male Female for Adults, Children, and Total
<i>12. Dental</i>	
Dental carries	PHC OP Morbidity separated by Male Female for Adults, Children, and Total
Dental fluorosis	PHC OP Morbidity separated by Male Female for Adults, Children, and Total
Other dental problems	PHC OP Morbidity separated by Male Female for Adults, Children, and Total
Gingivitis	PHC OP Morbidity separated by Male Female for Adults, Children, and Total
<i>13. Ophthalmic</i>	
Refractive errors	PHC OP Morbidity separated by Male Female for Adults, Children, and Total
Conjunctivitis	PHC OP Morbidity separated by Male Female for Adults, Children, and Total
Foreign body eye	PHC OP Morbidity separated by Male Female for Adults, Children, and Total
Styc	PHC OP Morbidity separated by Male Female for Adults, Children, and Total
Other related diseases	PHC OP Morbidity separated by Male Female for Adults, Children, and Total
Nutritional disorder	
Anemia	PHC OP Morbidity separated by Male Female for Adults, Children, and Total
Vitamin A deficiency	PHC OP Morbidity separated by Male Female for Adults, Children, and Total
Vitamin B deficiency	PHC OP Morbidity separated by Male Female for Adults, Children, and Total
Malnutrition	PHC OP Morbidity separated by Male Female for Adults, Children, and Total
Other vitamin deficiencies	PHC OP Morbidity separated by Male Female for Adults, Children, and Total
<i>15. Endocrine system</i>	
Diabetes Mellitus	PHC OP Morbidity separated by Male Female for Adults, Children, and Total
Goiter	PHC OP Morbidity separated by Male Female for Adults, Children, and Total
Others	PHC OP Morbidity separated by Male Female for Adults, Children, and Total
<i>16. All other causes</i>	
Accidents and Injuries	PHC OP Morbidity separated by Male Female for Adults, Children, and Total
Burns	PHC OP Morbidity separated by Male Female for Adults, Children, and Total
Surgical related diseases	PHC OP Morbidity separated by Male Female for Adults, Children, and Total

10.3.3 Derived requirements

The user requirement derived in this section follow from the close analysis of the current disease surveillance and notification systems in both Sri Lanka and Indian, discussed in the previous sections. The two main weaknesses deduced from the business analysis are -

- 1) The existing system purely thrives on a set of known diseases, labeled as communicable and or notifiable diseases and not on detecting emerging diseases or other adverse health events
- 2) The time taken in delivering the vital health information both upstream and downstream through paper, phone, and fax based system up and down the health system organizational structure is greater than 10 days

Therefore, the summary of the user requirements are –

- 1) design an system to detect all adverse events (including communicable diseases); thus, collect all patient health information for analysis in a timely manner
- 2) design a system that can directly communicate health information from the point of origin to the key decision makers at central levels with provision for the same information to be accessed by all actors at the in between stages in the health organizational structure to execute the required protocols

First, we introduce the key actors, their roles, and the functionality required for the purpose of data collection, analysis, and reporting. Secondly, we introduce the minimal set of attributes required to attain the system requirements for collection of health data, analysis, and reporting.

10.3.4 Functions, Actors, and Roles of envisaged RTBP

In general, the users are the healthcare workers, government or non-governmental (private). Although the names (titles) assigned to the healthcare workers for the purpose of disease surveillance and notification is different between Sri Lanka and India the roles and responsibilities are quite similar. Table 9 describes the set of functions, actors and their roles/responsibilities. The columns labeled ‘Expected’ under both Sri Lankan actors and Indian actors are the healthcare workers entrusted to carry out the prescribed function (protocols) and would be the resource persons expected to carry out the respective functions, namely, the government health officials. The column labeled “Actual” indicates the resource person who will be actually carrying out the respective function for the purpose of the pilot project.

Table 20 RTBP ICT system functions, actors, and roles/responsibilities

Function	Sri Lankan Actors		Indian Actors		Roles and Responsibilities
	<i>Expected</i>	<i>Actual</i>	<i>Expected</i>	<i>Actual</i>	
Data submission	PHI	Suwacevo	VHN/SHN	VHN/SHN	Gather diagnosis, symptom, signs, gender, and age group records with respect to in and out patient visitations from the healthcare providers (hospitals, clinics, PHCs, GPs, community health centers, etc.) in their

					jurisdiction.
Analysis	RE/CE	RA	NICD	DDHS/NIC	Periodically examine datasets from the central repository for a given time period with the use of software tools for manually or automatically detecting adverse events.
Decision Making	MOH, RE, CE	MOH	PHC, DDHS, DPHS, NICD	PHC, DDHS, DPHS, NICD	When an adverse event such as a possible disease outbreak or unusually increase of similar cases is detected through the analysis process a Decision Maker must decide whether or not the event is of significance to be communicated downstream to designated healthcare workers in the vulnerable geographical areas
Publishing -issue reports/alerts	RE or CE	RA	PHC, VHN, HI-DDHS	RA	There are three types of reports: low, high, and urgent priority reports/alerts. <i>Low</i> and <i>High</i> priority reports are generated and disseminated on a weekly (or periodic) basis identifying substantially significant events (e.g. WER). Recipient healthcare workers are not expected to take immediate action but closely monitor those diseases if they are of relevance. <i>Urgent</i> priority alerts are issued as and when a disease outbreak is detected and the healthcare workers in the vulnerable areas must be notified to take immediate action.
Subscribing - receive reports/alerts	MOH, RDHS, RE, Hospitals, GP, DGHS, DDG, and PHI	Suwacevo and MOH	VHN, PHC, HI-DDHS, CHN, SHN	VHN, PHC, HI, DDHS, CHN, SHN	Subscribers can choose to receive either Urgent, High, or Low priority alerts. Based on the individual’s responsibilities and the priority level of the alert the recipients will chose the course of action to be taken. If it is a low priority alert, they may choose to be vigilant and

					observe and if it is a high priority alert the individual may choose to apply intervention and prevention actions to safeguard their respective communities
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10.3.5 Anticipated problems

- Suwacevo will be playing the role of the PHIs. However, the Suwasevo do not have the same level of training as the PHIs who undergo 3-4 year of training in healthcare associated with their work.
- Although all forms carry all 3 local languages, the Sri Lankan healthcare system functions in English. The Suwacevo will not have the same level of English language competency as the PHIs, at least, not the domain specific language
- VHNs and SHNs are to be entrusted in submitting the disease and syndrome data. However, VHNs and SHNs are informed only if the PHC detect a cluster of common symptoms. Ideally, we would want the VHNs and SHNs to submit all symptoms. How they are to receive or extract information pertaining to all the symptoms reported by patients, is a question.
- Research Assistants (RAs) will be conducting the automated and manual analysis. It is doubtful that they will have the same level of experience as an acute physician or epidemiologist to detect adverse events that are not obvious.

