Medical Cause of Death of burn victims in a hospital in northern Iraq: a challenge for the health management information system

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"Medical Cause of Death of burn victims in a hospital in northern Iraq: a challenge for the health management information system"

A thesis submitted in partial fulfillment of the requirement for the degree of Master of International Health

By

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Abbreviation

A-MCoD: Antecedent Medical Cause of Death
ARF: Acute Renal Failure
ARS: Acute Renal Shock
BCU: Burn Care Unit
BIWRAMC: Borden Institute Walter Reed Army Medical Center
CBMIS: Community-Based Management Information System
CBMIS: Community-Based Management Information System
DF: Degrees of Freedom
DIC: Disseminated Intravascular Coagulation
D-MCoD: Direct Medical Cause of Death
EBH: Evidence Based Health
EBM: Evidence Based Medicine
ER: Emergency Room
FHSIS: Field Health Service Information System
GDP: Gross Domestic Product
GI: Gastro Intestinal
GTZ: German Agency for Technical Cooperation
HAI: Hospital Associated Infection
HMIS: Health Information Management System
HMT: Hospital Management Team
HOMIS: Hospital Management Information System
IACCI: Iraqi American Chamber of Commerce and Industry
ICD: International statistical Classification of Diseases and Related Health Problems
ICD-10: International statistical Classification of Diseases and Related Health Problems Tenth Revision
ICU: Intensive Care Unit
IFMCCD: International Format of Medical Certificate of Cause of Death
INGO: International Non Governmental Organization
IV: Intra Venous
JTTS: Joint Theater Trauma System
KRG: Kurdistan Regional Government
MCoD: Medical Cause of Death
MDG: Millennium Development Goal
MoH: Ministry of Health
MSH: Management Science for Health
NCVHS: National Committee on Vital and Health Statistics

OT: Operation Theater
PMIS: Patient Management Information System
SBT-hp: Sulaymaniyah Burn-Trauma Hospital
SoMCoD: Statistics of Medical Cause of Death
U.S.A: United States of America
U-MCoD: Underlying Medical Cause of Death
UN: United Nation
UNHCR: United Nation High Commissioner for Refugee
USAISR: U.S. Army Institute of Surgical Research
VF: Ventricular Fibration
WB: World Bank
WEDI: Workgroup for Electric Data Interchange
WHO: World Health Organization

Abstract

Kentaro HAYASHI, (2009), "Medical Cause of Death of burn victims in a hospital in northern Iraq: a challenge for the health management information system "
Key words: accuracy, appropriateness, validity, statistics of medical cause of death, burn injury, Health Management Information System
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Problem Statements: Health Management Information Systems (HMIS) play a core part of Evidence Based Healthcare (EBH). Medical cause of death (MCoD) and Statistics of medical cause of death (SoMCoD) are core information obtained from HMIS. If the quality of information is poor, it poses problems for the development of health policy and strategy. **Objectives**: Assess the validity of MCoD/SoMCoD and explore factors that influence information quality produced by the HMIS of Sulaymaniyah Burn-Trauma Hospital (SBT-hp), Iraqi-Kurdistan. **Method**: Comparison of SoMCoD obtained from data recorded in SBT-hp Hospital Management Team (HMT) database and that obtained from reviewing medical records by the specialists. Review literature about factors that influence the quality of information and HMIS in low/middle income countries. **Findings & Discussion**: Difference in descriptions of MCoD is found between the hospital and expert reviewers as well as inaccuracy and inappropriateness of MCoD and SoMCoD. From a literature review several factors were identified that influence the quality of information: "inadequate appreciation of the value of data", "Lack of guidelines", "Lack of standard case definitions", "Inability to achieve the needed concordance between efficiency/simplicity and sufficiency", "Lack of community and key stake holders participation", "Weakness in capacity to monitor & evaluation", "Lack of capacity in analysis/interpretation of data/information", "Weak feed back mechanism", "Weak environment and support from the laboratory", and "Shortage of trained personnel". **Conclusion**: To better describe the MCoD of burn victims in this hospital, international form of medical certificate of cause of death should be use. For better treatment results, the diagnostic entity "volume overload" has priority over "septicaemia" as was indicated by hospital statistics. Development of a well functioning HMIS in SBT-hp is challenging task and a prerequisite for EBH.

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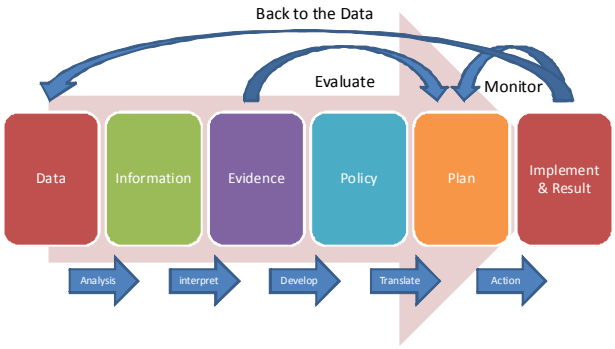
1. Introduction

Health Management Information System (HMIS), one of the core components of Evidenced-Based Health-Care/Hospital-Management (EBH), began to be accepted as an idea for decision making in delivery of health services for groups of patients or population. Evidence Based Medicine (EBM) is an emerging discipline now and a widely accepted idea for decision making in clinical practice. EBH will directly influence the cost of delivering health services (Muir 1997). In EBH, HMIS plays a crucial role because it provides evidence through the processing of data & information for decision making (Campbell 2009) (Figure 1-1).

Figure 1-1



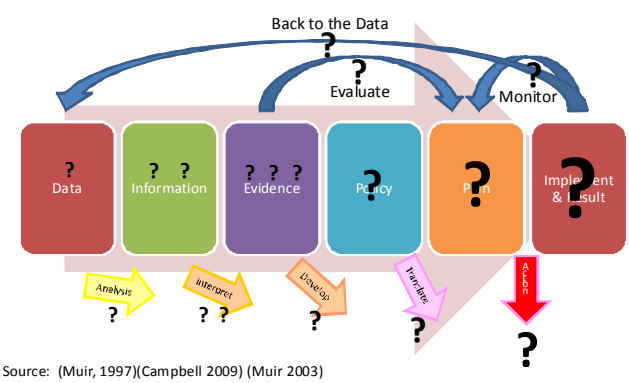
Source: (Muir, 1997)(Campbell 2009) (Muir 2003)

In middle/low income countries, because of limited budget, the importance of certain evidence is highly significant (Muir 2009). To provide efficient and equitable health care, accurate, timely and appropriate information and evidence is necessary. HMIS is also important in such context as there is difficulty in delivering basic health care to the population (GTZ 2004). The middle/low income country, coping with conflict, and highly dependent on foreign aid for its delivery of health services, faces severe financial limitations. Also foreign aid agencies will need good quality information to justify their interventions to their own donors. (Muir 2009) (Haywood 1997).

However, if HMIS is underdeveloped or defective, it would be unable to produce reliable evidence and would prevent the practice of EBH. Incorrect evidence will result in disoriented policy and planning (Figure 1-2).

In this thesis, I will identify the accuracy/appropriateness of data and information, as well as describe the validity of evidence used for developing

Figure 1-2



Source: (Muir, 1997)(Campbell 2009) (Muir 2003)

hospital policy at Sulaymaniyah Burn-Trauma Hospital (SBT-hp) in Iraqi-Kurdistan. By exploring factors influencing the quality of data & information and the reliability of evidence and HMIS of SBT-hp, I will make recommendations for developing a proper HMIS and management of burns in resource limited settings.

2. Background

In northern Iraq, there is an area called Iraqi-Kurdistan, the land of Kurds, which is internationally recognized as an autonomous federal entity (Vivano 2006). The Kurds are the biggest ethno-linguistic group, who have historically inhabited the mountainous areas to the south of Caucasus including northern parts of Iraq and don't have their own nation (Llya 1985).

Under the Ba'ath Party regime, the Iraqi-Kurds suffered a lot as known in al-Anfal Campaign (Human Rights Watch 1993). At the end of the First Gulf War, amid the withdrawal of Iraqi forces from three Northern provinces, Kurds established their safe haven in northern Iraq and Iraqi-Kurdistan emerged in 1992 (Fawcett 2001). Just after the establishment, Iraqi-Kurds were subject to a double embargo imposed by the United Nations (UN) on Iraq on one hand and by Saddam Hussein on the other hand. The severe economic hardship caused by the embargoes resulted in intra-Kurdish warfare till 1998 (Leezenberg 2005).

On March 20th, 2003, the invasion of Iraq was launched by the coalition forces of the United States of America (U.S.A.) initiative (CNN 2003). The former Iraqi regime was quickly toppled and on May 1, 2003, the U.S. president claimed victory (CNN 2003). Nonetheless, the war has continued for years, with insurgents against coalition forces, Iraqi police units and the Iraqi government. The insurgency has also featured regular and brutal attacks against the civilian population of Iraq often utilizing suicide bomber tactics (Daniel 2007).

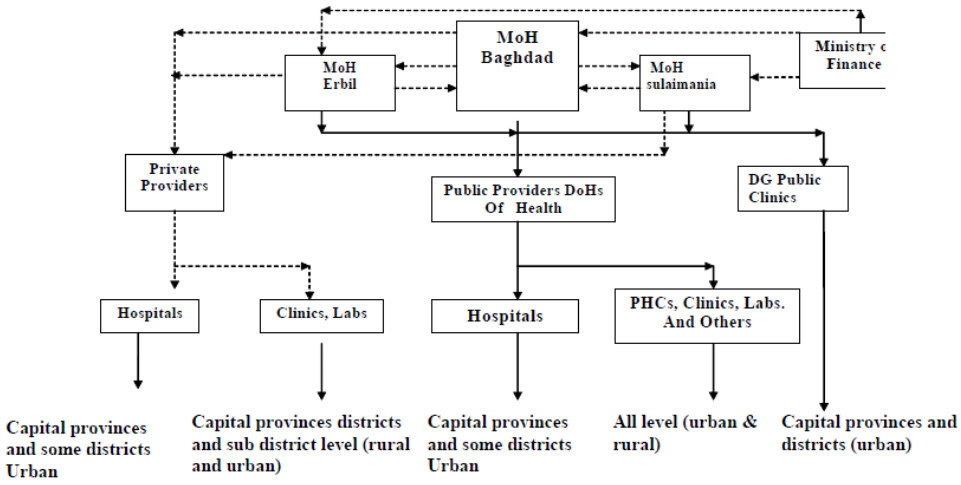
Iraqi-Kurdistan consists of 3 governorates, As-Sulaymaniyah, Erbil and Dahuk, covering a total area of 40,000 km^2 (Kurdistan Regional Government (KRG) 2008). The population is 3,760,000 (UN 2002). Iraqi-Kurdistan is classified as a middle income country by the World Bank (WB) (WB 2000). Gross Domestic Product (GDP) is 27 billion, and GDP/capital is 5,500 US$ (Wikipedia Iraqi Kurdistan 2009). Kurd is the main ethnicity but Iraq-Arab, Assyrian-Christians and Iraqi-Turkmens also exist as minor ethnic groups. Since 2003, massive immigration from Arab parts of Iraq as well as Turkey and South-Asia has been observed but the figure is not clear due to political & military instability (KRG 2009). The

dominant religion is Islam (both branches, Sunni and Shia), adhered to by 90% of its inhabitants. Christianity, Judaism and Yezidism exist as minor religious groups (KRG 2009).

The health system of Iraqi-Kurdistan has been administrated by both Ministry's of Health (MoH), MoH-Erbil & MoH-Sulaymaniyah, because of political independency from Baghdad (figure 2) (WHO 2005). MoH provide support and supervise all health providers, public & private, but face difficulties because of political instability. Since the financial sanctions of the 1990's, the cost of medical/health service has been totally dependant on the patients. There was no financial support from the government and both private and public insurance systems did not exist (WHO 2005).

Figure 2

Health Organization Diagram of Iraq & Iraqi-Kurdistan



Source: (WHO 2005)

In order to provide medical services for burn & trauma victims of the population of As-Sulaymaniyah district, Sulaymaniyah Burn-Trauma Hospital (SBT-hp) has been established as a public sector institute. The total area of As-Sulaymaniyah governorate is 17,023 km2, and the population is 1,547,000 (Iraqi American Chamber of Commerce & Industry (IACCI) 2009). However, as one of its primary functional features is a burn-care hospital and because of the restriction of available hospitals due to the military campaign, accepted burn cases come from the whole of Iraqi-Kurdistan and the rest of Iraq.

Of international burden of burn, 95% of fire-related burns occur in low/middle income countries (WHO 2008) (figure 3). It is therefore imperative that effective and efficient burn prevention and care is given due attention in international and public health. Smoking/alcohol abuse, low socio/economic environment, gender inequality, domestic violence, and some local cultural practices are risk factors for burn injuries (WHO 2004).

Figure 3

Burden of Burn in low/middle income country

REGION	Africa	The Americas		South-East Asia	Europe		Eastern Mediterranean		Western Pacific		WORLD
Income group	low/ middle	high	low/ middle	low/ middle	high	low/ middle	high	low/ middle	high	low/ middle	
Number of burn deaths (thousands)	43	4	4	184	3	21	0.1	32	2	18	312
Death rate (per 100 000 population)	6.1	1.2	0.8	11.6	0.7	4.5	0.9	6.4	1.2	1.2	5.0
Proportion global mortality due to fires (%)	13.8	1.3	1.3	59.0	1.0	6.7	0.02	10.3	0.6	5.8	100

*Countries within each geographical region have been further subdivided by income level, according to the divisions developed by the WB.
Source: (WHO Global Burden of Disease Database, 2002 (version 5)).

In low/middle income countries, the burden of burns in areas of conflict seems higher due to the changing nature of the war. Firstly, risk factors are enhanced by the conflict because the ultimate goal of war in the modern era is no longer territorial conquest but rather societal disruption (Ronald 2005).

Additionally, the increase of victims of suicide vehicle bomb attacks, one of the characteristics modern conflicts, contributes to the heavier burden of burns in areas of conflict. As modern conflict is characterized by guerillas or insurgents striking at seemingly randomly selected targets (Ronald 2005), the number of victims of vehicle bomb attacks has considerably increased (Iraq Body Count 2008). The fact that most fatalities due to vehicle bomb attacks are the result of burns, (Almong 2005) consequently increases the burden of burn in Iraqi-Kurdistan.

Related to the capacity to provide adequate burn care, there is a

remarkable difference in the outcome of burn care between high & middle/low income countries (WHO 2004). For example, a patient with a burn of 80% of total body surface would survive with satisfactory functional outcome in Australia (Davey 1999), whilst in Nepal no patient would survive with a burn to more than 40% of their total body surface (Liu 1998).

To save life by providing adequate care for war victims, an International Non Governmental Organization (INGO) started to support SBT-hp from June 2007. They provide financial & technical support, including hospital management. For this purpose, the INGO sends expatriate staff, inclusive of a hospital manager and medical specialists, to form the hospital management team (HMT) with cooperation of MoH-Sulaymaniyah.

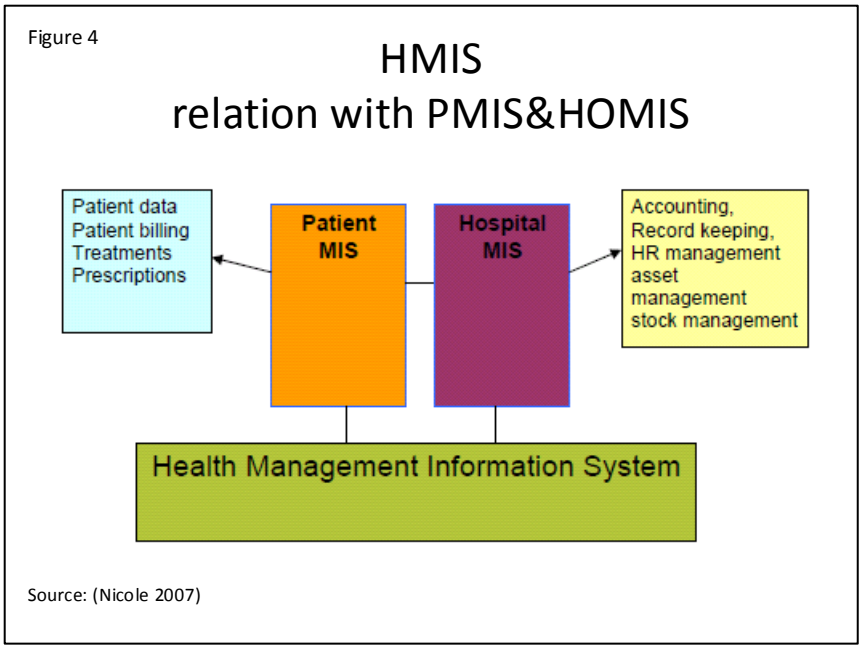
3. Objective

3.1. Problem Statement

The object of the HMT of SBT-hp is to reduce the mortality rate with efficient & effective intervention by practicing EBH. This could be achieved by having accurate, timely and appropriate information and reliable evidence through a properly functioning HMIS.

