

**A STUDY ON UNDER FIVE  
DEATHS IN MALAYSIA  
IN THE YEAR 2006**

**Ministry of Health  
Malaysia**



A STUDY ON UNDER FIVE DEATHS  
IN MALAYSIA  
IN THE YEAR 2006

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### 3. ABBREVIATIONS

|        |   |
|--------|---|
| A&E    | Accident & Emergency  |
| ACFRP  | Arizona Child Fatality Review Program   |
| CDM    | Clinical Data Management  |
| CFRT   | Child Fatality Review Team  |
| CHARGE | Coloboma, Heart defects, Choanal atresia, Retarded growth and development, Genital anomalies, Ear anomalies |
| CHD    | Congenital Heart Disease  |
| CNS    | Central Nervous System  |
| COD    | Cause of Death  |
| CRC    | Clinical Research Centre  |
| CRF    | Case Report Form  |
| DBKL   | Dewan Bandaraya Kuala Lumpur (Kuala Lumpur Town Council)  |
| DOB    | Date of Birth   |
| GI     | Gastrointestinal  |
| GP     | General Practitioner  |
| HIV    | Human Immunodeficiency Virus  |
| HKL    | Hospital Kuala Lumpur   |
| HMIS   | Health Management and Information System  |
| HO     | House Officer   |
| ICD10  | International Statistical Classification of Diseases and Related Health Problems 10 <sup>th</sup> Revision  |
| ID     | Identification  |
| IEC    | Independent Ethics Committee  |
| IMCI   | Integrated Management of Childhood Illness  |
| JOH    | Johor   |
| KED    | Kedah   |
| KEL    | Kelantan  |
| MEL    | Melaka  |
| MIC    | Mother's Identification Card Number   |
| MO     | Medical Officer   |
| MOH    | Ministry of Health  |
| MREC   | Medical Research Ethics Committee   |
| MRG    | Major Research Grant  |
| MVA    | Motor Vehicle Accident  |
| NA     | Not Applicable  |
| NAI    | Non Accidental Injury   |
| NEC    | Not Elsewhere Classified  |
| NICU   | Neonatal Intensive Care Unit  |
| NRD    | National Registration Department  |
| NRP    | Neonatal Resuscitation Programme  |
| NS     | Negeri Sembilan   |
| PALS   | Paediatric Advanced Life Support  |
| PHDW   | Paediatric High Dependency Ward   |
| PHG    | Pahang  |
| PHN    | Public Health Nurse   |

|        |   |
|--------|---|
| PICU   | Paediatric Intensive Care Unit                    |
| PKD    | Pejabat Kesihatan Daerah (District Health Office) |
| PLS    | Perlis  |
| PP     | Pulau Pinang                                      |
| PRK    | Perak   |
| RN     | Registration Number                               |
| RA     | Research Assistant                                |
| S/S    | Signs & Symptoms                                  |
| SAB    | Sabah   |
| SDP    | Source Data Provider                              |
| SEL    | Subject Enrolment Log                             |
| SLG    | Selangor  |
| SRW    | Sarawak   |
| STD    | Sexually Transmitted Disease                      |
| TB     | Tuberculosis                                      |
| TGG    | Terengganu  |
| UNICEF | United Nations Children's Fund                    |
| WHO    | World Health Organization                         |
| WPKL   | Wilayah Persekutuan Kuala Lumpur                  |
| WPLbn  | Wilayah Persekutuan Labuan                        |

#### 4. GLOSSARY

|   |  |
|---|--|
| Consultant  | Senior specialist on grade U54 and above.  |
| Ethnicity of child                                | Ethnicity of father; if ethnicity of father is not available, ethnicity of mother.   |
| Hospital death                                    | Death in a patient who arrived at the hospital with signs of life and had treatment in the hospital whether in the A&E, ward, intensive care etc. before he died. Included deaths occurring in all disciplines in the hospital and also included death during ambulance transportation from one hospital to another.   |
| Integrated Management of Childhood Illness (IMCI) | WHO and UNICEF child health strategy with the objectives of reducing death and frequency of illness and disability associated with the 5 major causes of diseases in children (pneumonia, diarrhoea, measles, malaria and malnutrition) and promoting improved growth and development. The components of this strategy are improvements in case management of the sick child in first level health facilities through the provision of training and clinical guidelines, improvements in the health system required for effective management of childhood illness and improvements in family and community practices. <sup>1</sup> |
| Non hospital death                                | Death that occurred outside the hospital which also included <ol style="list-style-type: none"><li>That brought in dead to the hospital</li><li>Death while on the way to care/hospital</li><li>Death in clinic/polyclinic</li><li>Death at home or elsewhere</li></ol>  |
| Other Malaysian                                   | Malaysian other than Malay, Chinese and Indian. Made up of mostly Orang Asli, Bumiputera Sarawak and Bumiputera Sabah.   |
| Specialist  | Doctor with a post basic qualification and had been gazetted as a specialist.  |
| Syndrome  | Congenital malformations with recognisable syndrome. eg Down Syndrome, Digeorge Syndrome.  |
| Treatment received for current illness            | Included treatment received in hospital and clinic, did not include self medication and traditional or complementary medication. For hospital deaths included only pre admission treatment.  |