10.3.6 Optimal set of Inputs, Outputs, and functionality of ICT system

The partners or teams designing and developing the necessary standards, software, and protocols are expected to use the tables below as a guide to developing the precise specification, which will be documented in the SRS. It is evident that the designers and developers will need to expand on this and introduce more attributes and relationships to build the working solutions.

10.3.6.1 Gathering of Diagnosis and Syndrome data

The Suwacevo and VHN will be providing a minimal set of information, listed in Table 10, for the purpose of analysis and detection of adverse health events. The Suwacevo or VHN will visit the healthcare providers, periodically, or use other means to retrieve in and out patient data from the registries (e.g. BHT) to digitize and send those records to a central database. The Suwacevo and VHN should be able to record the relevant data in digital form in a minimal allotted time such as at a rate of 05 seconds per record, which would amount to roughly 25 minutes to enter and submit 250 records.

Table 21 attributes of visitation data collection from the providers by the Suwacevo and VHN

<i>Attribute</i>	<i>Description</i>	<i>Example</i>
Sender ID	[Single Value]: A unique identifier to	1) Health system assigned unique

	associate the data with the healthcare worker (VHN or Suwacevo) submitting the data	ID 2) Name + National ID number 3) National ID Number
Provider	[Single value]: Healthcare provider: hospital, clinic, GP, community healthcare center, etc., where the data will be collected. This element will help identify location (or source) of the health record. It is anticipated that the patient will be from the nearby area. It is possible that a patient from outside of the area may visit the provider	1) provider name: Kurnegala Base Hospital, provider type: Hospital, provider town/village: Kurunegala 2) provider name: Sivaganga Maternity Hospital, provider type: Hospital; provider town/village: Wariyapola 3) provider name: Asiri Community Healthcare Center, provider type: clinic; provider town/village: Pannala
Diagnosis	[Single value]: Name of the disease the practitioner concludes (diagnoses) based on the patient's symptoms and signs	Dengue, Diarrhea, Parkinson's
Symptoms	[Multiple values]: The complaints made by the patient to the doctor. The same diagnosis for two different patients may not always accompany the same symptoms	1) fever, joint aches, vomit blood, rash (Dengue) 2) fever, joint ache (Dengue) 3) bloody stools (Diarrhea)
Signs	[Multiple values] : The observations made by the practitioner (doctor)	Swelling, Rash, Enlarged retinal, Discoloration of tongue
Gender	[Single value]: Male, Female, or Unknown	
Age Group	[Single value]: Age categories; it is at the discretion of the implementers as to how they wish to define the age categories	1) Adult / Child 2) 0 – 10, 11 – 20, ..., 91 – 100, 3) Infant (0 – 1), Child (2 – 12), Teenager (13 – 19), Youth (20 – 25), Adult (26 – 50), Elder (50 – 100)
No. of Cases	[Single Value]: In a particular reporting period, more than one patient may share the same diagnosis, symptoms, and signs and be of the same gender and age group. In the event an aggregate can be reported instead of having to repeat the record	1) Default value = 1 2) General value = any "Natural" number
Date	[Single Value]: The date the patients or the cases were recorded by the provider; i.e. visitation date or admitted date	

10.3.6.2 Relations database for storing gathered data

The relation database must have a record of the attributes defined in Table 11. The table structure will

contain more attributes than described in Table 11 as well as related data and preserve data integrity. The data gathered (health records of patient diagnosis and syndrome) by the healthcare workers from the provider will be stored in this database. The same data will be made available for the purpose of analysis.

Table 22 Information stored in the database

Attribute	Description	Example
Provider	Same as in Table 10	
Diagnosis	Same as in Table 10; can be null. The database will try to resolve (suggest) a diagnosis based on the received symptoms	
Symptoms	Same as in Table 10; cannot be null	
Signs	Same as in Table 10; can be null	
Gender	Same as in Table 10. If the input value is NULL then will default to "Unknown"	
Age Group	Same as in Table 10; cannot be null	
No. of Cases	Same as in Table 10; can be null, if null then will default to 1	
Date	Same as in Table 10; can be null	
ICD-10	[Single value]: International Code for Diseases version 10; the database will resolve the value based on the relationship of the codes associated with the diagnosis (disease). The healthcare workers will not be required to submit this data but the internal processes will fill in the voids.	A01.0 Typhoid fever A90 – Dengue Fever B01 – Varicella (chickenpox) none - some diseases are not classified. So 'none' should be a valid option
Lat/Lon	[Two values]: GIS longitude and latitude will be resolved by the database by looking up the values from the pre-registered GIS location information of the provider village/town or other location identifier.	1) Lon = 8.1414 Lat = 3.4123
Other	[Multiple values]: other attributes the user can set or processes the user can execute to detect adverse events	1) Spatial Scan 2) WSARE 3) Tipmon

10.3.6.3 Analysis for detection of events

Periodically, daily, every-other-day, or weekly, the RA (or Epidemiologist) will analyze the data for a given time frame to monitor and detect any emerging health threats. They may also execute other detection algorithms or processes for detection of possible adverse events. The users (detection and monitoring staff) will need to filter the dataset through various combinations of selected parameters identified in Table 12.

Table 23 Analysis done by RAs (or Epidemiologists) of the collected datasets

Attributes	Description	Examples
Period	[Two values]: Start and End date of the series of data to be analyzed. Neither value can be null. Some logic will be used to suggest the start and dates for a period	1) 11-Oct-2006 to 10-Oct-2007 2) 01-Mar-2008 to 31-Mar-2008
Disease (Diagnosis)	[Multiple value]: Same as in Table 10; user should have the option of selecting a single disease for analysis or a collection of disease to analyze the dataset	1) Parkinson's 2) Dengue, Malaria, (mosquito borne diseases) 3) Typhoid, Rubella, Jaundice (Child diseases)
Symptoms	[Multiple value]: Same as in Table 10; user should have the option of selecting a single symptom or a collection of symptoms to analyze the data	1) Cough 2) Fever, Cough 3) Fever, Joint Ache, Rash
Gender	[Multiple value]: Same as in Table 10; user should have the option of selecting Male or Female, Unknown or a subset of the genders such as Male and Unknown to analyze the dataset	1) Male 2) Male, Unknown 3) Male, Female, Unknown
Age group	[Multiple value]: Same as in Table 10; user should have the option of selecting one or a range of age groups	1) Child 2) All (Child & Adult) 3) Age: 10 – 25
Provider	[Multiple value]: Same as in Table 10; user should have the option of selecting one or a collection of providers.	1) Kurunegala base hospital 2) Kurunegala base hospital, Kuliypitiya hospital, Pannala Peripheral Unit
Area	[Multiple values]: user should have the option of selecting a polygon (i.e. GIS area). The locations will be subdivided as Country, Region, State, Province, District, Division, Area, Town/Village	1) Pannal MOH Division 2) Kurunegala District 3) Sivaganga District 4) Tamil Nadu State
Other	[Multiple values]: other attributes the user can set or processes the user can execute to detect adverse events	1) Spatial Scan 2) WSARE 3) Tipmon

10.3.6.4 Alerting and reporting of emerging disease outbreaks

Required attributes to generate weekly disease surveillance reports such as the WER and issuing alerts of potential threats such as emerging disease outbreaks. The RA (or epidemiologist) will extract a summary of the weekly report (e.g. WER) and send the report to the healthcare workers each week. In the event of detecting a significant health threat, the resources associated with detection and monitoring

(e.g. RA or Epidemiology Unit staff) will notify the decision makers (e.g. MOH or CE) of the potential threat. Thereafter, the decision maker will decide the priority level and authorize the detection and monitoring staff to issue a bulletin (alert) to those health officials in the vulnerable areas. The weekly reports are regarded as low or high priority bulletins (reports) and the immediate notifications (alerts) are regarded as urgent priority bulletins.