HMIS consists of 2 sub-systems: a Patient Managing Information System (PMIS) and Hospital Management Information System (HOMIS) (Nicole 2007). PMIS concerns patient data (bio-data and clinical information, billing, treatments and prescriptions). HOIMS deal with accounting, record keeping, HR management, asset management and stock management (Nicole 2007) (figure 4).

Figure 4

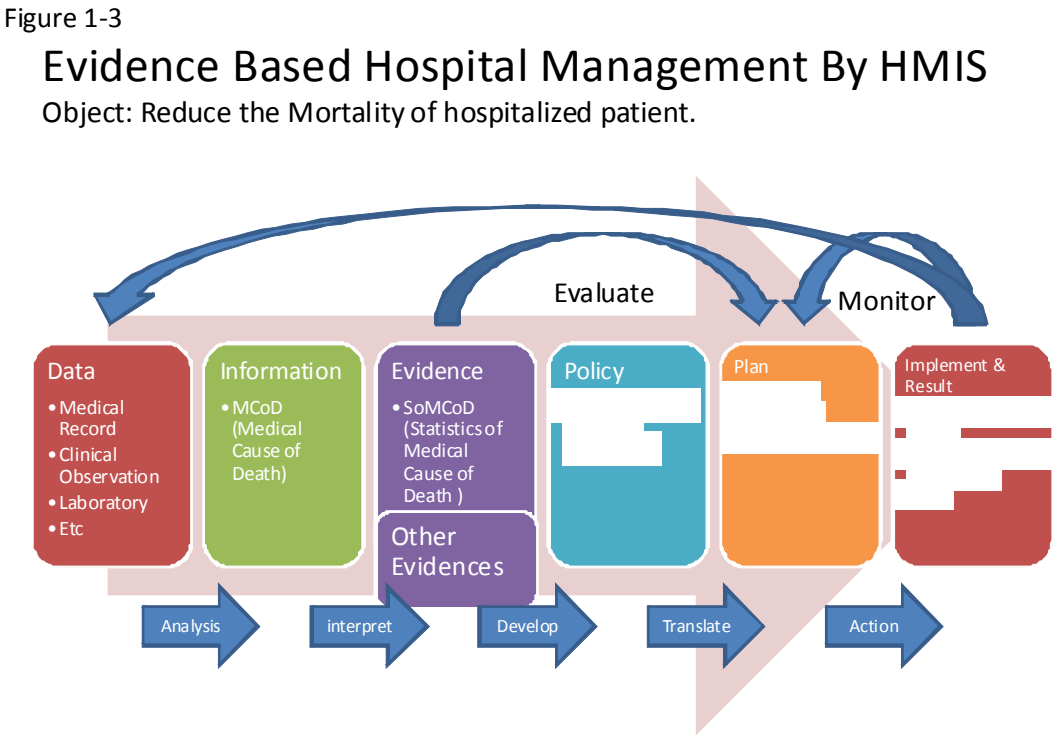


Source: (Nicole 2007)

Medical Cause of Death (MCoD) is clinical information in the PMIS. It is obtained from each individual through analysis of medical data, inclusive of medical records and clinical observations of medical doctors. It is accumulated and integrated as statistics of medical cause of death (SoMCoD). SoMCoD will be a part of the evidence for decision making in

hospital management because it will indicate what causes contribute to mortality in the hospital (Figure 1-3).

Figure 1-3



Source: (Muir, 1997)(Campbell 2009) (Muir 2003)

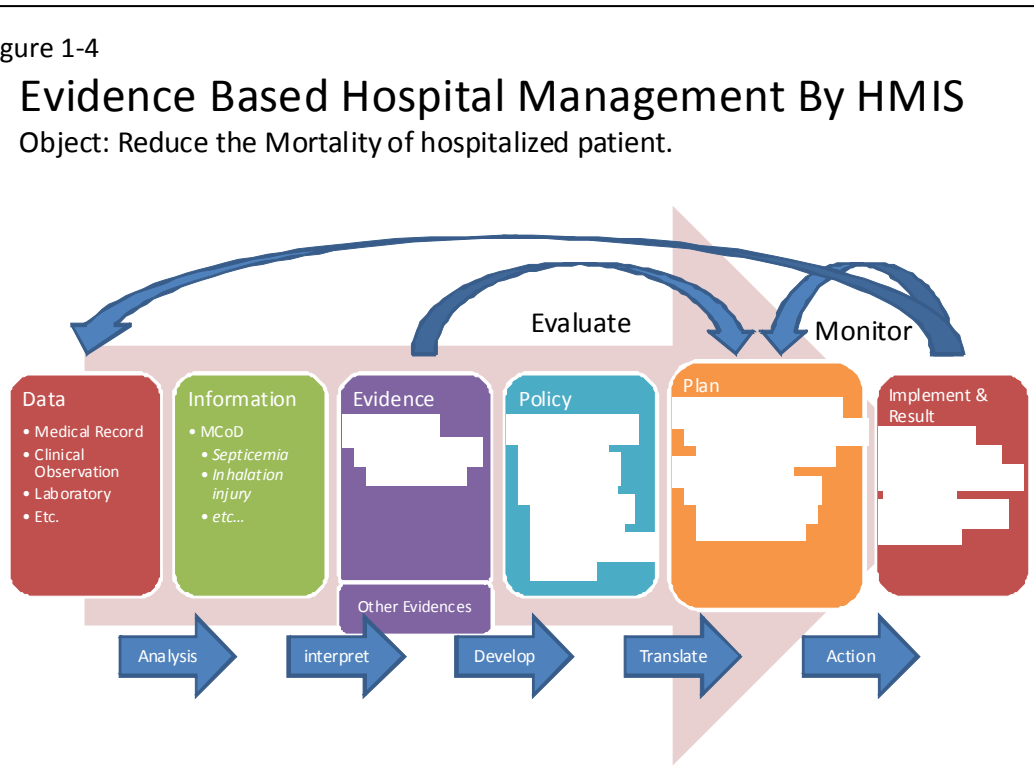
According to SoMCoD of SBT-hp, a significant percentage of fatalities amongst burn patients were du to septicemia (invasion of the bloodstream by virulent bacteria (Levy 2003)). Because of these findings the HMT prioritized Hospital Associated Infection (HAI) (Figure 1-4).

According to the WHO guideline for prevention and control of HAI, the strategy has many components. Components are inclusive of changing organizational structure, strengthening the laboratory function and surveillance system, renovation of hospital environment, improvement of clinical level practice, etc (WHO 2002).

Amongst all this the hospital environment plays quite an important role. Its components have a direct bearing upon HAI including the design of ward and operating theatre and associated facilities, air quality, water supply, food and handling of medical waste and laundry (WHO 2002). The policy to prioritize HAI in SBT-hp lead to costly intervention plans to change the hospital environment, including the construction and renovation of the facilities, hire new personnel etc (Figure 1-4).

However, one of the specialists of HMT pointed out the possibility that the MCoD used for statistics could be inaccurate and inappropriate. As a

Figure 1-4



Source: (Muir, 1997)(Campbell 2009) (Muir 2003)

result, the HMT might use unreliable evidence, and policies to prioritize HAI control could be flawed with plans and actions pointing in the wrong direction.

To find this out, it is necessary to validate the MCoD, and to validate the reliability of SoMCoD. If MCoD are not valid and SoMCoD are not reliable, what would be accurate and appropriate MCoD and reliable SoMCoD? What policy should be developed on the basis of more reliable data? And what is the problem with HMIS that provides invalid information and unreliable evidence at SBT-hp? What are the recommendations and suggestions to improve HMIS of SBT-hp?

3.2. General Objectives

Concerning burn care at SBT-hp, explore factors influencing the quality of information/evidence and describe the challenges facing the HMIS & EBH.

3.3. Specific Objectives

A) Assess the accuracy and appropriateness of MCoD and SoMCoD of burn victims used by the HMT for developing hospital management.

① Compare the MCoD of burn victims recorded in SBT-hp HMT database with the MCoD from the analysis of medical records by experts

② Compare the SoMCoD from SBT-hp HMT database with the SoMCoD derived from validated data by experts.

③ Assess the accuracy and appropriateness of SoMCoD from the SBT-hp HMT database.

B) Explore factors influencing the accuracy and appropriateness of MCoD and SoMCoD at SBT-hp.

C) Give suggestions and recommendations for developing a proper HMIS and proper use of information/evidence at SBT-hp.

4. Methodology

4.1. Study Setting

This study was based on burn induced fatality cases at SBT-hp, As-Sulaymaniyah, Iraqi-Kurdistan, Iraq which is an affiliation of Sulaymaniyah University Hospital. With cooperation of Sulaymaniyah-MoH and INGO, a HMT is organized with INGO in July 2007.

The hospital comprises a 30 bed Burn-Care-Unit (BCU), 30 beds Pediatric BCU, and a 60 bed general ward. In addition it has 4 operating theatres (OT) and an emergency room (ER). X-ray & Laboratory services are limited. Blood transfusion is available. Ventilator and dialysis machines are not available. There is limited availability of medicines recommended by WHO essential drugs guidelines (WHO 2007). All treatment costs, inclusive of medicine, are covered by the INGO.

Two plastic surgeons, 10 plastic surgeon trainees, 1 orthopedic surgeon, 3 anesthesiologists, and several nurses run the hospital. Additionally, the hospital has a pharmacist, X-ray technician and several administrative staff who are mostly ethnic Kurds. These employees are supervised by the HMT, consisting of several expatriate medical and paramedical staff.

All burn patients were initially assessed and a burn index recorded in the ER and hospitalized in BCU. All patients were given resuscitation intravenous (IV) fluid (Baxter) and a precautionary tetanus toxoid was given.

Night duty was carried out by a trainee doctor. All trainee doctors have at least more than 3 years experience of clinical practice. Vital signs and fluid balance of patients are checked and recorded at least 8 hourly.

4.2. Study Design

The study design is observational and descriptive. To assess the validity of MCoD/SoMCoD used by the HMT to develop the hospital management policy, a comparative study was done.

A literature reviews was done to explore factors that influence quality/reliability of information/evidence through HMIS and to make recommendations for developing a proper HMIS and proper use of

information/Evidence at SBT-hp.

Comparison was made with the data collected from the SBT-hp database and validated data elaborated by experts. Comparisons were made concerning the description of the MCoD, the SoMCoD, and the validity of SoMCoD taken from the HMT database.

Validity of SoMCoD from HMT database was judged through a "goodness of fit" test and by describing consistency/inconsistency between SoMCoD from HMT database and validated data.

Background information about HMIS, EBH and burn care is collected from websites of international organizations and also from a literature search in electronic databases and books. Background information about SBT-hp was collected from specialists of HMT.

4.3 Data Collection

4.3.1 Data from HMT database

Data was collected retrospectively from database of HMT, and consisted of basic bio data, Hospital ID and MCoD.

4.3.2 Valid data from specialist

Data about MCoD from the HMT database was compared with data validated by specialists "X" and "Y". Primary data (medical/clinical data) was collected from medical records of HMT specialists.

Specialists "X" and "Y" analyzed the data independently. The validity of data analyzed by specialist "X" as compared to that of specialist "Y" was established through a "goodness of fit" test, and taken as the standard for further analysis. (Annex 1).

Specialist X & Y were selected from specialists in anesthesiology or ICU or Emergency Medicine, and with proven experience in Burn Care Units.
Data consisted of basic bio data, Hospital ID and MCoD.

4.3.3 Secondary data

Secondary data was collected by the HMT specialist retrospectively from medical records of SBT-hp..

Secondary data collection was based on all the mortality records of Sulaymaniyah Trauma-Burn Hospital from 1st of August, 2007 to 18th December, 2007. Case selection is purposeful because of its availability and format of the data. Intervention of INGO started from end of July 2007 and the first mortality was recorded from August 2007. Data were collected retrospectively and therefore there was no bias on part of the specialist of HMT about the quality of information. The specialist who noticed the possible inaccuracy and inappropriateness of MCoD arrived to the hospital

on 25th December.

Secondary data is extensive and is listed in table 1.

table 1: Content of Secondary data
Basic bio data
Hospital ID
Date of admission and death
Place of burn
Cause of burn
Diagnosis of MCoD
Weight
TBSA of burn injury include record about the detailed area.
Calculated Burn Index
Resuscitation IV fluid volume
Interval before hospitalization and amount of volume if patient is referral from other hospital
Fluid in-out Balance (at least till day 8, 4~8 hourly)
Starting date and name of anti-biotic
Specific note (symptom and prescription) which specialist of HMT thinks important in MCoD.

In secondary data collection, medical records lost from the hospital or that were severely damaged were omitted. Measures were taken to ensure that deaths caused by injuries other than burns were excluded. According to the above procedures, 120 of medical records were reviewed and 100 primary data collected by the author of this thesis., who has working experience in one of the top institutes for burn care in Japan.

4.4. Preliminary Literature Review

A preliminary literature review was done to explore both the factors influencing the quality of data/information and to describe the challenge facing HMIS & EBH about burn care.

According to Allotey and Haywood, information/evidence was frequently inaccurate and inappropriate in "low/middle income countries" or "developing countries". As a result, "EBH" couldn't be performed and important decisions were made without reliable information/evidence, thus enhancing existing inequalities and inefficiencies (Haywood 1997) (Allotey 2000).

"MCoD" is "information" analyzed from medical records & clinical observations by medical doctors. "SoMCoD" is a part of "evidence" interpreted from MCoD. SoMCoD affects decision making, but if MCoD is inaccurate and inappropriate, the SoMCoD will be unreliable evidence for decision making. However, no studies could be found about the level of accuracy or appropriateness of MCoD/SoMCoD and how this affects health of the population/patients in low/middle income countries, in particular not of countries in conflict..

In this thesis I want to describe how accurate and appropriate MCoD/SoMCoD is in the SBT-hp as an example of a "specialized hospital", located in chronic and ongoing "conflict" areas, of "low/middle income countries" in "middle east Asia".

As the analytical framework for a literature review a document of the WHO about "constraints of infectious disease surveillance in the Eastern

Mediterranean Region" is used (Hallaj 1996). In this framework the following factors are mentioned that strongly influence the surveillance of infectious diseases:

- inadequate appreciation of the value of data
- Lack of guidelines
- Lack of standard case definitions
- Inability to achieve the needed concordance between efficiency/simplicity and sufficiency
- Lack of community and key stake holders participation
- Weakness in capacity to monitor & evaluation
- Lack of capacity in analysis/interpretation of data/information
- Weak feed back mechanism
- Weak environment and support from the laboratory
- Shortage of trained personnel.

In this study a literature search was carried out through Medline, PubMed and Google. Keywords used were, "Hospital Information System", "Health Information System", "Hospital Information Management System", "Health Information Management System", "evidence", "evidence based", "quality of data" "quality of information", "accuracy", "appropriateness", "validity", "reliability", "Medical Cause of Death", "Cause of Death", "Statistics of Medical Cause of Death", "Burn", "Burn Care", "Burn injury", "low income country", "middle income country", "developing country",

5. Study Results/Findings

5.1. Assessment of the accuracy and appropriateness of MCoD and SoMCoD of burn victims at SBT-hp.

5.1.1. Description of MCoD

The MCoD of burn victims recorded in SBT-hp HMT database was compared with the data that were validated by the two experts. This revealed important differences in how MCoD were described.

I. Difference in the variety of diagnosis to describe MCoD.

Difference in diagnosis to describe MCoD is observed. From the HMT database five diagnoses to describe MCoD were observed: "inhalation injury", "septicemia", "cardiac arrest", heart failure", "Ventricular Fibration (VF)" and "burn" (table 2a).

table 2: Expression of MCoD

table 2a: HMT database	table 2b: Specialists
Inhalation injury	Inhalation injury
inhalation injury+H.F	Septicemia
Septicemia	Pneumonia
Cardiac Arrest	Pulmonery edema
Burn and VF	volume overload
	Acute Renal Failure
	Acute Renal Shock
	Hyperkalemia
	GI Bleeding
	DIC
	Respi arrest
	Respi/Cardiac arrest

From validated data, a total of 12 diagnoses to describe MCoD can be found: "Inhalation injury", "Septicemia", "Pulmonary edema", "Volume overload", "Acute renal failure (ARF)", "Acute Renal Shock (ARS)", "Disseminated Intravascular Coagulation (DIC)", "Gastro Intestinal (GI) breeding", "Pneumonia", "Respiratory arrest", "Cardiac/Respiratory arrest", "Hyperkalemia" and " VF" (table 2b).

II. Difference in the way of description.

Difference in the way of description of MCoD is observed. MCoD of HMT database was described one course (table 3a). Valid MCoD of specialists are described by more than one course and in sequence (table 3b).

MCoD as used by the two experts to validate the data, is described in the "International form of medical certificate of cause of death (IFMCCD)" (WHO 2004) (Figure 5). It consists of "Disease or condition directly leading to death" and three "antecedent causes". Additionally, "other significant conditions contributing to the death but not related to the disease or conditions causing it" are used in this format.