Table 24 Weekly reports and urgent alerts issued by RA (Epidemiologist) to all healthcare workers

Attributes	Description	Examples
Headline	[Single values]: A head line describing one or more significant event(s)	<ol style="list-style-type: none"> 1) “Rains increase mosquito borne diseases” 2) “ Chikungunya appears in North Central province” 3) “Unusual fever like disease emerging among children”
Priority	[Single value]: indicating the urgency, severity, and certainty of the emerging disease with priority levels: high – healthcare worker should access alternate resources to learn more about the emerging disease and be vigilant, perhaps inform community, low – healthcare worker should be vigilant but does not need to take any action, or urgent – if message is intended for the healthcare worker (i.e. affects area healthcare worker is in) then take immediate intervention and prevention actions	<ol style="list-style-type: none"> 1) low 2) high 3) urgent
Area	[Multiple values]: to identify the geographical areas the significant event has emerged in or is affecting	<ol style="list-style-type: none"> 1) Western and Central Provinces 2) Sivaganga, Colombo, Kurunegala Districts 3) Pannal, Wariyapola Divisions 4) Kuliypitiya, Nathandiya, Pannala, Towns 5) Sri Lanka
Description	[Single values]: Table of, at most, top 5 diseases and their counts or the most significant urgent priority adverse event and a description of the incident.	<ol style="list-style-type: none"> 1) Dengue (23), Malaria (15), Flue (145), 2) Chikungunya (12) 3) “be advised, 12 cases of Chikungunya identified in Sivaganga district, rapidly spreading, take immediate action”
Resources	[Multiple values]: http link to website with full report for users to access to obtain further information and instructions	<ol style="list-style-type: none"> 1) http://www.epid.gov.lk/WER/ 2) http://www.sahana.lk/DS/GIS/WER 3) IVR: +9198555123123 4) Deputy Director Health Services: +914455599889988

10.3.6.5 Description of associated system attributes

This section defines the set of attributes associated with the data elements and database

Table 25 Sample of Diagnosis (diseases), symptoms, and signs

Diagnosis (Disease)	Symptoms	Signs
Cholera	Watery Diarrhea, Nausea, Vomiting, Muscle ramps, Thirst	Dehydration, Tachycardia, Drowsiness
Plague	Fever with Chills, Headache, Fatigue, Diarrhea, Chest pain, Vomiting, Muscle aches, Cough with blood stained sputum	Buboes, Bleeding from mucosal tissues, Gangrenes, Pneumonia, Coma
Yellow Fever	Fever, Headache, Muscle aches, Nausea, Loss of appetite, Dizziness, Abdominal pain	Red eyes, Red tongue, Yellowing of skin, Yellowing of sclera, Bleeding from nose, Heart arrhythmias, Liver failure, Kidney failure, Delirium, Seizures, Coma
Polio Myelitis / Acute Flaccid Paralysis	Fever, Headache, Vomiting, Diarrhea, Fatigue, Constipation, Difficult to swallow, Difficulty in breathing	Neck stiffness, Back stiffness, Muscle spasms, Increase sensitivity to touch, Paralysis of the limbs, Cranial Nerve palsy, Facial muscle paralysis, Features of bulbar palsy
Diphtheria	Sore throat, Painful swallowing, Difficulty in breathing, Fever, Chills, Malaise	Hoarseness, Swollen glands, Grey membrane covering throat, Red infected wound, Wound with gray patchy material, Eye signs
Dysentery	Abdominal cramp, Nausea, Vomiting, Fever, Diarrhea, Blood stained stools, Mucous stained stools	Abdominal tenderness
Pertussis	Runny nose, Sneezing, Mild cough, Low-grade fever, Dry cough	Whooping
Enteric Fever	Fever, Headache, Fatigue, Sore throat, Abdominal pain, Diarrhea, Constipation	Rash, High fever, Distended abdomen, Delirium, Typhoid state

Table 26 Attributes associated with the Healthcare Provider identification

Provider	Description	Example
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Attribute		
Name	Registered name of the healthcare provider or facility	Asiri hospital, Pannala Community Health Center, Dr. Roshan Hewapathirana, MD Chennai Family Clinic
Type	The type of the healthcare provider defined by the country's healthcare system	Hospital, Clinic, Community Health Center, Maternity Home, General Practitioner
State/Province 1)	State or Province within the country the provider operates in or is licensed to operate	Tamil Nadu, Rajasthan, Western Central
District 1)	District within the State or Province the provider operates in or is licensed to operate	Sivaganga, Kurunegala, Kandy
Village/Town 1)	Village or town within the District the provider operates in or is licensed to operate	Kuilyapitiya, Kurunegala, Pannala
Street Address	Postal street address the provider operates in or the facility is established	12 Colombo road, 42-12 Kiribathena road
GIS coordinates 1)	GIS Long & Lat coordinates of the location of the provider facility	Long: 10.1234 Lat:7.0987 Long: 34.1234 Lat: 23.1122

Table 27 Geographical coverage definitions with hierarchy

Parent	Child	Examples of Parent
Country	Province, State	Sri Lanka, India
Province	District	Western, Sabaragamuwa, Central
State	District	Tamil Nadu, Rajasthan, Maharashtra
District	Division, Block	Kurunegala, Sivaganaga
Block	--	Thirupathur
Division	Area	Pannala, Kulyapitiya, Wariyapola, Udubeddewa
Area	--	PHI area, VHN area

10.3.7 Inventory of Health Facilities

10.3.7.1 Kurunegala District, Sri Lanka

Table 28 Kurunegala district, Sri Lanka health facility inventory

Facility Type	Facility Name
Provincial General Hospital	TH-Kurunegala (Line Ministry Inst.)
Base Hospital Type A	BH-Kuilyapitiya

Base Hospital Type B	BH-Nikaweratiya, DH-Polpitiyagama, DH-Galgamuwa
District Hospital	DH-Alawwa, DH-Dambadeniya, DH-Maho, DH-Mawathagama, DH-Polgahawela, DH-Ridigama, DH-Sandalankawa, DH-Wariyapola, DH-Hettipola, DH-Hiripitiya, DH-Gokarella, DH-Bingiriya, DH-Katupotha, DH-Narammala
Peripheral Unit	PU-Ambanpola, PU-Dunakadeniya, PU-Kandanegedara, PU-Mahagiriella, PU-Mahananneriya, PU-Megalewa, PU-Muwanhela, PU-Nikawewa, PU-Pahalagiribawa, PU-Thalampitiya, PU-Kotawehera, PU-Kobeigane, Rural Hospital, RH-Ehetuwewa, RH-Delwita, RH-Gonigoda, RH-Mahamukalanyaya, RH-Wellawa, RH-Koshena, RH-Karambe, RH-Indulgodakanda, RH-Nawatalwatta, RH-Rajanganaya,
Central Dispensary & Maternity Homes	CM-Munamaldeniya, CM-Madahapola, CM-Rasanayakepura (Pahala Mawathagama)
Central Dispensary	CD-Boraluwewa, CD-Buluwala, CD-Dodangaslanda, CD-Divurunpola, CD-Diganpitiya, CD-Elabadagama, CD-Gonawa, CD-Hiruwalpola, CD-Bihalpola, CD-Bopitiya, CD-Batalagoda, CD-Balalla, CD-Bandara koswatte, CD-Udumulla, CD-Mothuwagoda, CD-Netiya, CD-Welikare, CD-Ataragalle, CD-Divullegoda, CD-Uhumeeya, CD-Dothalla, CD-Kadigawa, CD-Horathapola, CD-Kudagalgamuwa, CD-Minuwangette, CD-Tisogama, CD-Taranauduwela, CD-Talawa-Moragollagama, CD-Kalugalle, CD-Udubaddawa, CD-Kimbulwanaoaya, CD-Weerapokuna, CD-Weuda, CD-Usgala Siyambalagomuwa, CD-Kattimahana, , CD-Wadakada, CD-Kosdeniya, CD-Kumbukwewa, CD-Inguruwatte, CD-Makulpota, CD-Ethanawatta, CD-Potuhera, CD-Boyawalana, CD-Nagollagama, CD-Narangoda, CD-Melsiripura, CD-Kolambagama, CD-Maspotha, CD-Wewagama, CD-Udapolawatta, CD-Thambarombuwa, CD-Gonagama

10.3.7.2 Kurunegala District, Sri Lanka

Table 29 Kurunegala district, Sri Lanka health facility inventory

Facility Type	Facility Name
Provincial General Hospital	TH-Kurunegala (Line Ministry Inst.)
Base Hospital Type A	BH-Kuliyapitiya
Base Hospital Type B	BH-Nikaweratiya, DH-Polpitiyagama, DH-Galgamuwa
District Hospital	DH-Alawwa, DH-Dambadeniya, DH-Maho, DH-Mawathagama, DH-Polgahawela, DH-Ridigama, DH-Sandalankawa, DH-Wariyapola, DH-Hettipola, DH-Hiripitiya, DH-Gokarella, DH-Bingiriya, DH-Katupotha, DH-Narammala
Peripheral Unit	PU-Ambanpola, PU-Dunakadeniya, PU-Kandanegedara, PU-Mahagiriella, PU-Mahananneriya, PU-Megalewa, PU-Muwanhela, PU-Nikawewa, PU-Pahalagiribawa, PU-Thalampitiya, PU-Kotawehera, PU-Kobeigane, Rural Hospital, RH-Ehetuwewa, RH-Delwita, RH-Gonigoda, RH-

	Mahamukalanyaya, RH-Wellawa, RH-Koshena, RH-Karambe, RH-Indulgodakanda, RH-Nawatalwatta, RH-Rajanganaya,
Central Dispensary & Maternity Homes	CM-Munamaldeniya, CM-Madahapola, CM-Rasanayakepura (Pahala Mawathagama)
Central Dispensary	CD-Boraluwewa, CD-Buluwala, CD-Dodangaslanda, CD-Divurunpola, CD-Diganpitiya, CD-Elabadagama, CD-Gonawa, CD-Hiruwalpola, CD-Bihalpola, CD-Bopitiya, CD-Batalagoda, CD-Balalla, CD-Bandara koswatte, CD-Udumulla, CD-Mothuwagoda, CD-Netiya, CD-Welikare, CD-Ataragalle, CD-Divullegoda, CD-Uhumeeya, CD-Dothalla, CD-Kadigawa, CD-Horathapola, CD-Kudalgamuwa, CD-Minuwangette, CD-Tisogama, CD-Taranauduwela, CD-Talawa-Moragollagama, CD-Kalugalle, CD-Udubaddawa, CD-Kimbulwanaoya, CD-Weerapokuna, CD-Weuda, CD-Usgala Siyambalagomuwa, CD-Kattimahana, , CD-Wadakada, CD-Kosdeniya, CD-Kumbukwewa, CD-Inguruwatte, CD-Makulpota, CD-Ethanawatta, CD-Potuhera, CD-Boyawalana, CD-Nagollagama, CD-Narangoda, CD-Melsiripura, CD-Kolambagama, CD-Maspotha, CD-Wewagama, CD-Udapolawatta, CD-Thambarombuwa, CD-Gonagama