Figure 5

INTERNATIONAL FORM OF MEDICAL CERTIFICATE OF DEATH

Cause of death		Approximate interval between onset and death
I Disease or condition directly leading to death *)	a)..... due to (or as a consequence of)	.....
Antecedent causes Morbid conditions, if any, giving rise to the above cause, stating the underlying condition last	b)..... due to (or as a consequence of)	.....
	c)..... due to (or as a consequence of)	.....
	d).....	.....
II Other significant conditions contributing to the death, but not related to the disease or conditions causing it	.....	.....
	.....	.....
**This does not mean the mode of dying, e.g. heart failure, respiratory failure. It means the disease, injury, or complication that caused death.*		

Source: (WHO 2004)

III. Difference in the number of the sequence and order of MCoD.

Difference in the number of the sequence of MCoD is observed. From HMT database, 5 different kinds of MCoD is observed (table 3a). From valid data, 20 different kinds of sequence of MCoD is observed (table 3b).

Table 3

Table 3a
The way of description of MCoD of HMT database.

Inhalation injury	51
inhalation injury+H.F	1
Septicemia	46
Burn and VF	1
Cardiac Arrest	1

Table 3b
The way of description of MCoD of Specialists

Diagnosis X					
Direct course of death	1st related course	2nd related course	3rd related course	other significant condition	
Inhalation injury					1
Pulmonery edema	Inhalation injury				3
Pulmonery edema	inhalation injury			volume overload	11
Pulmonery edema	Acute Renal Failure	inhalation injury			14
Pulmonery edema	Acute Renal Shock	Inhalation injury			1
Pulmonery edema	Acute Renal Shock	inhalation injury		volume overload	5
Respi/Cardiac arrest	Acute Renal Failure	inhalation injury			8
Septicemia	Pneumonia	inhalation injury		volume overload	1
Septicemia	Pneumonia	Acute Renal Failure	inhalation injury		1
Pulmonery edema	Acute Renal Shock	inhalation injury			1
Septicemia					2
Septicemia	Pneumonia	Pulmonery edema		volume overload	6
DIC	Septicemia				1
DIC	GI Bleeding	Septicemia			2
VF	Hyperkalemia	Acute Renal Failure			1
Pulmonery edema				volume overload	5
Pulmonery edema	inhalation injury			volume overload	20
Pulmonery edema	Acute Renal Shock			volume overload	1
Pulmonery edema	Acute Renal Failure				2
Pulmonery edema	Acute Renal Shock	inhalation injury			1
Pulmonery edema	Acute Renal Shock	inhalation injury		volume overload	1
Pulmonery edema	Acute Renal Failure	inhalation injury			2
Pulmonery edema	DIC	GI Bleeding		volume overload	1
DIC	GI Bleeding				1
Respi arrest					1
Pulmonery edema				volume overload	3
Pulmonery edema	Acute Renal Failure				3
Respi arrest					1
					100

The two experts described three antecedents MCoD (A-MCoD) and one direct MCoD (D-MCoD) in chronological order. This was not the same in the HMT database, because most of MCoD are described by only one expression. There are only two cases in the HTM database with more than one expression to describe MCoD. Those are "Inhalation injury & heart failure" and "VF & Burn", but their sequence and order couldn't be observed.

IV. Mention of the underlying medical cause of death (U-MCoD).

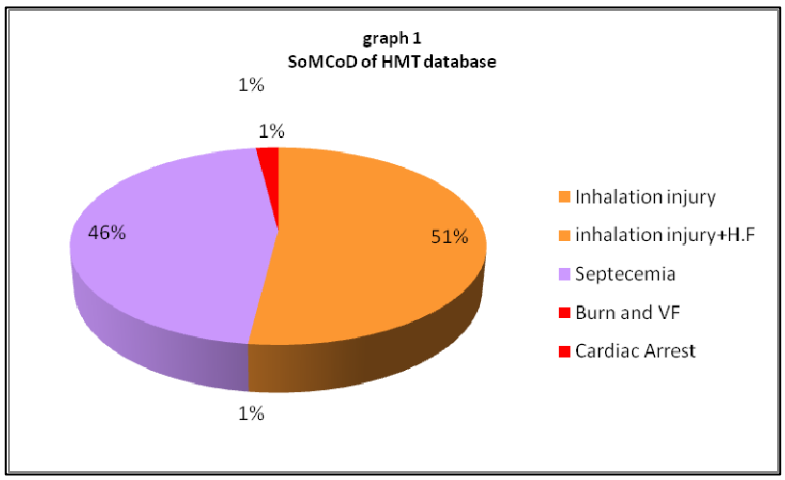
In the expert-validated data, Underlying Medical Cause of Death (U-MCoD) was selected from the sequence of MCoD for interpretation of the statistics in order to develop strategies to reduce the mortality rate of burn victim.

However, from the HMT database, these definitions could not be found and it is impossible to differentiate whether those records are U-MCoD, A-MCoD or D-MCoD.

5.1.2. Comparison of SoMCoD

I. SoMCoD from HMT database

SoMCoD from the HMT database shows that 49% of MCoD is inhalation injury and 48% is septicemia (graph 1).



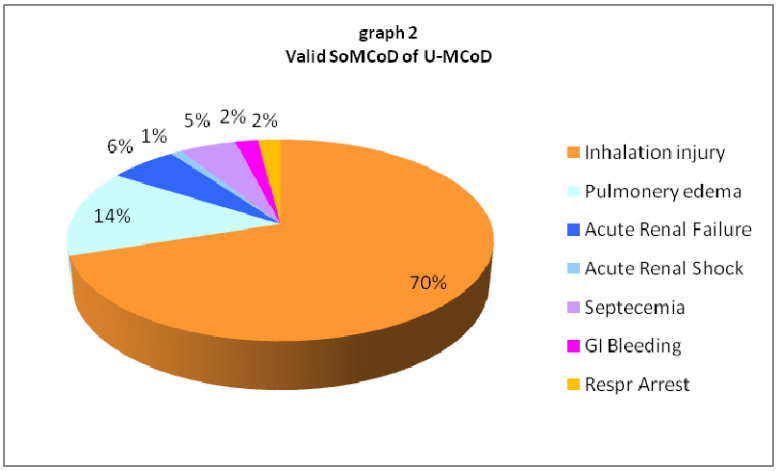
II. SoMCoD from expert-validated data

Because of differences in the way of describing MCoD from that of the HMT database, and in order to achieve the object C of this study, "Give suggestions and recommendations for the construction of proper HMIS and proper use of information/evidence at SBT-hp", several SoMCoD are obtained from expert-validated data:

i. Statistics of U-MCoD
ii. Statistics of D-MCoD
iii. Statistics of every MCoD having a possible contribution to death of the patient
iv. Statistic of every MCoD without D-MCoD and U-MCoD (Statistics of A-MCoD without U-MCoD)

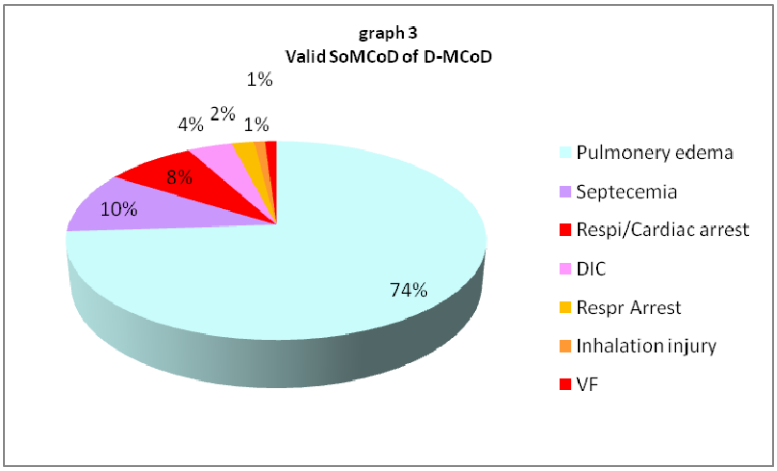
i. Statistics of U-MCoD

According to the statistics, U-MCoD from expert-validated data is 1st inhalation injury (70%), 2nd pulmonary edema (14%), 3rd ARF (6%), 4th Septicemia (5%) and 5th GI breeding (2%) and respiratory arrest (2%) (graph 2).



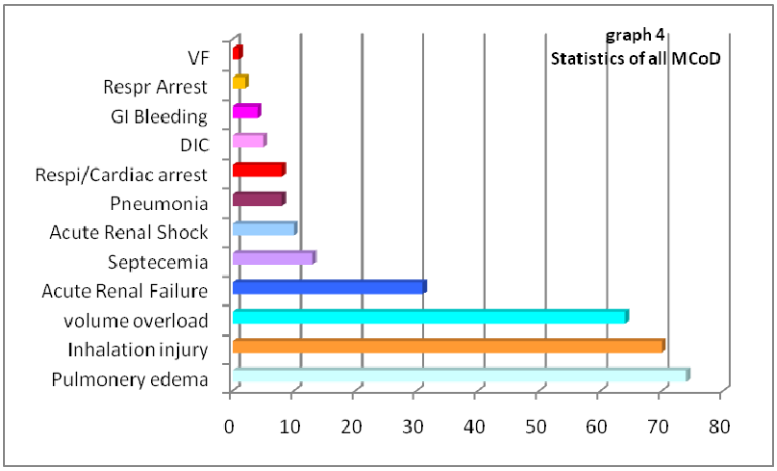
ii. Statistics of D-MCoD

According to the statistics, D-MCoD from expert-validated data is 1st pulmonary edema (74%), 2nd Septicemia (10%), 3rd cardiac/respiratory arrest (8%), 4th DIC (4%) and 5th Respiratory Arrest (graph 3).



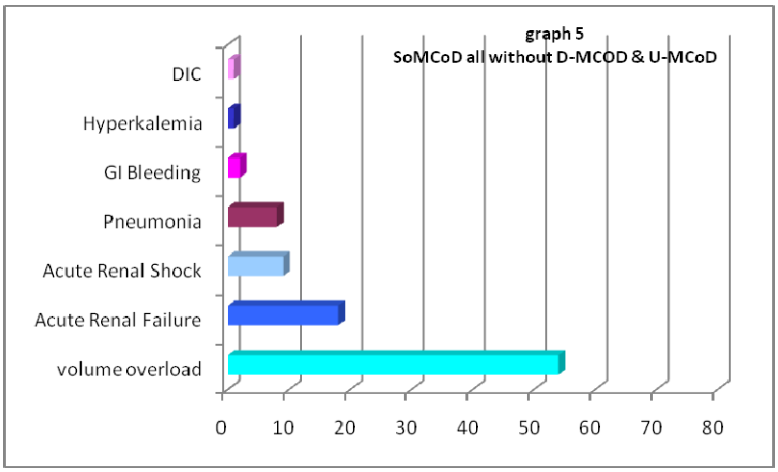
iii. Statistics of all MCoD which have a possibility to contribute to death of the patient.

According to the statistics, MCoD and other significant conditions contributing to the death is 1st pulmonary edema (74/290, 25.5%), 2nd inhalation injury (24.1%, 70/290), 3rd volume overload (22.1%, 64/290), 4th ARF (10.7%, 31/290) and 5th Septicemia (4.5%, 13/290) (graph 4).



iv. Statistic of all MCoD without D-MCoD and U-MCoD (Statistics of A-MCoD without U-MCoD)

According to the statistics, MCoD without D-MCoD & U-MCoD is 1st volume overload (58.1%, 54/93), 2nd ARF (19.4%, 18/93), 3rd ARS (9.7%, 9/93), 4th Pneumonia (8.6%, 8/93) and 5th GI-breeding (2.2%, 2/93) (graph 5).



5.1.3. Accuracy of SoMCoD of HMT database

Accuracy of SoMCoD from HTM database was assessed. As already shown in the previous study result, 98% of MCoD in the HMT database is described by only one cause. According to the International statistical Classification of Diseases and Related Health Problems Tenth Revision (ICD-10), when only one MCoD is recorded, this cause is selected just for tabulation. Generally, the aim of tabulation is to describe U-MCoD for public health purposes. However, the recorded cause might not be the U-MCoD. So it is possible that recorded causes in the HMT database have different meanings than U-MCoD. Therefore, an assessment of the validity was carried out on two issues. First, its 1st validity as U-MCoD, second its validity as D-MCoD. It is also possible that the HMT database is recording only part of all MCoD that contribute to death of the patient.

To know which MCoD is contributing to the accurateness of SoMCoD, the consistency of each diagnosis of MCoD in the HMT database is examined.

I. **Accuracy of SoMCoD from the HMT database as U-MCoD and as D-MCoD.**

Using the "goodness of fit" test, the SoMCoD from the HMT database does not match the U-MCoD (Annex 2). Chi-Square is "361.99", DF is "2", and P-value is "0.000003".

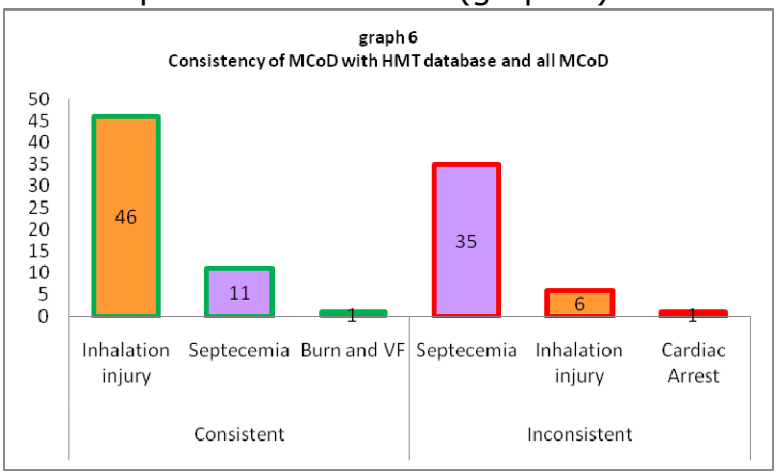
For statistical inference, null hypothesis was made as "SoMCoD of HMT database is not different from statistics of U-MCoD of specialist X". Exam result shows that chi-square 361.99, degrees of freedom (DF) 2, and it would happen 0.0003 %. If put the confidential level to 1%, it could be said that it rarely happen. Thus, it proofs that the null hypothesis is wrong. So by this exam result, SoMCoD of HMT database is different from statistics of U-MCoD.

By "goodness of fit" examination, accuracy of SoMCoD from the HMT database as D-MCoD is not found (Annex 2). Result of examination shows that Chi-Square is "2815.64", DF is "2", and P-value is "0.000002".

Same as above, for statistical inference, null hypothesis was made as "SoMCoD of HMT database is not different from statistics of D-MCoD of specialist X". Exam result shows that chi-square 2815.64, DF is 2, and it would happen 0.0002%. If put the confidential level to 1%, it could be said that it rarely happen. Thus, it proofs that the null hypothesis is wrong. So by this exam result, SoMCoD of HMT database is different from statistics of D-MCoD.

From both results, it could conclude that SoMCoD is neither U-MCoD nor D-MCoD and it is inaccurate (annex 2).

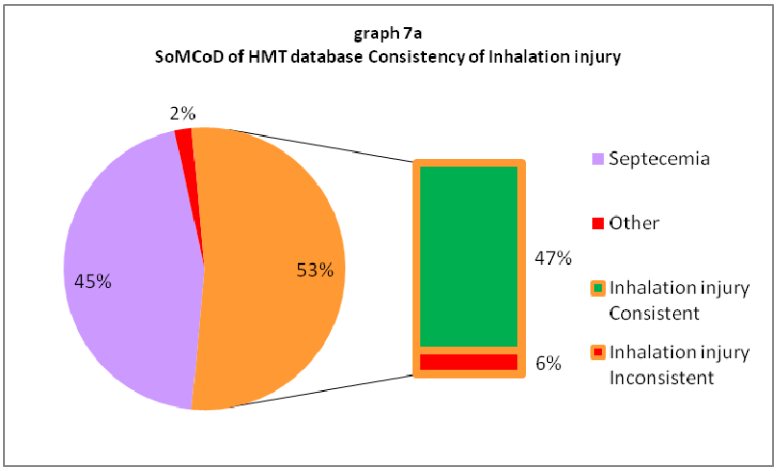
58% of MCoD of the database is consistent with all expert-validated MCoD including other significant conditions contributing to the death of the patient. The rest of the MCoD of the HMT database is inconsistent with any of the MCoD of the expert-validated data (graph 6).

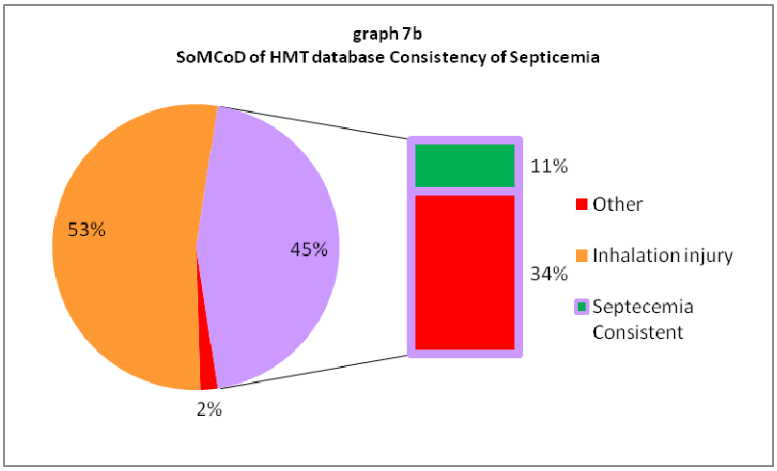


II. Consistency and Inconsistency of each diagnosis of MCoD in the HMT database

The consistency of "inhalation injury" and "Septicemia" is examined because 98% of the MCoD is recorded by these two diagnoses (51% is "inhalation injury" 46% is "Septicemia").