10.3.7.3 SRI LANKA disease communication paper documents

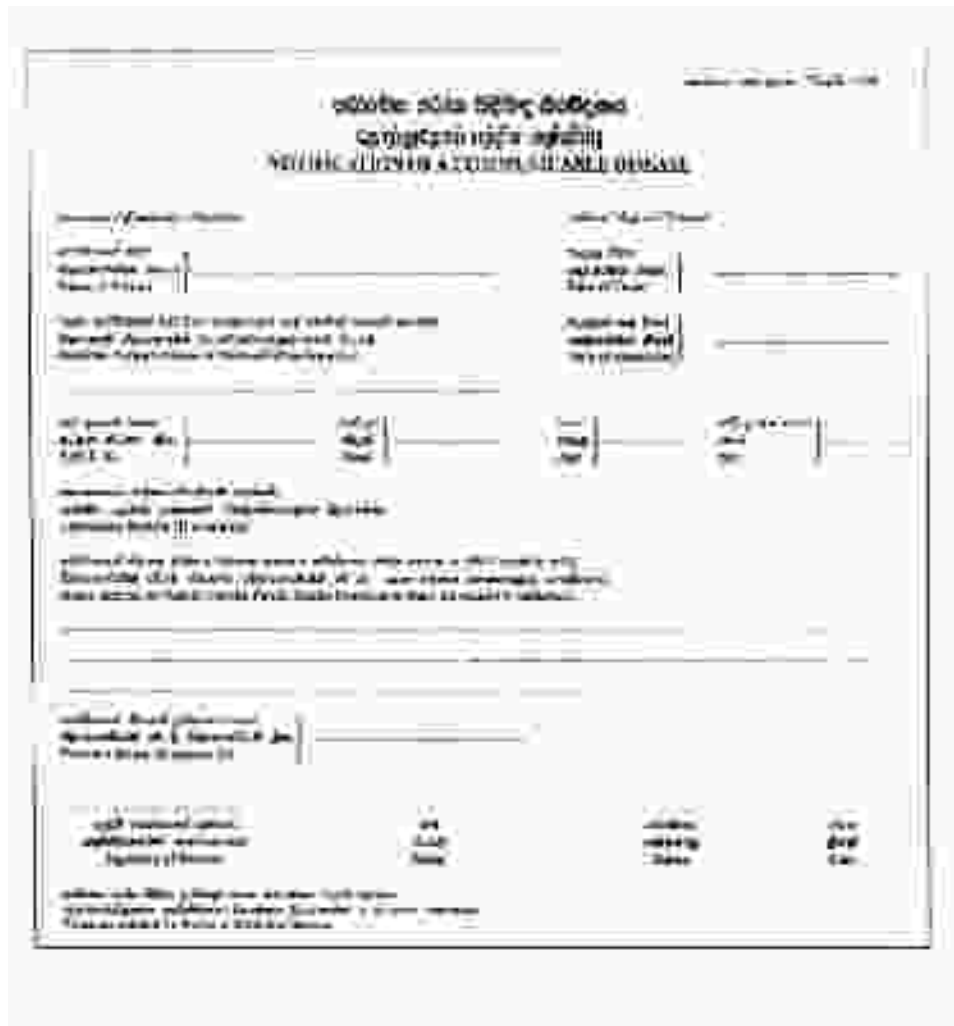


Figure 23: H-544 Form for communicating disease from MOH to PHI (Sri Lanka)

Table 4. Selected notifiable diseases reported by Medical Officers of Health

48th Nov - 1st Dec 2008 (10th Weekly)

D/DNS Division	Dengue Fever / DF		Dysentery		Eczematid		Etiatic Fever		Food Poisoning		Lepus febris		Typhoid Fever		Viral Hepatitis		Totals for island weekly
	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	
Colombo	26	3311	22	228	22	22	78	21	26	21	21	21	21	21	21	21	45
Galle	25	1872	22	200	22	22	23	21	21	21	21	21	21	21	21	21	44
Kalutara	11	874	11	102	10	10	10	10	10	10	10	10	10	10	10	10	20
Kandy	06	1225	06	60	06	06	11	01	01	01	01	01	01	01	01	01	12
Matale	10	823	10	297	10	10	11	10	10	10	10	10	10	10	10	10	17
Nuwara Eliya	02	31	02	301	02	02	12	00	00	00	00	00	00	00	00	00	14
Galle	10	113	10	10	10	10	10	10	10	10	10	10	10	10	10	10	14
Hambantota	08	113	08	10	08	08	12	00	00	00	00	00	00	00	00	00	10
Makumbura	11	111	11	10	11	11	10	10	10	10	10	10	10	10	10	10	10
Jaffna	00	4	00	271	00	00	18	00	00	00	00	00	00	00	00	00	00
Kulliyachchi	00	00	00	11	00	00	00	00	00	00	00	00	00	00	00	00	00
Moratuwa	00	00	00	10	00	00	00	00	00	00	00	00	00	00	00	00	00
Yanaraya	00	00	00	10	00	00	00	00	00	00	00	00	00	00	00	00	00
Mullitivu	00	00	00	10	00	00	00	00	00	00	00	00	00	00	00	00	00
Battaramulla	00	00	00	10	00	00	00	00	00	00	00	00	00	00	00	00	00
Ampara	00	00	00	10	00	00	00	00	00	00	00	00	00	00	00	00	00

Figure 26: Weekly Epidemiological Report (WER) published on the web by the Epidemiology Unit (Sri Lanka)

10.3.7.4 INDIA present disease communication web document

The screenshot shows a web-based form for entering morbidity data. At the top, there are fields for 'PHC ID', 'PHC Name', 'District', and 'Block'. Below this is a section for 'PHC Details' with a table for 'PHC Details' containing columns for 'PHC ID', 'PHC Name', 'District', 'Block', and 'State'. The main part of the form is a large table for 'Morbidity Report' with columns for 'Disease', 'Age Group', 'Male', 'Female', and 'Total'. The 'Disease' column lists various ailments like 'Malaria', 'Typhoid', 'Dysentery', etc. The 'Age Group' column has categories like '0-4', '5-9', '10-14', '15-19', '20-24', '25-29', '30-34', '35-39', '40-44', '45-49', '50-54', '55-59', '60-64', '65-69', '70-74', '75-79', '80-84', '85-89', '90+'. The 'Male', 'Female', and 'Total' columns are for recording the number of cases. The form is designed for data entry through a web browser.

Figure 27: PART I - Public Health Center Morbidity Report Entry report (entered through the web)

Section	Item	Yes	No	Other
1. General Information	1.1 Patient Name			
	1.2 Age			
	1.3 Sex			
	1.4 Date of Birth			
	1.5 Address			
	1.6 Contact Number			
	1.7 Date of Report			
2. Presenting Complaint	2.1 Cough			
	2.2 Fever			
	2.3 Headache			
	2.4 Sore Throat			
	2.5 Fatigue			
	2.6 Loss of Appetite			
	2.7 Other			
3. History of Present Illness	3.1 Onset			
	3.2 Duration			
	3.3 Progression			
	3.4 Associated Symptoms			
	3.5 Previous Episodes			
	3.6 Risk Factors			
	3.7 Exposure			
	3.8 Contact			
	3.9 Travel			
	3.10 Other			
4. Past Medical History	4.1 Diabetes			
	4.2 Hypertension			
	4.3 Asthma			
	4.4 Heart Disease			
	4.5 Kidney Disease			
	4.6 Liver Disease			
	4.7 Other			
5. Social History	5.1 Smoking			
	5.2 Alcohol			
	5.3 Occupation			
	5.4 Other			
6. Additional Comments	6.1			
	6.2			
	6.3			

Figure 28: PART II - Public Health Center Morbidity Report Entry report (entered through the web)

10.3.8 The proposed hospital re-categorization

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The network of government hospitals is primarily responsible for carrying out the curative health care delivery system. The range of hospitals includes sophisticated teaching hospitals to maternity homes and central dispensaries, which are scattered in the rural areas. Teaching hospitals, base hospitals, District general hospitals, District hospitals, peripheral units, rural hospitals, and maternity homes provide in-patient care facilities for over 95% of the patients who seek admission.

Keeping in line with the health policy of Sri Lanka it is essential that these hospitals be developed in order to ensure equity of health care delivery system. It has been stipulated in the National Health Policy developed in 1996 and the 1998 Presidential Task Force report on Health Policy Implementation that one District Hospital in every District will be upgraded in to a District General Hospital. Presently hospitals are selected for development when funds are available. Sometimes opinion based, unorganized hospital development has caused problems such as unavailability of Human Resources and logistical problems leading to under utilization of these developed hospitals.

The door to successful user-friendly hospital system hinges on evidence based, planned hospital development system. Therefore, it is proposed that a comprehensive need-based, bottom-up, hospital development plan to be developed using a participatory approach. This concept paper described the detailed steps in developing a National Hospital Development Plan.

As the first phase of the activity, it is proposed to re-categorize the hospitals into four categories, which will provide the foundation for decision making in the hospital developmental process. Once approved it is proposed to workout finer details, the infrastructure, human resources, equipment, drugs and supplies, and other logistics which will enable hospitals to be developed in a uniform manner. This proposal explicitly describes the proposed re-categorization of hospitals.

10.3.9 The nomenclature of hospital to be changed

Teaching Hospital/Provincial Hospital (Kurunagala)

Teaching hospitals are those hospitals where professorial wards are established and are engaged in under-graduate and/or post-graduate training. In provinces that do not have a teaching hospital, will be developed with similar facilities. (Kurunagala is a teaching hospital)

List of Services offered:

1. Outpatient department (OPD) with separate Preliminary Care Unit, Emergency Care Unit and Screening Facilities.
2. Clinic Facilities
3. In-ward Facilities

three Medical units
 three Surgical units
 three Gynecology and Obstetrics units
 three Pediatric units
 one Neurology unit
 one Cardiology unit
 one Dermatology unit
 one Psychiatry unit
 one Rheumatology unit
 one Oncology unit
 one STD/AIDS unit

one Neuro-surgical unit
 two Orthopedic surgical unit
 two ENT surgical unit
 two Eye surgical unit
 one Genito-urinary surgical unit
 one Paediatric surgical unit
 one Nephrology unit
 one Neo-natology unit
 Chest Medicine
 Transfusion Medicine

4. Intensive Care Units

- Medical Intensive Care Unit (MICU)
- Surgical Intensive Care Unit (SICU)
- Cardiac Intensive Care Unit (CICU)
- Coronary Care Unit (CCU)

5. Operation Theatres

6. Diagnostic services

- Radiology Dept.
- Pathology Dept. with Histopathology, Hematology and Microbiology units

7. Accident service/Trauma Surgery unit

8. Medico-legal Department

9. Maxcillo Facial Surgical Unit

10. Orthodontic Unit

11. Public Health Unit

12. Medical Statistic Unit

13. Dept. of Anesthesia

District General / District Base Hospitals (Kuliyapitiya, Nikaweratiya)

All existing District general hospitals and base hospitals will be renamed as District base hospitals. Each District will have one District general hospital and one or two District base hospitals to fulfill the needs of the population.

List of Services offered:

1. Outpatient Department (OPD) with separate Preliminary Care Unit, Emergency Care Unit and Screening Facilities.
2. Clinic Facilities
3. In-ward Facilities

Two Medical units
 Two Surgical units
 Two Gynecology and Obstetrics units
 Two Pediatric units
 one Psychiatry unit
 one Dermatology unit
 one Orthopedic surgical unit
 one ENT surgical unit
 one Eye surgical unit
 two Anesthesia Units

4. Intensive Care Unit
5. Operation Theaters
6. Diagnostic services
 - Radiology Dept.
 - Pathology Dept.
7. Medico-legal Dept.
8. Maxillo facial Surgical Unit
9. Public Health Unit
10. Medical Records Unit

Divisional Hospitals

All District hospitals, rural hospitals, and peripheral units Will be re-named as Divisional hospitals (DH) irrespective of the number of beds.

Type A DH – More than 100 patient beds
 Type B DH – Between 50-100 patient beds
 Type C DH – Fewer than 50 patient beds

Each DDHS area is to be served by one divisional hospital according to availability of resources.

List of Service offered:

1. Outpatient care with a ETU for limited emergency and screening
2. Basic laboratory facilities

3. Minor operation facilities
4. Lab our room
5. Wards:
 - one Maternity ward
 - one male and one female Medical and Surgical ward
 - One children's ward
6. Dental unit
7. Facilities for continuation of treatment of patient referred by secondary and tertiary medical institutions for a limited period of time
8. Facilities for a polyclinic including Ante-Natal, Post Natal, Family Planning, Child Health, Well Women clinic etc.
9. Ambulance

(Services of visiting consultants will be available in some of these hospitals through outreach clinics)

Primary Medical Care Units

Central Dispensaries &

- Maternity Homes will be renamed as PUC

List of Services offered:

1. Outpatient care
2. Limited emergency care: facilities for stabilization of patients before referring to secondary or tertiary care medical institutions.
3. Facilities for a poly-clinic including ante-natal, post-natal, family planning, child health, and well-women.

Acknowledgement

The information on this topic was obtained with the assistance of Mr. P.V. Ariyawansa, Executive Assistant/District Coordinator, Sarvodaya, Kurunegala District Office, Kuliypitiya, Sri Lanka and Mr. Neil Sirisena, District Health Education Officer, Medical Officer of Health Office, Kuliypitiya, Sri Lanka.

10.3.10 ICD 10 Examples

B01 Chickenpox (Varicella)	diffuse papulovesicular rash; vesiculopustular rash appearing on the trunk and face; Detection of viral antigen; Isolation of the virus from skin scraping Demonstration of specific IgM in a serum
A00 Cholera	severe dehydration, acute watery diarrhea, vomiting; isolation of <i>Vibrio cholera</i> O1 or O139 from stools
A90 Dengue Fever	An acute febrile illness of 2-7 days duration with 2 or more; of the following: headache, retro-orbital pain, myalgia, arthralgia, flushed