Among all 52 cases which recorded inhalation injury as MCoD in the HMT database, 48 cases are consistent (88.0%) and 6 cases (12.0%) are inconsistent with all MCoD from expert-validated data (graph 7a). Among all 46 cases which recorded inhalation injury as MCoD at the HMT database, 11 cases are consistent (23.9%) and 35 cases (76.1%) are inconsistent with all MCoD from expert-validated data (graph 7b)





5.2. Factors influencing accuracy and appropriateness of MCoD and SoMCoD at SBT-hp.

To explore factors influencing the accuracy and appropriateness of MCoD and SoMCoD at SBT-hp, a literature review is done using analytical framework derived from "Constraints of infectious disease surveillance of Eastern Mediterranean" as found by Hallaj (1996).

5.2.1. Inadequate appreciation of the value of data

Inadequate appreciation of the value of data/information would strongly affect surveillance of infectious disease. If people taking part in surveillance can't realize that data/information will be used for decision making affecting individuals and population's health and life, they can't take their job concerning surveillance seriously. This will result in poor records, analysis and reports (Hallaj 1996).

Akande (2009) told that to strengthen HMIS in Nigeria, a bottom up approach is necessary, because of inadequate appreciation of the value of data at peripheral level (Akande 2009). By strengthening HMIS by a bottom

up approach, information/evidence would be valid and reliable.

If peripheral medical staff of SBT-hp didn't appreciate the value of MCoD, and realize that the information would be used to interpret to some evidence, and recognize that the evidence would be used for decision making affecting the burn victim, it would affect their routine job concern with HMIS. This would affect the accuracy and appropriateness of MCoD & SoMCoD of SBT-hp.

5.2.2. Lack of guidelines

Lack of guidelines constrains the surveillance of infectious disease. Especially the lack of clear assignment, distribution and lineation of responsibility in the guidelines is emphasized by Hallaj. Who has to collect and to whom should it be sent? What kind of data/information to be collected and how it should be collected? When & where it should be collected and when and where it should be sent? Lack of clear assignment and distribution of responsibility and its lineation leads to an attitude of "keep a low profile" or "do not do others' jobs" to the health worker who feels that they are already overburdened. Even with existing guidelines, if they are not clear, and there is no handover to the newcomer it will result in ignoring of the guidelines (Hallaj 1996).

The National Committee on Vital Health Statistics, U.S.A. (NCVHS) mention the importance of responsibility in HMIS. According to the report from NCVHS (2001), important attributes in construction of HMIS are a clear leadership mandate, an appropriate distribution of responsibility and accountability, and an agreed-upon process and milestones for all stakeholders of HMIS.

Problems about describing the MCoD, discussed previously, indicate problems concerning the guidelines. Without guidelines and a proper format to describe the MCoD, it is difficult to have proper information.

As well as implementing the guidelines, without clear a format to describe MCoD, when it must be done and reported, without distribution of responsibility of diagnosis of MCoD, without lineation of the responsibility to whom those reports are sent, accurate/appropriate MCoD can't be expected. This applies also to the SoMCoD. Clear assignment of the way to describe SoMCoD and when it must be done and reported, distribution of the responsibility to the specific person to interpret the information, and to whom those reports are submitted, will affect the accuracy and appropriateness of SoMCoD.

5.2.3. Lack of standard case definitions

It is crucial for accuracy and consistency of the information in surveillance of infectious diseases, that the same definition and criteria are used to diagnose diseases. To establish a practical standard case definition, it is necessary to have a certain quality which could fulfill the purpose of surveillance including comparing those data/information with other institutes but at the same time, it should be simple enough to be used by the health workers of whom a majority has a limitation in their skills and works in limited setting. Some time, top-clinicians thought that the use of standardized definition would derogate their clinical skill and as a result they disliked using standardized case definition, even for reporting purposes. This makes it difficult to standardize case definitions (Hallaj 1996).

According to the Hand-book for Emergency of the United Nation High Commissioner for Refugee (UNHCR), diseases recorded in the HMIS must have a case definition and a standard description which will guide health workers in their diagnosis and ensure the consistency and validity of data (UNHCR 2005).

If there is a standard case definition in diagnosis of MCoD of the burn patient, it would result in increased accuracy and appropriateness of MCoD and SoMCoD. However, it must have a certain quality to be used as information, and it must be manageable by the capacity of the existing HR at SBT-hp and capacity of the equipment of SBT-hp.

5.2.4. Lack of balance between efficiency / simplicity and sufficiency

The quantity of information must be balanced to increase the efficiency/simplicity of the surveillance system and to increase the usefulness of the surveillance system. To increase the efficiency, useless information for decision making shouldn't be collected and reported. To increase the usefulness, only necessary information needed for decision making should be collected and reported. If collected data/information has very little value in terms of usefulness and necessity, analyzed information and interpreted evidence is useless, unnecessary and becomes redundant. Overloaded information will complicate every step in the surveillance process. An incomplete picture of disease patterns will result in waste of time and effort (Hallaj 1996).

One of the challenges in the development of a HMIS is how to find the optimal balance between comprehensiveness and efficiency (GTZ 2004). According to Gladwin (2003), gaps in needed data/information, overload of data/information, shortages of information and the lack of an overall information strategy, are found frequently in HMIS of low/middle income

countries (table 4).

If this balance between comprehensiveness and efficiency of primary data collection are not appropriate, it will complicate the process of analysis/diagnosis, and result in problems of accuracy/appropriateness of MCoD. And if quantity of information in MCoD lacks balance between comprehensiveness and efficiency, process of interpretation to SoMCoD would be complicated again, and will result in an incomplete picture of the mortality of SBT-hp.

table 4: Frequent observed problems of HMIS in Low/Middle income country
Gaps in information needed
Poor data collection and processing practice
Lack of analysis/interpretation of data/information
Under-utilization of available data/information
Overload or Shortage of data/information
Poor reliability and validity of data/information
Lack of skills in information management and/or Lack of training and human resource development
Lack of compatibility between systems
Unaffordable to develop & maintain
Lack of overall information strategy
Lack of blueprint of successful design
Lack of blueprint of implementation strategy

5.2.5. Lack of community and key stake holders participation

Participation of stake holders in surveillance is indispensable to ensure its quality. Timely reporting, context reviewing, detection of underlying factors, it is difficult to have those without participation of stake holders at field level. For example, without participation of the community, the private health sector and independent departments such as military/university hospitals, it would be difficult to have good quality data/information in infectious surveillance (Hallaj 1996).

According to the Management Science for Health (MSH), Community-Based Management Information System (CBMIS) will complement a Field Health Service Information System (FHSIS) as part of HMIS (MSH 2001). CBMIS is a community participatory information system that enables the peripheral health services providers to systematically identify, categorize and prioritize the health services for the population. By participation of the community, real situation and underlying factors existing in the field could be found. According to Charles J (1982), reluctant participation of hospital in national HMIS, result in the national HMIS not being able to provide reliable information for decision making.

If the medical person close to the patient participated in HMIS, it would improve the accuracy/appropriateness of MCoD. And, if the person, medical or not, offering the service to the patient from different approach and subject at SBT-hp, participated in HMIS to identify MCoD of burn victim, accuracy/appropriateness of MCoD and SoMCoD would be improved.

Gudaviciene (2004) found that adjacent and chronic diseases are not

recorded in 35% of the burn case which hospitalized to their ICU. If families are actively involved and provide such information, lack of important information could be avoided. Not only the clinical information, but it could be other crucial public health information which HMT team didn't have because of lack of community participation. To know what happens with burn victim before and also after the hospitalization may be a quite important in terms of public health point of view.

If the family or the community surrounding the patient actively participated in HMIS of SBT-hp, it would complement the HMIS and may contribute to improve the accuracy/appropriateness of MCoD and SoMCoD.

5.4.6. Weakness in capacity to monitor & evaluate

The capacity to monitor the process and the output, as well as the response triggered by the result of monitoring, is an important indicator of strength of the surveillance system and its proper functioning (Hallaj 1996).

As Adam (2004) described in the Millennium Development Goal (MDG) for health, monitoring and evaluation is a core component of HMIS.

If monitoring & evaluation capacity is sufficient, accuracy/appropriateness of MCoD and SoMCoD would be checked an

d adjusted properly.

5.4.7. Lack of capacity in analysis/interpretation of data/information

A strong central unit able to analyze/interpret the data/information is needed for infectious disease surveillance. Without a capacity to analyze/interpret data correctly, a good quality of information for decision making can't be expected. At the same time, capacity for analysis/interpretation is required in peripheral level for timely action (Hallaj 1996).

Transforming data into useful information is one of the greatest challenges in the development of a well-functioning HMIS (Gladwin 2003). And as reported by Duran-Arenas, one of the major obstacles in the implementation of quality improvement initiatives in low/middle income countries is the lack of timely and appropriate information for local or frontline health service managers (Duran-Arenas 1998). So, decentralization of the capacity to analyze and interpret data/information is one of the most important aspects challenge for HMIS (Gladwin 2003).

If medical doctors have a stronger capacity to analyze MCoD, and HMT has stronger capacity to integrate/interpret those MCoD to SoMCoD, accuracy/appropriateness of MCoD and SoMCoD would improve. Even if

HMT lacks capacity, so long as the higher level has a sufficient capacity, it would ensure better quality and reliable information, be it delayed.

5.4.8. Weak feedback mechanism

A weak feedback mechanism influences surveillance systems. Without feedback, people lose the interest and motivation to analyze, record and report. Especially for peripheral staffs in disease surveillance, it is difficult to show the value and utility of their contribution and they rarely have an opportunity to realize the value of their tedious and cumbersome job (Hallaj. 1996).

According to Owen (1995), people perform well if their real achievements are recognized, whether it rewarded financially or not. Certain feed back is one way to recognize the achievement.

According to Charles et al (1982), mandate participation without proper feedback in HMIS would cause reluctance to be involved in the system. Proper feedback such as incentives to participation, provision of user friendly system, continuous and regular communication, and prompt reporting back to the participant could reduce the reluctance of those stake holders.

Carters' (1997) also suggests the importance of feedback mechanism in HMIS at the manager level and concludes that feedback is a major contributor to their motivation and satisfaction in hospital information management.

Proper feedback mechanisms in HMIS of SBT-hp, would improve accuracy/appropriateness of MCoD & SoMCoD.

5.4.9. Weak environment and support from the laboratory

Weak diagnostic capabilities of the laboratory and a weak scientific/academic/technological environment related to infectious diseases pose a surveillance problem. Without reliable laboratory data and other scientific technology, it is difficult to analyze data properly (Hallaj 1996).

As UNHCR recommended, in their construction of HMIS in limited setting, confirmation of the diagnosis of peripheral health worker by a laboratory or other standard test would ensure the validity and consistency of data/information (UNHCR 2005). Laboratory or other standard test, could support the peripheral health worker and medical staff. One of the problems frequently found in HMIS in low/middle income countries are a lack of validity and consistency of the data/information (Gladwin 2003). Support from laboratory and other standard tests would support the case definition

of each case, thus it would result in increased validity and consistency of the data/information,

Data/information from laboratory and other scientific-technological tool/equipment/facility could confirm observation of signs/symptoms of medical personnel as well as provision of the new data/information for diagnosis. So without those support, analysis becomes just estimation and narrows the analytical frame work to diagnose the MCoD. If there is proper support of laboratory and scientific-technological tool/equipment/facility for analysis of MCoD, capacity of HMIS of SBT-hp will increase and be able to provide accurate/appropriate MCoD & SoMCoD.

5.4.10. Shortage of trained personnel

Shortage of trained personnel at all levels in the health system is a major constraint in infectious diseases surveillance system. It is due to lack of training opportunity, lack of continuous in-service training of health workers, and lack of training modules for the different level health workers.

Gladwin (2003) told that lack of skills in information management and/or lack of training and human resource development is one of the frequent problems found in HMIS in low/middle income countries.

If we have skillful personnel who could analyze MCoD and produce accurate SoMCoD, or if we have human resource training to enable staff to manage data, information and evidence properly, it would strengthen the HMIS of SBT-hp.

6. Discussion

6.1. Describing MCoD

To break the chain of fatal events or to effectuate a cure at some point, it is necessary to know MCoD. This is exactly why MCoD is recorded. To achieve this effectively, it is important to know the U-MCoD. U-MCoD could be defined as the disease or injury which initiates the train events leading directly to death or the circumstances of the accident or violence which produces the fatal injury (WHO 2004).

So to determine U-MCoD, it is necessary to depict the chain of fatal events which lead directly to death and it is necessary to ensure that all relevant information is recorded. Relevant information should include diseases, morbid conditions or injuries which either resulted in or contributed to death and the circumstances of the accident or violence which produced any such injuries. To fulfill those tasks, it is important that the one who has authority to record should not be selective and comprehensive with conditions when recording MCoD (WHO 2004).

In order to know the sequence of fatal events to determine the U-MCoD, it is recommended to describe MCoD as an IFMCCD as expert-validated data. If one describes according to the Rules and Guidelines of ICD-10 with IFMCCD, it will most likely reveal the U-MCoD through checking the antecedent causes (WHO 2004).

However, as shown in the study, limitations in the variety of diagnosis to describe MCoD like in the HMT database make it difficult to describe the disease and morbid conditions or injuries which either resulted in or contributed to death (table 3). This is especially true for severe burns of which the pathology is complicated (annex 3). Without multiple diagnoses, it is difficult to depict the chain of fatal events. The fact of limited expression to describe MCoD restricts the depiction of accurate and appropriate chain of fatal event.

Limited number of MCoD for each case also makes it difficult to describe the train of morbid events. As the study shows, most HMT database described MCoD for each individual only by one cause (table 4). Without several causes, it is impossible to describe MCoD as a chain of fatal events and impossible to know what/which is the U-MCoD and at which point we could/should have intervened. Description of MCoD using the IFMCCD method does make it possible to depict the chain of fatal events by diverse MCoD. Following this, it is possible to determine the U-MCoD, and enables us to observe retrospectively the point at which we could have intervened.

Additionally, identifying U-MCoD provides clear and meaningful information for hospital management. In order to reduce the mortality rate effectively and efficiently, it is necessary to prevent precipitating causes which can be derived from the evidence.

However, there is discussion about the problems in variety of expression to describe MCoD of burn. Bauer (1986) described the problem of integrating information about MCoD of burn cases because the description is different in different institutes. It remains difficult to determine a single U-MCoD of burn patient: the complex pathology of burn makes impossible to select single U-MCoD (Alexander 2002).

6.2. Accuracy of SoMCoD of HMT database and Comparison of SoMCoD

6.2.1. Accuracy of SoMCoD from HMT database

SoMCoD from HMT database are not accurate as for U-MCoD and as for D-MCoD (annex 2). With high inconsistency of SoMCoD from HMT databases compared to SoMCoD from expert-validated data could lead us to conclude

that SoMCoD from the HMT database doesn't show the MCoD. This means that the SoMCoD from HMT database is inaccurate and inappropriate.

It was found that the diagnosis of "septicemia" as MCoD contributes most to the inaccuracy of SoMCoD from HMT database.

6.2.2. Statistics of valid data

i. Statistics of U-MCoD

For effective and efficient prevention of death, it is necessary to break down the underlying cause of death among the chain of fatal events and to identify the initial events (the U-MCoD). One of the most effective hospital management and public health strategies for the prevention of death is to intervene in the most frequent U-MCoD.

Statistics of U-MCoD shows that inhalation injury is the most frequent U-MCoD (graph 2). In terms of public health point of view, it is clear that intervention in inhalation injury should be prioritized.

However, it would be a quite challenging task. Because clinical practice which could reduce the burden derived from inhalation injury may be limited especially in the context of a conflict area like the surrounding environment of SBT-hp (annex 4). So in developing policy, HMT have to consider this.

ii. Statistic of D-MCoD

D-MCoD is the final destination of train of fetal events. By solving D-MCoD, we could bring the patients back from the verge of death. Knowing the frequency and distribution of D-MCoD is important especially from clinical point of view. Because we could know which kind of clinical symptoms we have to care about and which kind of clinical intervention we should strengthen to avoid death of the patient.

From hospital management point of view, statistics of D-MCoD is also important. Because by knowing which kind of clinical symptom is most frequently observed which related directly to increasing mortality, we can strength the monitoring system and develop investigation methods specific to those symptoms. By knowing which kind of clinical intervention should be strengthened, we could invest in specific treatments to cure the patient which will rescue the patient from the verge of death. Thus we could use D-MCoD in effective & efficient hospital management.

Statistics of D-MCoD shows that pulmonary edema is most frequent D-MCoD (graph 3). To reduce the mortality rate of the burn patient in this hospital, it is expected that stopping the chain of events leading to pulmonary edema may be one of the most effective strategy. And clinically, if we could treat pulmonary edema successfully, we could save lives.

However, it would be a quite challenging task as well to reduce the burden derived from inhalation injury. Because clinical practice which could reduce the burden derived from pulmonary edema is limited (annex 4). So in developing policy, the HMT will have to consider this.

iii. Statistics of all MCoD which have a possibility to contribute to death of the patient.