	<p>extremities, tender hepatomegaly, rash, eucopenia, thrombocytopenia and hemorrhagic manifestations</p> <p>Isolation of the dengue virus from serum, plasma, leukocytes, or autopsy samples. Detection of viral genomic sequences serum, CSF or autopsy tissues by polymerase chain reaction (PCR).</p> <p>Demonstration of a fourfold or greater rise in IgG titer to one or more dengue virus antigens in paired serum samples by ELIZA or HI assay.</p>
A91 Dengue Hemorrhagic Fever / Dengue Shock Syndrome	<p>Rapid and weak pulse, narrow pulse pressure (- 20 mmHg) or hypotension for age, cold clammy extremities and restlessness.</p> <p>Positive tourniquet test Petechiae, ecchymosis or purpura</p> <p>Bleeding: mucosa, gastrointestinal tract, injection sites or other</p> <p>Hematemesis or melaena and thrombocytopenia (100,000 cells or less per mm³) and evidence of plasma leakage due to increased vascular permeability, manifested by $\geq 20\%$ rise in average hematocrit for age and sex $\geq 20\%$ drop in hematocrit following volume replacement treatment compared to baseline signs of plasma leakage (pleural effusion, ascites, hypoproteinaemia)</p> <p>Isolation of the dengue virus from serum, plasma, leukocytes, or autopsy samples Detection of viral genomic sequences in autopsy tissue, serum or CSF samples by polymerase chain reaction (PCR)</p> <p>Demonstration of a fourfold or greater change in IgG titer to one or more dengue virus antigens in paired serum samples by ELIZA or HI assay</p>
A 36 Diphtheria	<p>stridor characterized by laryngitis, pharyngitis or tonsillitis, and adherent membranes of tonsils, pharynx and/or nose. Isolation of toxigenic <i>Corynebacterium diphtheria</i> from a clinical specimen.</p> <p>A rise in serum antibody (fourfold or greater)</p>
02, A 03, A 04, A 06, A 09 Dysentery	<p>diarrhea with blood and or mucus and with or without fever, nausea, abdominal cramps, and tenesmus. Stool culture and ABST for sensitivity pattern.</p>
G04 Encephalitis	<p>A febrile illness of variable severity associated with neurological features ranging from headache to alteration of level of consciousness and signs and symptoms suggestive of meningitis and encephalitis. Symptoms can include headache, fever, meningeal signs, seizures, stupor, disorientation, coma, tremors, paresis (generalized), hypertonia, loss of coordination.</p> <p>Fourfold or greater rise in JE virus-specific IgG antibody in paired sera (acute and convalescent phases), ELISA, haemagglutination inhibition test or virus neutralization test, in a patient with no history of recent yellow fever vaccination and where cross-reactions to other flaviviruses have been excluded JE virus specific IgM antibody in a single blood sample in late acute phase or early convalescence</p>

	<p>JE virus-specific IgM antibody in the CSF by IgM capture ELISA or Detection of the JE virus, antigen or genome in brain, spinal cord by immunochemistry or immunofluorescence or PCR</p>
A01 Enteric Fever (Typhoid Fever)	<p>insidious onset of sustained fever, headache, malaise, anorexia, in children coated tongue, relative bradycardia, splenomegaly, constipation or diarrhea, nonproductive cough and may have a skin rash.</p> <p>Enteric fever – Isolation of <i>Salmonella typhi</i> from blood, stool or other clinical specimen. Serological tests based on agglutination antibodies (SAT) are of little diagnostic value because of limited sensitivity and specificity. However, the demonstration of a fourfold rise in antibody titre is confirmatory of salmonella infection.</p>
A02, A05, T61, T 62 Food Poisoning	<p>Acute gastroenteritis in a person linked to an ingested food or liquid: or an outbreak of acute gastroenteritis in two or more persons linked by common exposure to a food or liquid ingested</p> <p>Isolation of certain food borne organism (e.g. <i>Salmonella</i>) or toxins from relevant clinical samples. Isolation of suspected organism in sufficient quantities from incriminated food samples or detection of toxins from food samples.</p>
A82 Human Rabies	<p>Acute neurological syndrome (encephalomyelitis) characterized by forms of hyperactivity in the majority of subjects (furious rabies) or paralytic syndromes seen less often (dumb rabies) which progresses towards coma and death usually by respiratory failure, within 10 to 14 days after developing the first symptom, if no intensive care is instituted. An exposure could be bites, scratches, contamination of mucous membranes or contamination of an open wound with saliva from a suspected rabid animal, which usually should be obtained from the patient's medical history. The incubation period may vary from less than 1 week to more than 1 year, but usually falls between 30-90 days.</p> <p>Detection of rabies viral antigens by direct fluorescent antibody (FA) in clinical specimens, preferably brain tissue (collected at post mortem)</p> <p>Detection by FA on skin or corneal smear (collected ante mortem)</p> <p>FA positive after inoculation of brain tissue, saliva or CSF in cell culture, or in mice by intracerebral inoculation</p> <p>Detectable rabies-neutralizing antibody titre in the CSF of an unvaccinated person</p> <p>Identification of viral antigens by PCR on fixed tissue collected post mortem or in a clinical specimen (brain tissue or skin, cornea or saliva)</p> <p>Isolation of rabies virus from clinical specimens and confirmation of rabies viral antigens by direct fluorescent antibody FA testing</p>

A27 Leptospirosis	<p>Acute febrile illness with headache, myalgia and prostration associated with any of the following symptoms: conjunctival suffusion / conjunctival hemorrhage meningeal irritation anuria or oliguria / proteinuria / hematuria jaundice hemorrhages (from the intestines; lung bleeding is notorious in some areas), purpuric skin rash cardiac arrhythmia or failure and a history of exposure to infected animals or an environment contaminated with animal urine; commonly as an occupational hazard.</p> <p>Other common symptoms include nausea, vomiting, abdominal pain, diarrhea, and arthralgia.</p> <p>Direct microscopy (dark ground) of blood and urine Isolation from blood or other clinical materials through culture of pathogenic leptospirosis Positive serology, preferably Microscopic Agglutination Test (MAT), using a range of Leptospira strains for antigens that should be representative of local strains or using a non-pathogenic leptospira strain to detect genus specific antibodies with a 4 fold rise.</p>
B50 - 54 Malaria	<p>A patient residing in malaria endemic area or having a history of visiting a malaria endemic area, presenting with fever or history of fever with chills & rigors and headache. (Nonspecific symptoms otherwise unexplained, includes – Myalgia, backache and joint pain)</p> <p>Demonstration of malaria parasites in blood films (mainly asexual forms) by Microscopy or Antigen detection by Rapid Detection Test.</p>
B05 Measles	<p>Fever and Maculopapular (i.e. non-vesicular) rash and at least one of the following: Cough, Coryza (i.e. runny nose), Conjunctivitis (i.e. red eyes)</p> <p>Detection of measles specific IgM antibodies in blood collected within 3-28, days of onset of rash</p> <p>Isolation of measles virus from urine, naso-pharyngeal aspirates or peripheral blood lymphocytes during the prodrome or rash stages of the disease</p>
G00, A87 Meningitis	<p>Fever of acute onset with one or more of the following signs of meningeal, irritation/inflammation, Neck stiffness, Irritability, Poor sucking (in infants), Seizures, Bulging fontanel (in infants), Other signs of meningeal irritation/inflammation, Altered consciousness</p> <p>Culture: Isolation of a causal organism by culturing CSF and/or blood. Antigen Detection: Demonstration of an antigen of a causal organism by methods such as latex agglutination or counter-immunoelectrophoresis, in CSF and/or blood.</p>
B26 Mumps (Infectious Parotitis)	<p>An illness with acute onset of unilateral or bilateral tender, self-limited swelling of the parotid or other salivary gland, lasting more than or equal to 2 days, and without other apparent cause.</p>

	Demonstration of mumps specific IgM antibody in a single serum sample.
A20 Plague	<p>Rapid onset of fever, chills, headache, severe malaise, prostration, with bubonic form*- extreme painful swelling of lymph nodes (buboes) in axilla or groin, pneumonic form*- cough with blood-stained sputum, chest pain, difficulty in breathing</p> <p>*Both forms can progress to septicemic form with toxemia; characterized by disseminated intravascular coagulation, hypotension and cardiac failure.</p> <p>Isolation of Yersinia pestis in cultures from buboes, blood, CSF or sputum or Passive haemagglutination (PHA) test, demonstrating an at least fourfold rise in antibody titre, specific for F1 antigen of Y. pestis, as determined by the haemagglutination inhibition test (HI) in paired sera.</p>
B06 Rubella	<p>An illness that has following characteristics: Acute onset of generalized maculopapular rash Temperature greater than 99.00F (greater than 37.20C), Arthralgia/arthritis, lymphadenopathy (Usually sub occipital, post auricular and cervical) or conjunctivitis</p> <p>Detection of Rubella specific IgM in blood specimen obtained within 28 days of onset of the rash. Either seroconversion or four fold rise of IgG antibody between acute and convalescence samples.</p>
P35 Congenital Rubella Syndrome (CRS)	<p>Surveillance case definition An illness usually manifesting in infancy resulting from rubella infection in utero and characterized by signs or symptoms from the following categories*: Cataracts/congenital glaucoma, pigmentary retinopathy, congenital heart disease (most commonly patent ductus arteriosus, or peripheral pulmonary artery stenosis), loss of hearing, purpura, splenomegaly, jaundice, meningoencephalitis, microcephaly, mental retardation, radiolucent bone disease, laboratory data consistent with congenital rubella infection</p> <p>*Some children may have only one symptom</p> <p>Demonstration of a rubella specific IgM antibody in the infant. Almost all infants with CRS will have a positive rubella specific IgM in the 1st 6 months of life and 50-60% will be positive during the 2nd 6 months of life. Demonstration of a significant rise in Rubella specific IgG antibody in the infant during follow up or IgG rubella antibody level that persists at a higher level and for a longer time period than expected from positive transfer of maternal antibody (Maternal IgG antibody persists up to six months of age and then gradually disappears).</p>

Not classified - Severe Acute Respiratory Syndrome (SARS)	<p>Fever (≥ 38°C) and One or more symptoms of lower respiratory tract illness (cough, difficulty in breathing, shortness of breath) and Radiographic evidence of lung infiltrates consistent with pneumonia or Respiratory Distress Syndrome (RDS) or autopsy findings consistent with the pathology of pneumonia or RDS without an identifiable cause. And No alternative diagnosis can fully explain the illness and History of visit to an affected area or close contact with a patient suspected to have SARS; within 10 days of the onset of the illness</p> <p>Isolation of SARS virus from nasopharyngeal aspirate, blood or stools.</p> <p>Detection of rising titres of SARS viral antibody between acute and convalescence samples.</p>
Not classified – Simple Continued Fever of 7 days or more	A febrile illness lasting 7 days or more where no cause is found even after seven days provided basic investigations have been carried out.
A35, A34 -	<p>Clinical picture compatible with Tetanus: Acute onset of hypertonia and/or painful muscular contractions (usually of the muscles of the jaw and neck) and generalized muscle spasms without other apparent medical cause.</p> <p>Diagnosis is mainly dependent on the clinical criteria.</p> <p>Detection of tetanus toxoid antibody in an unvaccinated and untreated patient and demonstration of a specific tetanus toxoid antibody response in a laboratory where appropriate laboratory facilities are available.</p>
A33 - Neonatal Tetanus	Any neonatal death between 3 – 28 days of age in which the cause of death is unknown or Any neonate reported as having suffered from neonatal tetanus between 3 – 28 days of age and not investigated.
A15 – A19 Tuberculosis (Pulmonary)	Signs and symptoms suggestive of tuberculosis particularly cough of three weeks duration or more. Symptoms suggestive of Tuberculosis: Hemoptysis Loss of appetite Shortness of Breath Loss of weight Fever and night sweats Tiredness. Smear positive patient: Two sputum smears are positive for Acid Fast Bacilli (AFB), One sputum smear positive for AFB and radiological abnormalities consistent with active pulmonary tuberculosis, One sputum smear positive for AFB and culture positive for Mycobacterium tuberculosis Smear negative patient with positive culture.
A75 Typhus Fever	An acute febrile illness associated with an eschar, headache, macular popular skin rash conjunctival injection, lymphadenopathy and profuse sweating and cough. Defervescence within 48 hours following Tetracycline therapy strongly suggestive of Rickettsial

	<p>infection. Eschar may or may not be present History of tick bite or travel to scrub areas Rash may be overlooked in patients with dark skin</p> <p>Demonstration of a fourfold rise in antibody titre by Weil-Felix test or IF test. The Weil-Felix test is less specific and less sensitive than the IF test. The Weil-Felix test is currently available at the Medial Research Institute and the IF test will be available in the future.</p>
B15 – B19 Viral Hepatitis	<p>Acute illness including acute jaundice, dark urine, anorexia, malaise, extreme fatigue, and right upper quadrant tenderness.</p> <p>Hepatitis A: Demonstration of Hepatitis A IgM Antibody in a serum sample.</p> <p>Hepatitis B: Demonstration of Hepatitis B surface antigen (HBsAg) or HBc antigen IgM in a serum sample. 38</p> <p>Note 1: The anti-HBc IgM test, specific for acute infection, is not available in most countries. HBsAg, often available, cannot distinguish between acute new infections and exacerbations of chronic hepatitis B, although continued HBsAg seropositivity (>6 months) is an indicator of carrier stage.</p> <p>Note 2: For patients negative for hepatitis A or B, further testing for a diagnosis of acute hepatitis C, D, or E is recommended. anti-HCV positivity in a previously negative person</p> <p>Hepatitis C: (seroconversion)</p> <p>Hepatitis D: Anti-HDV positive HBsAg positive or IgM anti-HBc positive (only as co-infection or super-infection of hepatitis B)</p> <p>Hepatitis E: IgM anti-HEV positive</p>
A37 Pertussis / Whooping Cough	<p>A person with a paroxysmal cough* with at least one of the following**: inspiratory 'whooping', post-tussive vomiting (i.e. vomiting immediately after coughing), Subconjunctival hemorrhage without other apparent cause, *In older children if cough lasts more than two weeks **In neonates apneic attacks may be present</p> <p>Isolation of Bordetella pertussis or Bordatella parapertussis Detection of genomic sequences by polymerase chain reaction (PCR).</p>
A95 Yellow Fever	<p>A disease characterized by acute onset of fever followed by jaundice within 2 weeks of onset of first symptoms. Hemorrhagic manifestations and signs of renal failure may occur; and a history of travel to a Yellow fever affected area within the last six days (longest incubation period for yellow fever)</p> <p>Isolation of yellow fever virus, or Detection of yellow fever specific IgM or a four-fold or greater rise in serum IgG levels in paired sera (acute and convalescent) or Positive post-mortem liver histopathology or Detection of yellow fever antigen in tissues by immunohistochemistry</p>

	Detection of yellow fever virus genomic sequences in blood or organs by PCR
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