As told already, interventions concerning the most frequent U-MCoD are one of the most effective hospital management and public health strategy to reduce mortality. However, it is not necessary to intervene only in U-MCoD. If the interventions affects a cure at some points in the chain events or, it could prevent the death anyway. To intervene at most frequents points would also be effective. This also applies to "other significant conditions contributing to the death". In that way it remains useful to have statistics of all MCoD.

Statistics of all MCoD which have a possibility to contribute to death of the patient shows that pulmonary edema and inhalation injury is 1st and 2nd, which is most frequent U-MCoD & D-MCoD in each Statistics, volume overload appear in 3rd. and ARF in 4th (graph 4). So one of the ways to reduce mortality rate of burn victim in this hospital is to tackle with the problem of "volume overload" which is most frequently appear to all of chain of fatal event without most frequent U-MCoD & D-MCoD in burn victims in SBT-hp.

iv. Statistic of all MCoD without D-MCoD and U-MCoD (Statistics of A-MCoD without U-MCoD)

As described already, it is best to stop fatal events from it initial point. For practical reasons, however, it is sometimes difficult to intervene at this point because of hospital capacity. At the same time, fatal events could stop anyway if we success to intervene at the end of the chain of fatal events clinically however; it is difficult sometimes to intervene at this point because it is a result of many effort of attempting to save the patient life

So to detect the most frequent MCoD manageable from clinical as well as hospital point of view, it is important to have statistics of all MCoD without D-MCoD & U-MCoD.

From the statistics, most practical intervention would be to deal with volume overload, ARF and ARS.

However, intervention to the ARF, ARS would be a quite challenging task as well as reducing the burden derived from inhalation injury and pulmonary edema. Because clinical practice which could reduce the burden derived

from ARF and ARS is limited (annex 4). So in developing policy, HMT have to consider about those clinical limitations of the context surrounding SBT-hp.

6.2.3. Limitation of the study about "accuracy of SoMCoD of HMT database and Comparison of SoMCoD"

The findings about "accuracy of SoMCoD of HMT database" and "Comparison of SoMCoD" could be affected by bias. This could be selection bias of the data recorded from original record, bias of the author in selecting the two experts, and observation bias of specialists. To reduce the affect of the bias, counter measures were taken.

1. Selection bias of the data recorded in original record

Selection of the data from original medical record was carried out by the specialist of HMT. He is the one who started to suspect the inaccuracy of MCoD so there are the possibilities that he selected the data purposefully to derive the result. To reduce this potential bias, data selection was reviewed by another specialist with experience in diagnosis of burn victim.

2. Bias of the author in the selection of two experts

The author, himself a burn specialist, selected two experts for the validation of the chain of events of MCoD. To avoid bias, specialists were chosen from different specialties, one from anesthesiology and one from emergency medicine.

3. Observation bias of specialists and validity of SoMCoD of specialist X.

Validated data were obtained from specialists X. To minimize observation bias derived from specialists X, analysis of the same data is asked from specialist Y and tested with the "goodness of fit" test (annex 1).

As SoMCoD of specialist X showed no difference from specialist Y, it could be concluded that it is valid enough to examine SoMCoD of HMT database.

6.3. Influencing factors for HMIS

6.3.1. Inadequate appreciation of value of data

I. Motivation and Inadequate appreciation of value of data

The literature study drew attention to "inadequate appreciation of the value of data" of staff participating in HMIS affecting the quality of data/information and evidence.

According to Akande, inadequate appreciation of the value of data is derived from lack of motivation and lack of education (Akande 2009). Muir (2003) also pointed out the importance of motivation for the good performance in general (figure 6).

People are motivated if they think that objectives are achievable,

realistic, and the outcome recognized as valuable, or worth doing it (Owen 1995).

By appreciating the value of data, we could expect survival of the patient and patients and his/her family's social life after de-hospitalization and it becomes object of medical staff. However, the high mortality rate of burn injuries in low/middle income countries makes it difficult to think that objective is achievable. Additionally, stigma of the patient and rejection from the society due to disability/disfigurement makes it difficult to believe that such objective can be achievable.

Relatively high mortality rates and stigma/rejection derived from disability/disfigurement specific to burn injuries in low/middle income countries also poses difficulties for the value of the outcome. Firstly, death of the patient must not be recognized as a valuable outcome to both family and the medical person. And secondly, an unhappy life couldn't be recognized as a valuable outcome for patient, family and medical doctor. Generally, value of the outcome of medical practice is recognized by the result itself and/or by being shown gratitude from the patient or family. However, if patients die or live unhappily, those results are not recognized as a valuable outcome and it is impossible to be shown gratitude from the patient and family in general.

According to the WHO burn fact sheet, burn victims who suffer just above 40% of total body surface area (TBSA) have no chance of survival in Nepal compared to 80% of TBSA in Australia with successful functional outcome (WHO 2002). Similarly, in conditions surrounding the SBT-hp, it would be difficult to think that they could achieve the final objectives by appreciation of the value of the data.

Additionally, if there is a lack of appreciation for saving the lives of burn victims culturally, it would also negatively impact the appreciation of accurate data. Souad and L'Agence France-Presse report that there is strong discrimination of those who break cultural taboos in some part of Middle East Asia inclusive of northern-Iraq. And people breaking certain taboos are burnt by fire (Souad 2003) (AFPBB article 1569467, 2007). If some of the burns are a result of cultural practices it would diminish the value of saving that life.

Sharma (2006) suggests clinical negligence of the burn victim in India. Clinical negligence will also lead to depreciation of the value of data of victims. If this were true at the SBT-hp, it may be a result from cultural practices.

II. Political Use of the data

Inadequate appreciation of the value of data is not only a problem at peripheral levels but also at central level. According to Richard, inadequate appreciation of the information/evidence can be observed in decision makers who use evidence for policy making (Richard 2005).

Empirical studies suggest managers use information for political purposes, using information to seek legitimacy for their decisions rather than to make or clarify those decisions (Feldman 1988) (Feldman 1981) (Guldner 1993).

According to the research of Melander, evidence used in new drug application has a bias because of political gains for the pharmaceutical industry (Melander 2003). More crucially, it is widely acknowledged that managers use information other than that provided by formal organizational information systems such as HMIS; this other information may be verbal and observational, or may be embedded in the training and experiential background of managers (Mintzberg 1975).

Political use of the evidence will lead to depreciation of the value of the data. As well as peripheral level, if central level in this case HMT, doesn't appreciate the value of MCoD and SoMCoD as one of the crucial information/evidence to develop hospital policy, information/evidence derived from HMIS will be poor.

6.3.2. Lack of Guideline

Guidelines, with clear assignment of job, with distribution of responsibility and delineation, can improve the quality of data/information and evidence.

However, according to Chet et al, one reason for malfunctioning of HMIS is lack of accountability of the public health servant. Even if they have a clear assignment, they wouldn't collect/access the information and analyze/interpret it because of lack of accountability. Not only peripheral level, but also central level managers lack accountability. Not all managers are serious about their managerial and financial accountability (Chet 2005).

According to Chet et al, lacking of accountability is not only due to lack of a system that takes disciplinary actions against poor performance or corruption, but is also due to lack of knowledge and skills (Chet 2005), from peripheral level to the central level. So if the persons who assign tasks have proper knowledge and skills, it will strengthen the HMIS and quality of data/information and evidence.

Since the war in Iraq, education materials for doctors have increased,

from basic to advance levels, about burn care (Barillo 2008) (Ennis 2008) (White 2008). In the context of SBT-hp, through further improving skills and knowledge about burn care, medical doctors could understand the pathology of burn care properly, leading to improvement of accurate/appropriate diagnosis of MCoD. The HMT team also needs to improve management skills and knowledge.

6.3.3. Lack of Standard Case Definition

In the context of burns, problems about standardization of diagnosis and definitions in diagnose of MCoD are reported by Bauer (Bauer 1987). According to Bauer, the use of diverse terms for MCoD of the burn patient and lack of unit definition in diagnosis of the condition makes it difficult to compare data. Additionally, the relation between each condition and diagnosis is more complicated than in other diseases. Bauer recommends making a standard format for international comparison of results (Bauer 1987).

However, it is quite a challenging task to establish and introduce a standard definition in MCoD of burn victims which is simple and user friendly for peripheral doctors, and to possibly use the limited laboratory/technological support in the conditions surrounding the SBT-hp, because of the complicated pathology specific to burns.

Autopsy could clarify MCoD. As discussed by Roulson (2005) and Ong (2004), autopsy could provide quite accurate pathological information enabling a correct diagnosis of MCoD. According to the study about MCoD of ICU patient by autopsy, major miss/lack of diagnosis of MCoD is found in 8.5% to 37% cases (Ong 2002) (Nadrous 2003) (Combes 2004) (Dimopoulos 2004) (Mort 1999) (Marget 2006). In the same study specific to burn cases, major miss/lack of diagnosis of MCoD is found in 8.5% to 18.5% (Kallinen 2008) (Fish 2000). All these studies were carried out in developed countries.

These discrepancies of MCoD between premortem clinical examination and autopsy in developed countries indicate the difficulty to clarify the pathology and diagnose MCoD correctly of severe burn cases. So it would be difficult to have a standard case definition which could provide enough quality of information for HMIS about burn cases.

The complexity of the pathology of burn victims and the limited setting of SBT-hp are big obstacles in establishing standard case definitions. In the SBT-hp, it is difficult to have laboratory support & modern scientific technology. Shojania (2003) suggested that modern

laboratory/technological support could cover the absence of autopsy and provide good support the diagnosis of correct MCoD

However, the limited setting surrounding SBT-hp prohibits this support. This makes it difficult to establish a simple, user friendly, standard case definition of burns that could be used by peripheral medical staff.

6.3.4. Inability to achieve the needed concordance between efficiency/simplicity and sufficiency.

This study has established that by improving concordance between efficiency/simplicity and sufficiency of collected data/information, its quality will be improved.

According to Hallaj (1996), imbalances between efficiency/simplicity and sufficiency of the system derive from a lack of design or previous determination of the expected indicators. Goldwin (2003) also emphasizes the lack of a blueprint and successful design as problems observed in HMIS in low/middle income countries.

To diagnose MCoD of burn victim, it is difficult to expect concordance between efficiency/simplicity and sufficiency in data collection because of complex pathology. Diverse information is necessary to diagnose MCoD, from detailed clinical observation to laboratory and other examination data.

However, symptoms and data which become crucial information to diagnose MCoD should be selected, collected and recorded. Recent burn treatment guidelines (Joint Theater Trauma System (JTTS) of U.S. Army Institute of Surgical Research (USAISR) 2008) (Walter Reed Army Medical Center (WRAMC) 2004), provide some practical advice about which information should be collected and recorded. It should be adjusted, however, to the setting of each context.

Regarding SoMCoD, Some difficulties remain to be discussed about IFMCCD and guidance of ICD-10 by Workgroup for Electric Data Interchange (WEDI) (WEDI 2000). However, as suggested by study of Schelhase et al (2007) the proper use of IFMCCD and coding rule of ICD-10 improve the epidemiological study of SoMCoD. Using those standards would lead to the needed concordance of SoMCoD of burn victims.

6.3.5. Lack of Community Participation and other stakeholders

Reasons for stakeholders' lack of participation are diverse but that of the community is mostly due to lack of cognition that they are a part of surveillance system. For other stakeholders' it may be due to lack of partnership in achieving a common objective (Hallaj 1996).

In the context of SBT-hp, the nurse would be one of the closest people

to the target population of burn victims. So cognition of the nurse that they are a part of HMIS would contribute to completion of the HMIS of SBT-hp. They would make timely reports, be familiar with the context, and contribute to the detection of underlying factors about data/information pertinent to MCoD, resulting in improvement of quality of data/information.

Other significant people involved with the patient are anesthesiologists, anesthetic nurses, laboratory technicians, pharmacists, X-Ray technicians, laundry managers, etc. Participation of those with a different position/approach toward the patient by building the partnership may complete the HMIS of SBT-hp.

According to Neil, participation of the pharmacist within the health information system of ICU could result in effective and efficient care (Neil 2004). The above examples affirm that increased participation of all stakeholders may contribute to completion of the HMIS of SBT-hp.

6.2.6. Weakness of monitoring & evaluation and lack of capacity in analysis/interpretation of data/information

According to literature search, proper monitoring and evaluation of the process and outcome of HMIS, and capacity building of the process especially for analysis/interpretation of data/information will strengthen the HMIS.

Some quality assurance programs such as "Audit" and "Benchmarking" have several benefits such as reduced physical and mental staff stress, improved safety of service, ensure the security of service provider, strength the effectiveness as well as cost effectiveness (Field 1992).

"Auditing" provides a method for the assessment, evaluation which lead to improvement of the quality of care (Irvine 1997). Clinical audit is applied for the whole clinical team and medical audit is applied for the services delivered by doctors (Irvine 1997). Basic steps of "Auditing" is following: "Determine the subjects of audit and prioritize the subjects"; "select an effective and feasible approach for the definition of criteria"; "Collect data about current performance and assess the current performance against criteria"; "Identify the necessity for change"; "Implement"; and "Re-evaluation" (Irvine 1997).

"Benchmarking" is another way to evaluate quality compare to other providers or national/local standard (Elis 2000). Benchmarking gives an opportunity to set performance standards (Ellis 2000). The overall aim of benchmarking is to achieve and maintain best clinical practice. To seek what is feasible and optimal in given circumstances by comparing with

national/local standard is also important components of "Benchmarking" (Ellis 2000). Ellis (2000) told that there are following major steps; "select a particular activity; organize a working team"; "collect and analyze the data about given interventions"; "take action to change the current practice"; "re-evaluation" (Ellis 2000).

Mancey-Jones (1997) told that the expected outcome of audits is improved quality of medical practice. Wagaarachchi (2001) describe success to reduce the fatal events in obstetric complications by auditing prioritized to the management of life-threatening obstetric complications in Ghana and Jamaica. Those example shows that audit is a feasible, acceptable and effective measure to improve the quality of medical services at district hospital level in low/middle income countries.

Applying those methods will enforce the monitoring & evaluation function of HMIS concerned with MCoD & SoMCoD of SBT-hp. At the same time, it will strengthen the analysis/interpretation capacity of data/information concerned with the MCoD & SoMCoD because it is one of the clinical services/practices delivered by doctor and clinical team. As well as the peripheral staff and HMT team of the SBT-hp, it may require applying those methodologies to higher levels for capacity building.

6.2.7. Weak Feedback Mechanism

There are many kinds of feedback and many ways to feedback. According to Hallaj, a successful outcome was observed by issuing epidemiological bulletins within the infectious surveillance system. (Hallaj 1996) Another study by Pillay, suggests that certain incentives for health managers would influence their performance. This was done by .comparing competency of health managers in both the private and public sector (Pillay 2008). Feedback about career opportunity would also affect to the motivations of health information managers according to Carter (Carter 1997). The creation of an effective feedback system will be a challenge in the context of SBT-hp.

Herzberg (1985) found that achievement, recognition, promotion and the work itself could motivate people. On the other hand, factors like low salary, poor working conditions and poor supervision cause dissatisfaction. (Herzberg 1985). And all of those responses of employee are result of feedback.

As described in literature, recognition of the performance of the team is important feedback for the team and worker (Hallaj 1996). And performance of clinical practice is generally feedback through the expressed

gratitude of the patient or family. However, due to the relatively high mortality rate in low/middle income country, this would be difficult. Considering this background, acknowledgement of the MCoD has the possibility to de-motivate the staff. Feedback from the patient would be absent and would compound the situation, if they convey information about death as being a poor result of their clinical practice.

Feedback about career opportunity may increase staff motivation. However, in conflict situations, it is difficult to have these opportunities. Decision making ability for MCoD contributes to being a good hospital information manager. However, within the context of the hospital and the conflict of war, it is virtually impossible to attain such a career ambition. Incentives are difficult within the scarce financial bounds of this context.

6.2.8. Weak environment and support from the laboratory

Bates (2004) emphasizes the importance of laboratory and quality management for accuracy of data and information. Processing data with lack of those supports and procedures could result in problems with the quality of information.

Within the context of Sulaymaniyah Burn-Trauma Center quality of information about MCoD would be improved with increased support of the laboratory, X-ray and other useful examination.

Autopsy is one of the tools which could support strongly analysis of MCoD. It could be in the form of a specialized laboratory for MCoD which would enable quality control of MCoD analyzed by clinicians. As described already, autopsy could provide quite accurate information about MCoD even in burn injury (Kallinen 2008) (Fish 2000).

6.2.9. Lack of Trained HR

This study has determined that leadership, motivation, problem solving skills, flexibility and negotiation skills are required competencies for the health information manager. Additionally, clinical classification skill is also ranked as an important skill. Without training, it is difficult to find such human resources (Callen 2002).

Importance of trainings for hospital managers in public sectors is emphasized. According to Pillay, there are big differences in competency was observed between pubic and private sector hospital managers (Pillay 2008).

It has emphasized that not only in the public sector of middle income countries, but for improvement of quality and productivity, it is necessary in the education of evidence based management to Chief Executives of large

health care systems of developed countries, (Griffith 2002).

In the context of Sulaymaniyah Burn-Trauma hospital, HMT was organized with personnel of DoH and INGO. Even as a hospital manager of public sector, and even as a Chief Executive of health care system of developed country, refurbishment of skills and knowledge about evidence based management seems to be necessary for HMT.

7. Conclusion & Suggestion

7.1. From assessment of MCoD & SoMCoD of SBT-hp

From this study, importance of the way of defining MCoD is found. This study shows that inappropriate definitions MCoD can't produce useful information to make management decisions. As done in the expert-validated data, the use of IFMCCD may be one of the solutions in better describing the MCoD. Selection of U-MCoD makes clear what should be prioritized in developing policy.

However as study of Bauer (1986) suggest that it would be difficult to achieved standard definitions of MCoD of burn victim if each individual or institute use their own definition or diagnosis in describing the MCoD. Additionally, as suggested by the Alexander (2002), it is quite challenging to select a single U-MCoD of burn victims because of its complexity of pathology. So, even the use of IFMCCD may be difficult to describe appropriate MCoD of burn victims and couldn't be a solution for fulfillment of task of HMIS of burn care. Bauer suggested, there may be necessary to establishing international standard registration specific to burn.

Practically, those registrations of MCoD of burn victims are not internationally standardized; applying IFMCCD as a format to describe MCoD in HMIS of SBT-hp is the first action the HMT could implement to improve the quality of information and reliability of evidence.

According to statistics, it is estimated that "pulmonary edema", "inhalation injury", "ARF" or "ARS", "volume overload" are the most contributing conditions for the mortality of burn population of SBT-hp. However, as discussed in this study, there are limitations in intervention to "inhalation injury", "pulmonary edema" and "ARF/ARS" because of the setting surrounding SBT-hp. Core treatment for these three conditions requires quite high technical standard and equipment. Among them are respiratory ventilator and dialysis machine, which are difficult to obtain in the surrounding context. Additionally, training for proper use and maintenance of those equipments would take time. Furthermore, to have safe environment, like 24 hour electricity supply, permanent provision of

basic disposable sanitation equipment etc., to run those machines is quite difficult to expect in conflict settings. So it is not realistic to expect to have such core counter measures for "inhalation injury", "pulmonary edema", and "ARF/ARS". Of course the HMT team could consider other optional treatment for those conditions, like use of inhaler, drugs etc. It is possible and necessary to develop the policy by considering those other optional treatment (annex 5). However, to develop policies the focus on those conditions should be limited.

The HMT must prioritize to the intervention for "volume overload" at first, because it would change the mortality immediately with a simple education and without a lot of investment. As discussed in this study and corresponding to the need of burn care in Iraq war, importance of "volume overload" is realized once counter measures for "volume overload" has been created (JTTS of USAISR 2008) (Barillo 2008) (Ennis 2008) (White 2008). Use of those guidelines would be quite benefit for the medical workers and for the patients.

7.2. From exploring influencing factor of MCoD & SoMCoD of SBT-hp

The literature study showed that improving attitude towards "inadequate appreciation of the value of data" of the staffs taking part in HMIS, the quality of data/information/evidence can be improved.

However, to raise motivation to improve the attitude of "inadequate appreciation of the value of data" is quite challenging especially for burn in the context surrounding SBT-hp because of the cultural aspects. As reported by Sharma (2006), it is quite difficult to proof but there are the possibilities that medical negligence exist. If the cultural context surrounding SBT-hp were nourishes the medical negligence of some cases, it would be extremely difficult to motivate people. Therefore,, it seems opportune to further study the influence of the specific cultural behavior to the motivation of the staff working on the environment surrounding SBT-hp.

By avoiding misuse of the evidences politically by the central level, it will nourish the culture of evidence based decision making. It is said that changing culture will achieve by the attitude of the top of the organization (Muir 2008). So by changing attitude of the HMT and respect the culture of evidence based practice as chief executive of the hospital, this will be followed by the top of the clinical team and spread to the peripheral health workers. Clinical teams will then start to realize the importance of information of medical cause of death and this will contribute to construct a proper HMIS.

As discussed, proper guideline with clear assignment, distribution of the responsibility and lineation of the responsibility may contribute a lot for constructing proper HMIS of SBT-hp. However, even there are clear guidelines and distribution of the responsibility, lack of the accountabilities prevent well performance. As Muir (2003) describe, performance will be better by increase competency as well as motivation which already we discussed. It would be necessary to increase and support the environment that nourish the competency of the staff for well perform HMIS.

As discussed, it would be difficult to have standard case definition which could provide enough quality of information for HMIS about burn cases. The limited setting surrounding the SBT-hp, couldn't expect support from laboratory and modern technology, and there are no way to establish standard case definition of burn simple enough to be used by peripheral medical staff like un-trained doctor. As described by the Hallaj, standard case definitions are necessary to have sufficient quality and it should be simple enough to use by the health workers of which majority has a limitation in their skills and works in a limited setting (Hallaj 1996). So making simple standard definition about MCoD of burn victim which is available at setting surrounding SBT-hp would be quite challenging task. However, effort should be made and further study is needed in this area.

By improving concordance between efficiency/simplicity and sufficiency of collected data/information, its quality will be improved. For the diagnoses of MCoD, adjustments need to be made in the context of SBT-hp; however, it is achievable by with using exiting guidelines. For the SoMCoD, use of ICD-10 will help the interpretation and integration of the information. By making balance by those strategies, HMIS of SBT-hp will improve.

By participation of stakeholders who are close to the target population or whose approach/position toward the target population is different, HMIS of SBT-hp would be complete and quality of data/information would be increase. Additionally, the participation of the family and community will enable to have a broader picture about burn in the area. That information is important from the public health point of view and thus also important for hospital management. The HMT should consider this fact and make a plan for the communication with the family of the patient and the community.

Applying some of quality assurance programs such as Audit and Benchmarking will enhance the monitoring & evaluation function of HMIS concerns about MCoD & SoMCoD of SBT-hp. It will also strengthen the analysis/interpretation capacity concerning MCoD & SoMCoD, because the

diagnosis of MCoD could be seen as the clinical services/practice delivered by doctor and clinical team. Apart from the peripheral staff and HMT team of the SBT-hp, it may be required to apply application of these methods by the upper layers of management, which will require additional capacity building. By applying those methods, the capacity to monitor and evaluate the process and outcome of HMIS of SBT-hp would be compensated.

Giving a proper feed back will strengthen the HMIS of SBT-hp. However, there are many limitations in the environment surrounding SBT-hp for proper feedback, for example the context of conflict and limited budget. However, health information managers are important and such positions focusing on the MCoD would be playing a core role. If impossible in the MoH system, there would be opportunities in the system of INGO. Especially for an INGO which prefers to intervene and support in conflict areas, as a focus on the MCoD about burn care could also be useful in other contexts. Consider the fact that burns is a hot international issues as 95% of burden of the burn is in low/middle income country, and most fatalities due to vehicle bomb attacks are the result of burns, such INGO position will be necessary and create organizational opportunities..

Support of laboratory and other scientific-technological institutes, like autopsy will also strength the HMIS of SBT-hp. However, it is quite difficult to have those supports regularly because of the limited setting. In such limited cases, it should be better to use those support for quality control purpose. However, it is necessary to make standard case definition, if we consider using autopsy for quality control purposes.

Trained human resources are essential for HMIS. How to best train people in a working environment of ongoing conflict and unstable political/social structure, and an environment of medically stressful conditions, would be necessary to study further.

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Pray for the soul of the victims.
And pray for the peace in Kurdistan, Iraq and the World.

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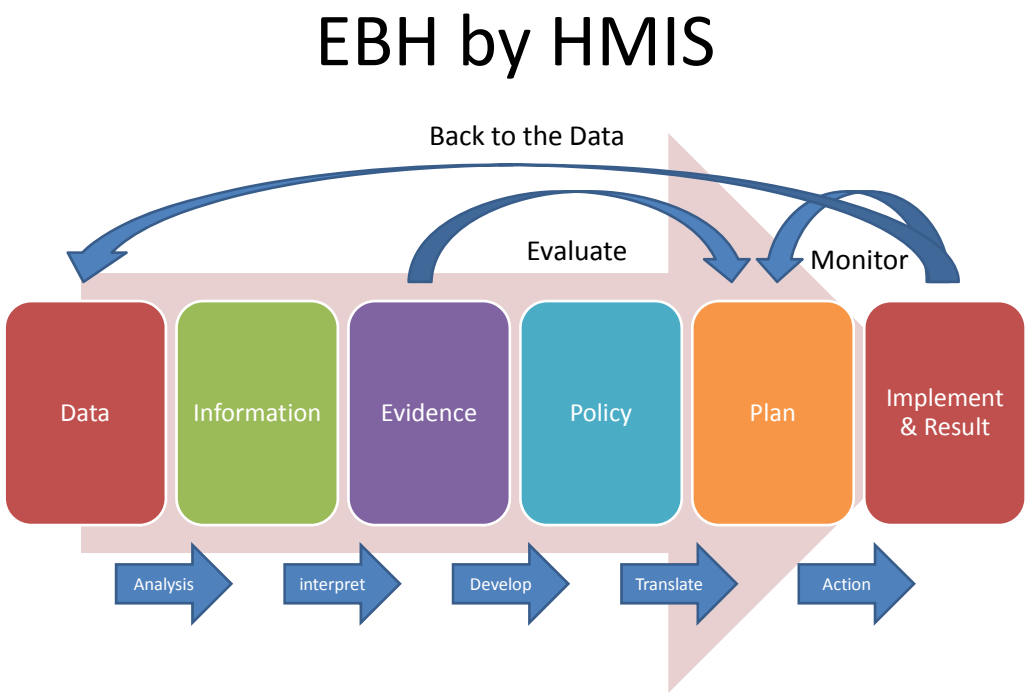
9. List of Figures, Tables and Graphs

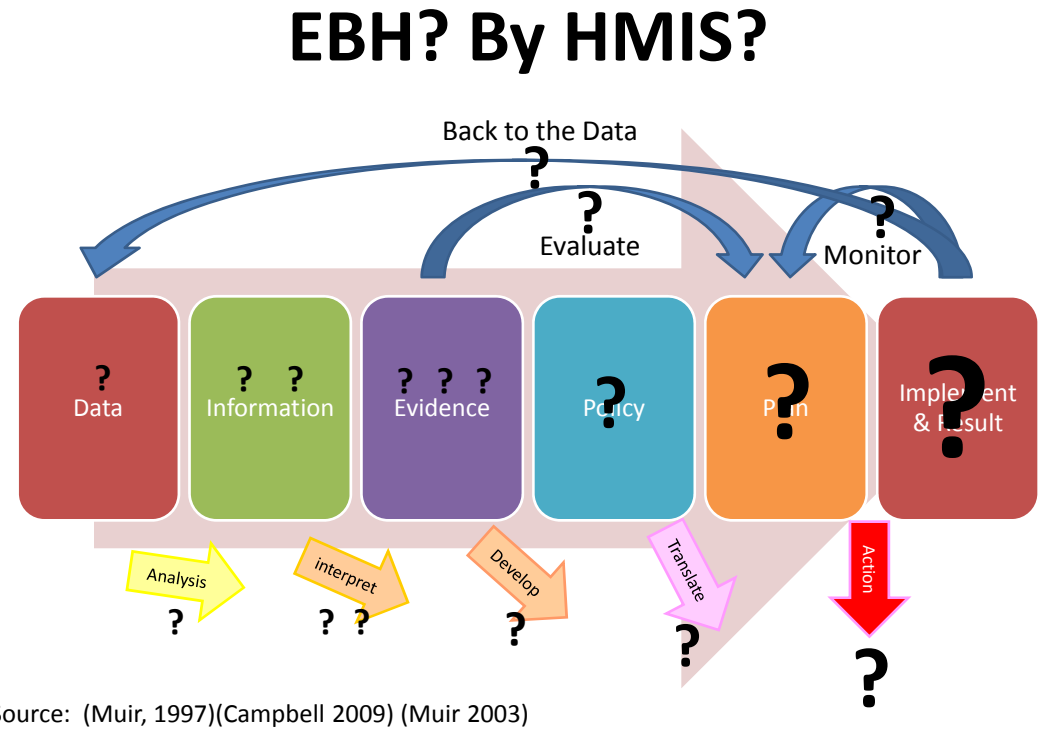
Figures

Figure 1-1



Source: (Muir, 1997)(Campbell 2009) (Muir 2003)

Figure 1-2

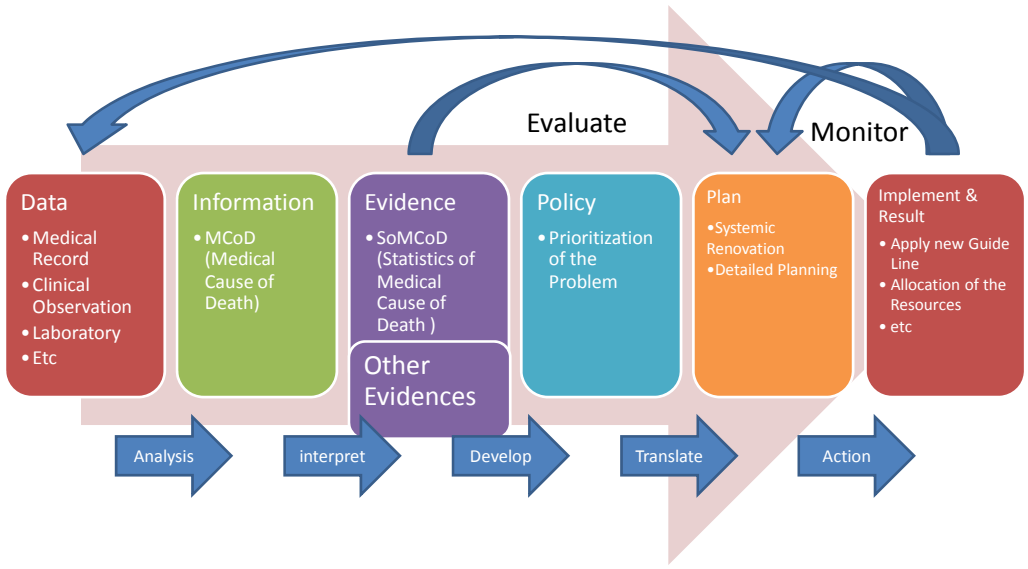


Source: (Muir, 1997)(Campbell 2009) (Muir 2003)

Figure 1-3

Evidence Based Hospital Management By HMIS

Object: Reduce the Mortality of hospitalized patient.

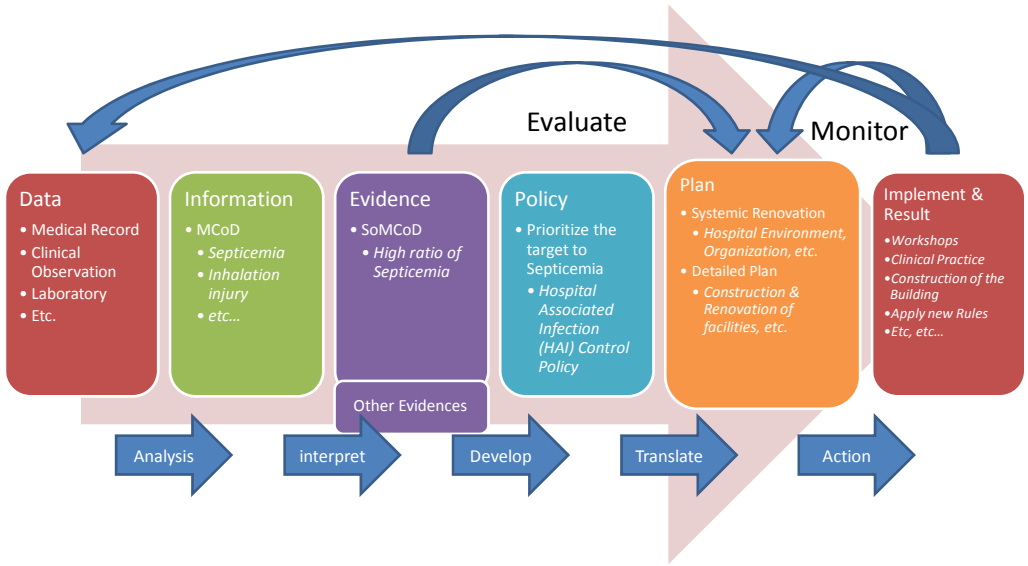


Source: (Muir, 1997)(Campbell 2009) (Muir 2003)

Figure 1-4

Evidence Based Hospital Management By HMIS

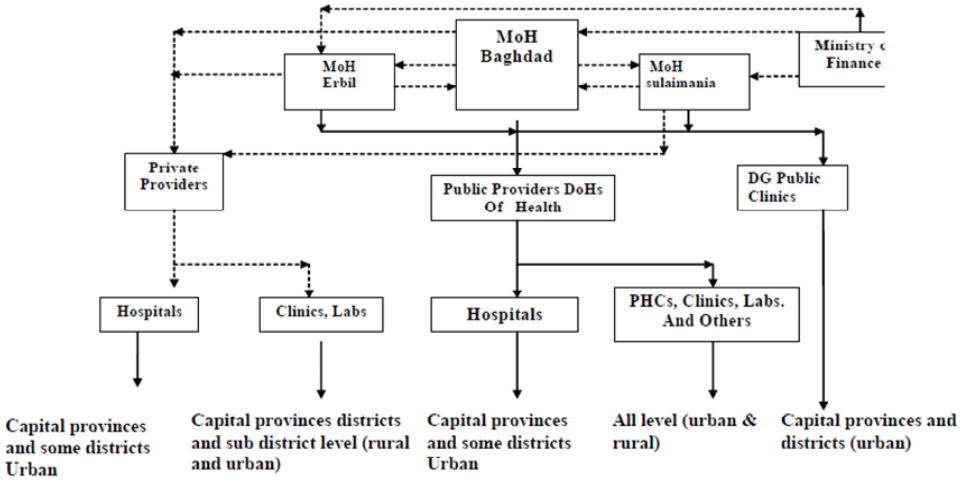
Object: Reduce the Mortality of hospitalized patient.



Source: (Muir, 1997)(Campbell 2009) (Muir 2003)

Figure 2

Health Organization Diagram of Iraq & Iraqi-Kurdistan



Source: (WHO 2005)

Figure 3

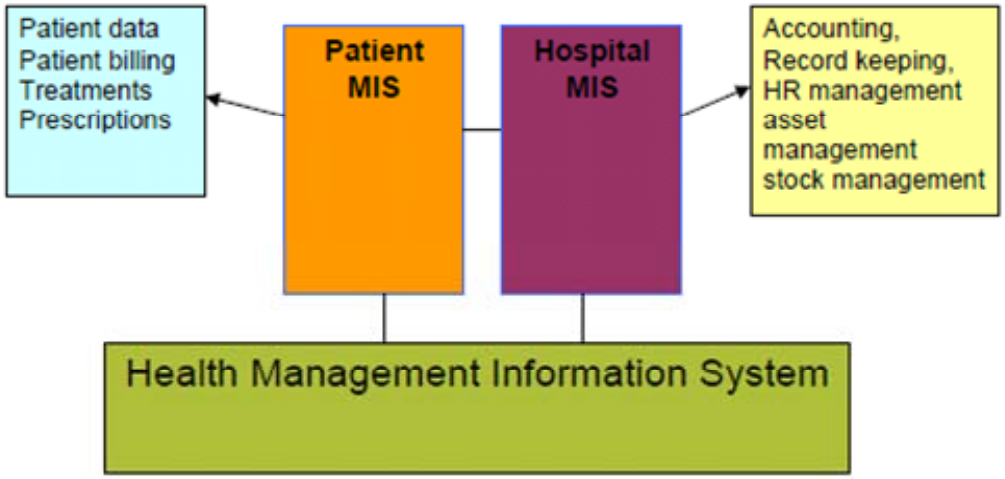
Burden of Burn in low/middle income country

REGION	Africa	The Americas		South-East Asia	Europe		Eastern Mediterranean		Western Pacific		WORLD
Income group	low/ middle	high	low/ middle	low/ middle	high	low/ middle	high	low/ middle	high	low/ middle	
Number of burn deaths (thousands)	43	4	4	184	3	21	0.1	32	2	18	312
Death rate (per 100 000 population)	6.1	1.2	0.8	11.6	0.7	4.5	0.9	6.4	1.2	1.2	5.0
Proportion global mortality due to fires (%)	13.8	1.3	1.3	59.0	1.0	6.7	0.02	10.3	0.6	5.8	100

*Countries within each geographical region have been further subdivided by income level, according to the divisions developed by the WB.
Source: (WHO Global Burden of Disease Database, 2002 (version 5)).

Figure 4

HMIS
relation with PMIS&HOMIS



Source: (Nicole 2007)

Figure 5

INTERNATIONAL FORM OF MEDICAL CERTIFICATE OF DEATH

Cause of death		Approximate interval between onset and death
I Disease or condition directly leading to death *)	a) ..... due to (or as a consequence of)	.....
Antecedent causes Morbid conditions, if any, giving rise to the above cause, stating the underlying condition last	b) ..... due to (or as a consequence of)	.....
	c) ..... due to (or as a consequence of)	.....
	d)	.....
II Other significant conditions contributing to the death, but not related to the disease or conditions causing it	.....	.....
	.....	.....
**This does not mean the mode of dying, e.g. heart failure, respiratory failure. It means the disease, injury, or complication that caused death.*		

Source: (WHO 2004)

Figure 6

$$P = M \times C / B$$

- P: The performance of an individual or team
- M: the level of motivation of the individual/team
- C: the level of competency of the individual/team
- B: barriers the individual/team has to overcome in order to perform well

Source: (Muir 2003)

Table

table 1: Content of Secondary data
Basic bio data
Hospital ID
Date of admission and death
Place of burn
Cause of burn
Diagnosis of MCoD
Weight
TBSA of burn injury include record about the detailed area.
Calculated Burn Index
Resuscitation IV fluid volume
Interval before hospitalization and amount of volume if patient is referral from other hospital
Fluid in-out Balance (at least till day 8, 4~8 hourly)
Starting date and name of anti-biotic
Specific note (symptom and prescription) which specialist of HMT thinks important in MCoD.

table 2: Expression of MCoD

table 2a: HMT database

Inhalation injury
inhalation injury+H.F
Septicemia
Cardiac Arrest
Burn and VF

table 2b: Specialists

Inhalation injury
Septicemia
Pneumonia
Pulmonery edema
volume overload
Acute Renal Failure
Acute Renal Shock
Hyperkalemia
GI Bleeding
DIC
Respi arrest
Respi/Cardiac arrest

Table 3

Table 3a
The way of description of MCoD of HMT database.

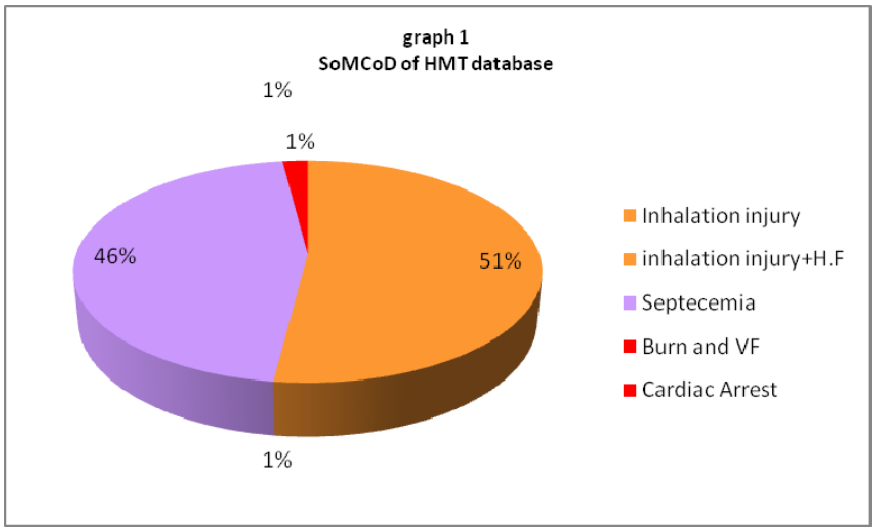
Inhalation injury	51
inhalation injury+H.F	1
Septicemia	46
Burn and VF	1
Cardiac Arrest	1

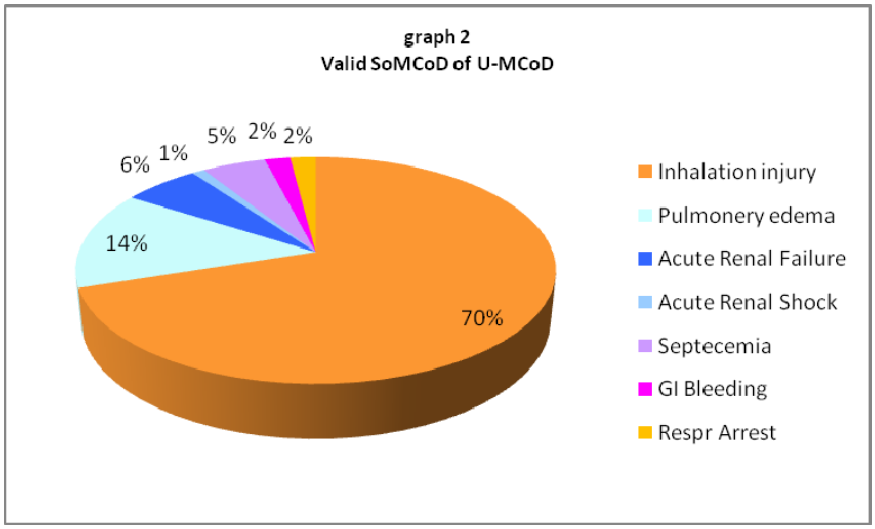
Table 3b
The way of description of MCoD of Specialists

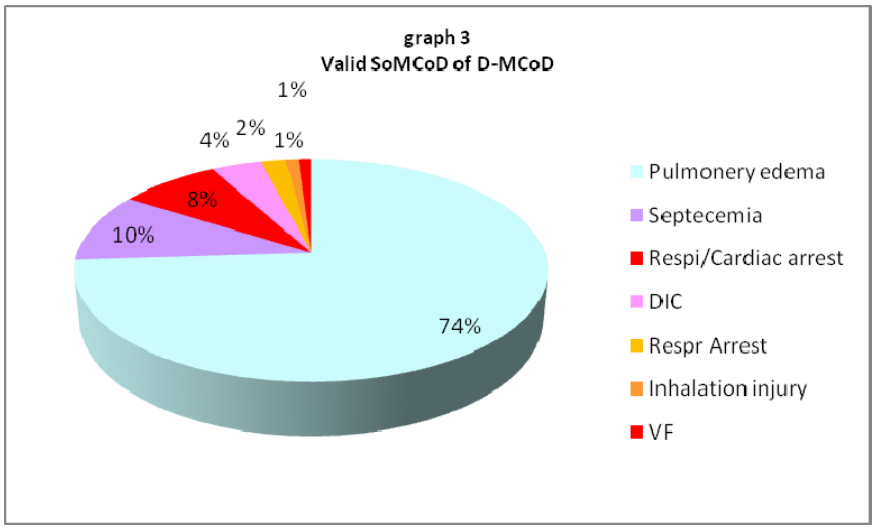
Diagnosis X					
Direct course of death	1st related course	2nd related course	3rd related course	other significant condition	
Inhalation injury					1
Pulmonery edema	Inhalation injury				3
Pulmonery edema	inhalation injury			volume overload	11
Pulmonery edema	Acute Renal Failure	inhalation injury			14
Pulmonery edema	Acute Renal Shock	Inhalation injury			1
Pulmonery edema	Acute Renal Shock	inhalation injury		volume overload	5
Respi/Cardiac arrest	Acute Renal Failure	inhalation injury			8
Septicemia	Pneumonia	inhalation injury		volume overload	1
Septicemia	Pneumonia	Acute Renal Failure	inhalation injury		1
Pulmonery edema	Acute Renal Shock	inhalation injury			1
Septicemia					2
Septicemia	Pneumonia	Pulmonery edema		volume overload	6
DIC	Septicemia				1
DIC	GI Bleeding	Septicemia			2
VF	Hyperkalemia	Acute Renal Failure			1
Pulmonery edema				volume overload	5
Pulmonery edema	inhalation injury			volume overload	20
Pulmonery edema	Acute Renal Shock			volume overload	1
Pulmonery edema	Acute Renal Failure				2
Pulmonery edema	Acute Renal Shock	inhalation injury			1
Pulmonery edema	Acute Renal Shock	inhalation injury		volume overload	1
Pulmonery edema	Acute Renal Failure	inhalation injury			2
Pulmonery edema	DIC	GI Bleeding		volume overload	1
DIC	GI Bleeding				1
Respi arrest					1
Pulmonery edema				volume overload	3
Pulmonery edema	Acute Renal Failure				3
Respi arrest					1
					100

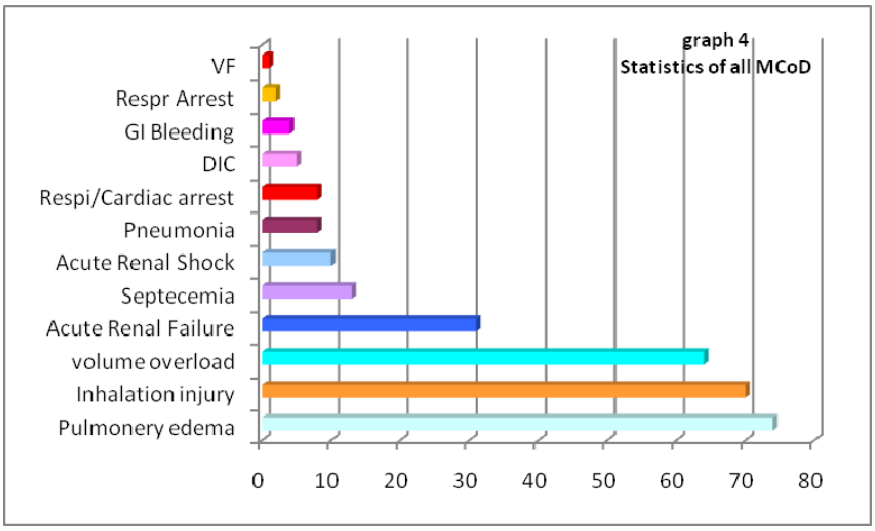
table 4: Frequent observed problems of HMIS in Low/Middle income country
Gaps in information needed
Poor data collection and processing practice
Lack of analysis/interpretation of data/information
Under-utilization of available data/information
Overload or Shortage of data/information
Poor reliability and validity of data/information
Lack of skills in information management and/or Lack of training and human resource development
Lack of compatibility between systems
Unaffordable to develop & maintain
Lack of overall information strategy
Lack of blueprint of successful design
Lack of blueprint of implementation strategy

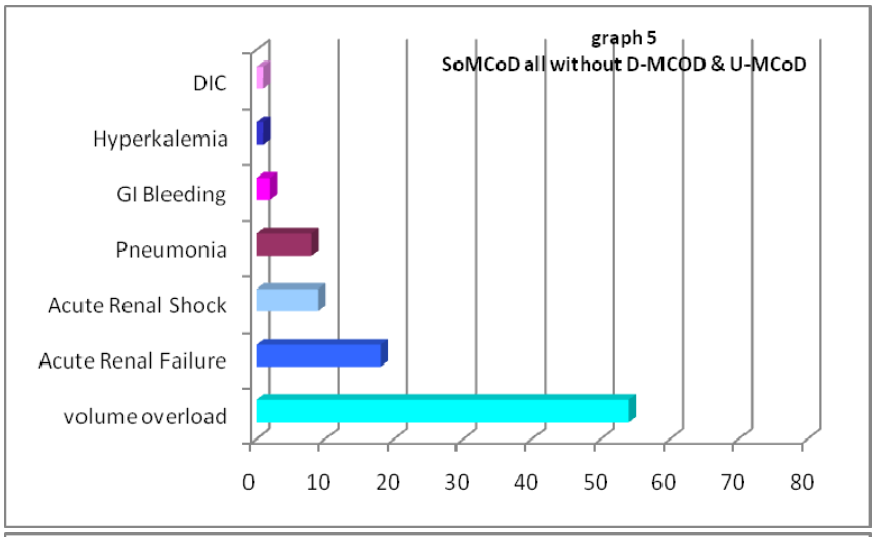
Graph

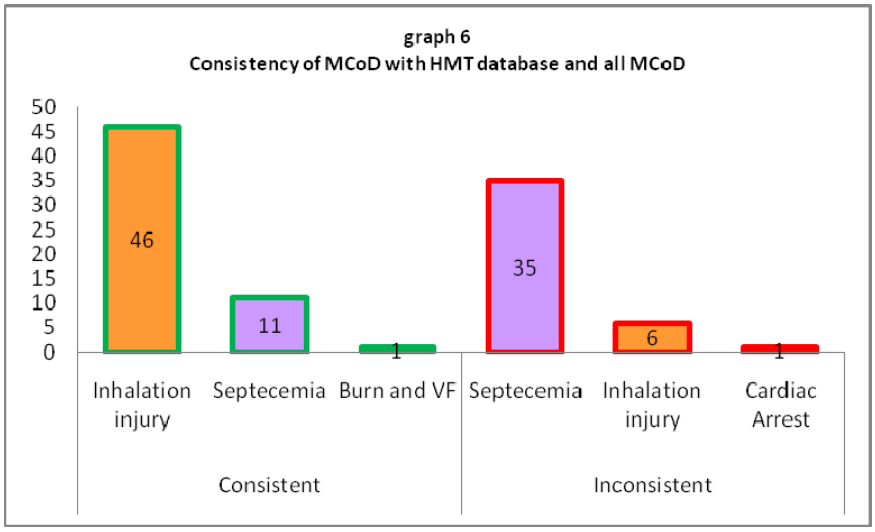

graph 1
SoMCoD of HMT database
1%
1%
46%
51%
1%
Inhalation injury
inhalation injury+H.F
Septecemia
Burn and VF
Cardiac Arrest

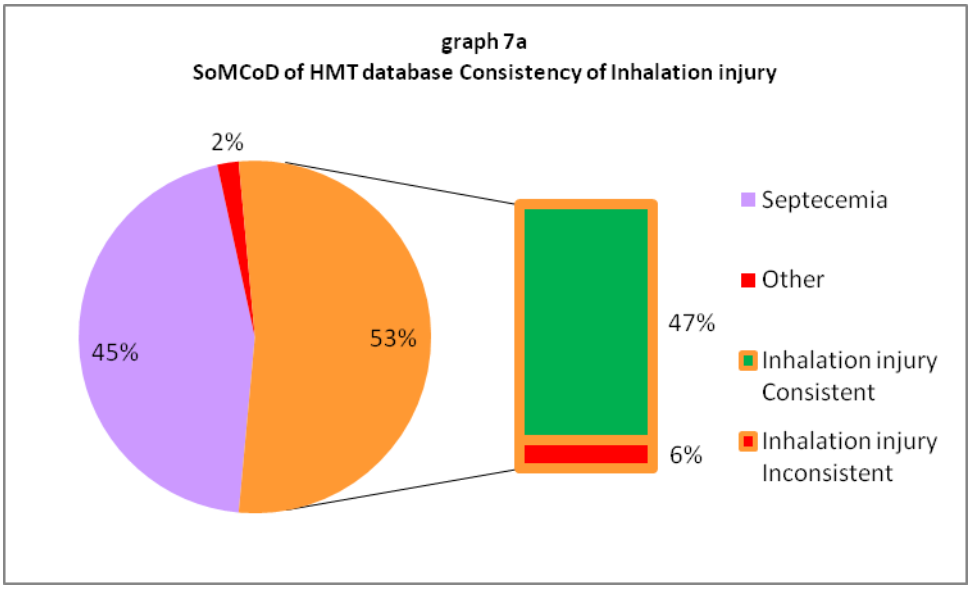

graph 2
Valid SoMCoD of U-MCoD
6%
1%
5%
2%
2%
14%
70%
Inhalation injury
Pulmonery edema
Acute Renal Failure
Acute Renal Shock
Septecemia
GI Bleeding
Respr Arrest

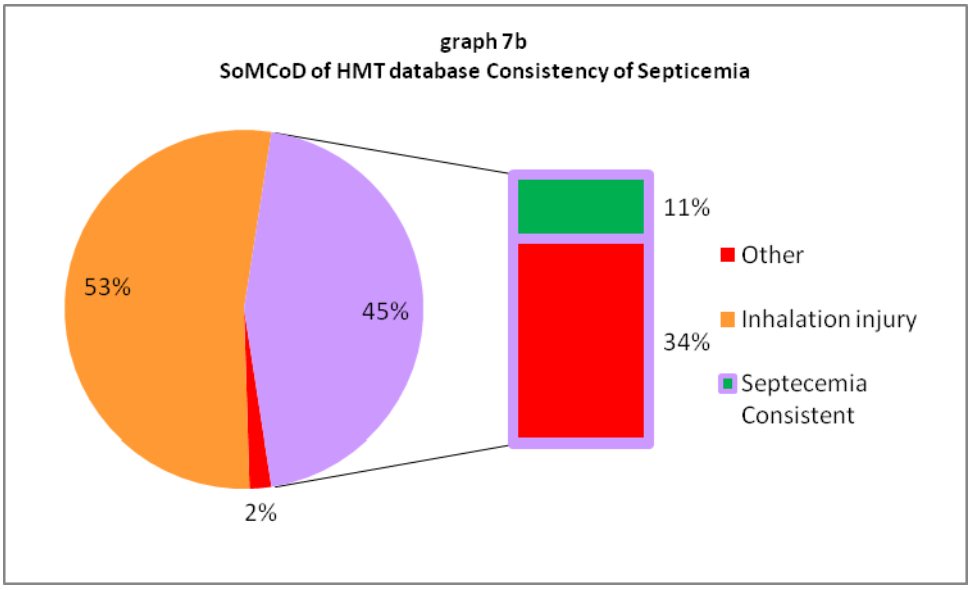

graph 3
Valid SoMCoD of D-MCoD
1%
4%
2%
1%
8%
10%
74%
Pulmonery edema
Septecemia
Respi/Cardiac arrest
DIC
Respr Arrest
Inhalation injury
VF


graph 4
Statistics of all MCoD
VF
Respr Arrest
GI Bleeding
DIC
Respi/Cardiac arrest
Pneumonia
Acute Renal Shock
Septecemia
Acute Renal Failure
volume overload
Inhalation injury
Pulmonery edema
0
10
20
30
40
50
60
70
80


graph 5
SoMCoD all without D-MCOD & U-MCoD
DIC
Hyperkalemia
GI Bleeding
Pneumonia
Acute Renal Shock
Acute Renal Failure
volume overload
0
10
20
30
40
50
60
70
80


graph 6
Consistency of MCoD with HMT database and all MCoD
50
45
40
35
30
25
20
15
10
5
0
46
11
1
35
6
1
Inhalation injury
Septecemia
Burn and VF
Septecemia
Inhalation injury
Cardiac Arrest
Consistent
Inconsistent


graph 7a
SoMCoD of HMT database Consistency of Inhalation injury
2%
45%
53%
47%
6%
Septecemia
Other
Inhalation injury Consistent
Inhalation injury Inconsistent


graph 7b
SoMCoD of HMT database Consistency of Septicemia
53%
45%
2%
11%
34%
Other
Inhalation injury
Septecemia Consistent

10. Annex

Annex 1: Validation of data of Specialist X

Validation of data of "specialist X" with "specialist Y" by "goodness of fit" is carried out. Epi-Calculator 2000 is used for the examination. Because the way of description of MCoD of both specialist X and Y is based on the IFMCCD, examination is carried out by both U-MCoD and D-MCoD.

Percentage of diagnosis below 5% of total diagnosis is counted as others because those don't have a significant value to be differentiated.

In examination of "goodness of fit" of "U-MCoD", diagnose as "inhalation injury" is count together with "pulmonary edema" and categorized as "respiratory complication" because both condition is concerning with respiratory tract and intervention for those are the same. Diagnosed as "ARS" in specialist B is count as "ARF" because "ARS" is part of "ARF" but different in clinical manifestation.

In examination of "goodness of fit" of "D-MCoD", diagnosed as "pneumonia" in specialist C is count as "septicemia". Because cause of "pneumonia" is bacterial infection which is same cause of "septicemia" and both diagnosis could be categorized as death by infection of bacteria.

Validity of SoMCoD of U-MCoD of Specialist X with Specialist Y

	Observed (Specialist X)	Expected (Specialist Y)
Respiratory Complication	84.00	84.00
ARF	7.00	7.00
Others	9.00	9.00
Result		
Chi-Square	0.00	
DF	2	
P-value	1	

Validity of SoMCoD of U-MCoD of Specialist X with Specialist Y is confirmed by examination of "goodness of fit" with chi-square 0.00, DF 2, p-value 1

Validity of SoMCoD of D-MCoD of Specialist X with Specialist Y

	Observed (Specialist X)	Expected (Specialist Y)
Pulmonary Edema	74.00	73.00
Septicemia	10.00	10.00
Respi/Card Arrest	8.00	8.00
Others	8.00	9.00
Result		
Chi-Square	0.12	
DF	3	
P-value	0.988702	

Validity of SoMCoD of U-MCoD of Specialist X with Specialist Y is confirmed by examination of "goodness of fit" with chi-square 0.12, DF 3, p-value 0.988702

Annex 2: Validation of data of SoMCoD of HMT database

Validation of data of SoMCoD from HMT database is carried out by "goodness of fit". Epi-Calculator 2000 is used for the examination.

Because of the difference of the way of description of MCoD by HMT database and that by valid data, examination is carried out by the both estimation that MCoD of HMT database is describing U-MCoD and D-MCoD.

In examination of "goodness of fit" of "U-MCoD", diagnose as "inhalation injury" is count together with "pulmonary edema" and categorized as "respiratory complication" because both condition is concerning with respiratory tract and intervention for those are the same. Diagnosed as "ARS" in specialist B is count as "ARF" because "ARS" is part of "ARF" but different in clinical manifestation.

Percentage of diagnosis below 5% of total diagnosis is counted as others because those don't have a significant value to be differentiated.

Sheet 3a
Validity of SoMCoD of HMT database as U-MCoD

	Observed (HMT data)	Expected (Specialist Y)
Respiratory Complication	52.00	84.00
ARF	0.00	7.00
Septicemia	46.00	5.00
Others	2.00	4.00
Result		
Chi-Square	356.39	
DF	3	
P-value	0.000002	

Validity of SoMCoD of HMT database as U-MCoD is confirmed by examination of "goodness of fit" with chi-square 356.39, DF 3, p-value 0.000002

Sheet 3b
Validity of SoMCoD of HMT database as D-MCoD

	Observed (Specialist X)	Expected (Specialist Y)
Pulmonary Edema	0.00	74.00
Septicemia	46.00	10.00
Respi/Card Arrest	0.00	8.00
Others	54.00	8.00
Result		
Chi-Square	476.10	
DF	3	
P-value	0.000003	

Validity of SoMCoD of HMT database as D-MCoD is confirmed by examination of "goodness of fit" with chi-square 476.10, DF 3, p-value 0.000003

Annex 3: Pathology of Burn

Damage of the skins, mucosa and muscle by burning causes problem in metabolism of water and electrolyte of human body, cause strong inflammation which affect to all organs, and makes easier to got systemic infection.

Damage of the skin by the burn makes easier to evaporate body fluid and makes easier to lose body fluid and electorate. Especially potassium balance, which strongly associate with cardiac arrest, is affected because of damage to the cells of mucosa and muscle. Those conditions make dehydration and inconsistency of serum electorate balance which directly lead to death by itself and affect other ill condition. Myoglobin released from destroyed cells is known as quite harmful substance for the kidney. ARF caused by Myoglobin, low perfusion derived from dehydration and other harmful substances derived from strong inflammation makes worse the condition of fluid and electorate balance.

Strong inflammation derived from release of hormones and cytokines by the damaged and peripheral cells cause disturbance in communication of the specific functional cells inside the body. Those disturbances of the communication of the cells increase trans-permeability of vessels, cause micro to macro edema and result in dysfunction of many organs. Especially Lungs trunks and limbs are known to easily affected organs. Increase of trans-permeability cause lung edema and deteriorate the gas-exchanging function. Deterioration of oxygenation and accumulation of carbon dioxide will affect to all of the organ and metabolism inside the body. Swelling caused by the edema in trunks and limbs, result of increase of trans-permeability of vessels, cause compartment-syndrome. Compartment-syndrome in trunk causes difficulty in breathing by rigidity of the trunk. That of limbs makes necrosis in peripheral through ischemic condition made by physical obstruction of blood flow.

Stress caused by the inflammation affected also to the gastro-intestinal tract. Cytokines released from the cells cause unbalance for regeneration and immune system of mucosa membrane. Because of this, burn patient develop ulcer in gastro-intestinal tract. If appropriate major didn’t take, all the condition will deteriorate because lose of blood. Loss of blood will not only decrease the perfusion for organs but also affect for the oxygenation, and transportation of the carbon dioxide through loss of red blood cells, coagulation systems as result in DIC which will cause MOF.

Damage of the skin and those conditions describing above makes easier

to get infection after all. Physical barrier is already removed, low perfusion to the organs and damaged area by the excessive systemic inflammation decrease the opportunity to affect the immune system. If other condition already become weaken by the multiple and train of response, it would be easy to develop septicemia.

Addition to those multiple and sequent event, if the cause of the burn is fire, medical practitioner have to consider about the possibility to have damage in respiratory tract, which we call inhalation injury. Inhalation injury is caused by the inspiration of the heat air. It would damage the respiratory tract from upper respiratory tract to lower respiratory tract include alveolar. Damage in upper respiratory tract will result in obstruction of the air flow which will directly cause to death and damage in lower respiratory tract will cause inflammation in trachea-bronchial and alveolar level which results in both obstruction of air flow and lung edema. Those conditions will also make easy to got pneumonia (JTTS of USAISR 2006) (Walter Reed Army Medical Center 2004).

Annex 4: Treatment of Burn

Treatment of inhalation injury could divided by two region. One is treatment for upper respiratory obstruction caused by inhalation injury and the other is for lower respiratory obstruction caused by inhalation injury.

Upper respiratory obstruction, one of the results of inhalation injury, is caused by the regional; most of it is vocal cord and surrounding space of larynx, inflammation and edema. It will directly result in death without treatment. There are two clinical strategies to deal with this problem. One is by reducing the edema and second is to keep the air way mechanically. For reducing the edema, use of steroid could affect. However, it is difficult decision whether to use steroid for the burn patient. Because of its pathology, burn victims are quite susceptive to the infection so prescribing steroid will increase the risk of infection. To avoid the side effect of administration of steroid systematically, applying steroid locally by using inhaler could be a solution if there are no choice to keep the air way mechanically. To keep the air way mechanically, intubation or tracheotomy is necessary. Both procedures need a certain skill with certain equipment. Especially in management after intubation, it is necessary to sedate the patient. And for the management of sedation for intubation, respiratory ventilator is necessary to avoid the respiratory depression cause by the sedative drugs.

For lower respiratory obstruction, also one of the results of inhalation injury, is caused by spasm and edema derived from inflammation. Clinical strategy to treat this condition is two. One is systemic and local use of drugs including using of steroid which is not recommended because of increasing risk for infection, as same reason in treatment of upper respiratory obstruction. Drugs used for lower respiratory obstructions are expectorants and bronco-dilator like, β1-adrenergic receptor stimulator, xanthine derivative, etc. Second is to give Positive Endo-Expiratory Pressure (PEEP) mechanically in respiration. To give PEEP, intubation, tracheotomy, or other equipments develop for this purpose and respiratory ventilator is necessary.

For lung edema caused by the damage of alveolar level due to inhalation injury, clinical strategy to treat this condition is three. Those are systemic steroid use which is not recommended again, to give PEEP mechanically, and volume management including using diuretics like furosemide for not to develop the lung edema.

For the treatment of “ARF” and “ARS”, it is necessary to know the pathology of “ARF” and “ARS” in burn patient. One is called pre renal failure,

which is result of the low perfusion of the blood to the kidney. And the other is called renoparenchymal renal failure, which is due to histological damage to the renoparenchymal part of kidney by toxic substance, like “Myoglobin” released from damaged muscle, or other course. Dehydration by excessive evaporation and by lost of body fluid from the body surface cause low perfusion cause pre renal failure and excessive toxic substance for the kidney cause renoparenchymal damage. Difference between “ARF” and “ARS” is ability to secrete the urine. Once after kidney shows oliguria by becoming kidney failure, some cases that it could produce urine again after a good perfusion are observed. So in context of the burn, pathologically and clinically, correction of the dehydration is required for prevention and treatment of ARF & ARS as well as other damages caused by the dehydration. If kidney doesn’t function any more as regulator of water/electrolyte balance and releaser of toxic substance, there is no way to compensate without dialysis.

Dehydration is quite dangerous for burn patient. It will not only affect to their kidney function, but also directly lead to the death by ischemia of the crucial organs and extreme discordance of serum electrolyte balance. Sudden Cardiac arrest, respiratory arrest, VF will be occurred by dehydration.

To avoid these conditions, it is recommended to give certain big amount of volume of IV fluid after patient got burn injury for the resuscitation. However, after this resuscitation phase is over, it is required to manage the in-out balance of fluid strictly because there would be a possibility to death by this enormous amount of fluid in resuscitation phase.

IV fluid administrated during this resuscitation phase would not only be in the circulation of blood flow but most of it would be reserved in the interstitial tissues. Because of the systemic inflammation due to the damage of tissues by burn, trans-permeability of the vessels is becoming quite high. This environment enforces the leak of the IV fluid from blood vessels and reserved those fluids in cells and interstitial tissues.

Around 72 hours after injury, those fluids reserved in interstitial tissue start to back again to the circulation of the blood flow system. Excess volume of fluid in circulation would normally adjust by the kidney through urination. However, if this amount of volume is out of the range that kidney could deal with or if there are some problems in kidney function to produce urine, those excessive volumes of fluid in the circulation of blood will leak out to the damaged or susceptible tissues connect to the body surface.

Lung is one of the susceptible tissue connect to the body surface and easy to leak those excessive volume of fluids. Especially when alveolar and surrounding tissue is damaged by the inhalation injury, susceptibility of the lung is eminent and results in the “lung edema”.

To avoid this lung edema, it is recommended to do the strict volume management for not to be make the condition of “volume overload” after the administration of resuscitation fluid. Condition of “volume overload” increase high risk for developing lung edema and deteriorate other condition. According to “Emergency War Surgery” text book of BIWRAMC (69; BIWRAMC 2004), it is recommended to change the speed and amount of administration of IV fluid according to the Urine out put in limited setting which couldn’t obtain the benchmarks of appropriate fluid volume in the blood circulation like Central Venous Pressure (BIWRAMC 2004).

According to the both analyzer, definition of “volume overload” will judge from this principal. It is strongly recommended to change IV fluid to keep urine out put between 0.5ml/kg/hour and 1.0ml/kg/hour (BIWRAMC 2004). This clinical practice seems to easily be applied even in the context of Study (JTTS of USAISR 2006) (Walter Reed Army Medical Center 2004).