## 5. SYNOPSIS

**Title:** STUDY ON UNDER FIVE DEATHS IN MALAYSIA IN THE YEAR 2006

### **Number of Sites**

All 14 states

### **Number of Subjects**

Planned : All deaths in children aged 28 days up to 5 years (28-1824 days) in the year 2006.

Evaluable: All the reported deaths.

### **Objectives**

1. To determine the under five mortality rate in Malaysia, and its distribution by personal characteristics and geographic areas for the year 2006.
2. To determine the common causes of under five deaths in Malaysia, and its distribution by personal characteristics and geography.
3. To determine the circumstances leading to death including the pre- and in-hospital care, with view to identifying opportunities to improve our health care provision and processes.

### **Methodology:**

#### **Study Design**

Observational, epidemiological and clinical study.

#### **Sampling & Subjects**

All children aged 28 days up to 5 years (28-1824 days) who died in the year 2006.

#### **Variables**

The variables obtained were

- State, District, Hospital.
- Name of patient, RN/MyKid/MIC, sex, ethnicity, date of birth, age.
- Date and time of admission, date and time of death, place of death.
- Cause of death (ICD classification).
- Co-morbid conditions (specify conditions).
- Symptoms (fever, cough, diarrhoea, convulsion) and duration.
- Treatment: date, place of treatment.
- Hospital treatment: place (ward, PHDW, PICU), person (HO, MO, specialist).
- Death preventable or not preventable.
- If preventable, is it patient, provider or system factor?
- Death not in a health facility: place of death, person who certified death, why not brought to Hospital.

#### **Statistical Methods**

The sample size for this study was not pre determined prior to the study. All children who died at age 28 to 1824 days in the year 2006 were included. All data obtained were used for analysis. Numerical data were analyzed for frequencies and rates, using the year 2006 population census as the denominator. The CRF received were reviewed for completeness and appropriateness by the researchers. Any incomplete or inappropriate data were queried back to the sites. The causes of death were also reviewed, and re classified when necessary according to the modified International Statistical Classification of Diseases and Related Health Problems 10<sup>th</sup> Revision, ICD 10 (appendix 4) by the researchers and project manager and analyzed for frequencies. The classifications of the 4 most common causes of death which were certain infectious and parasitic diseases, congenital malformations deformations and chromosomal abnormalities, injury poisoning and external causes, and diseases of the respiratory system

were further subclassified. The reasons for preventable deaths were also subclassified according to family factors, peripheral and referral centre problems and department and treatment problems. Each of these subclassifications was studied in more detail.

## Results

A total of 1699 deaths in children aged 28 to 1824 days (under 5 years of age and excluding neonates) were reported by 96 hospitals and 86 health districts. Of these 1303 (76.7%) were hospital deaths and 396 (23.3%) were non hospital deaths. The overall under 5 death incidence rate was 0.6 per thousand age specific population and 3.5 per thousand live births.

Most of the under 5 deaths (61.8%) occurred in the first year of life. The death incidence rate decreased as the age increased, from a rate of 1.6 at age of zero to a rate of 0.1 at age of four. The death incidence rate was higher in males compared to females at a ratio of 1.2 : 1.

The highest death incidence rate was in the ethnic group 'other Malaysian', which included mainly the Orang Asli, Bumiputera Sabah and Bumiputera Sarawak children. The rate of 1.3 in this group was more than 2 times the national rate of 0.6.

In all the ethnic groups except Orang Asli, more deaths occurred in hospitals. In Orang Asli children more than half the deaths (59.2%) did not occur in hospitals. In non citizens, there were very few non hospital deaths, possibly due to under reporting.

Overall, the 5 most common causes of deaths were in the ICD 10 classifications congenital malformations, deformations and chromosomal abnormalities (25.1%), certain infectious and parasitic diseases (18.8%), diseases of the respiratory system (13.0%), diseases of the nervous system (8.2%) and injuries, poisoning and external causes (7.5%).

Death from congenital malformations, deformations and chromosomal abnormalities was highest in the first year of life and decreased with age. Death from certain infectious and parasitic diseases increased from age 0 to peak at 2 years of age and then decreased. Death from injuries, poisoning and external causes was low at 0 and 1 year of age and increased with age becoming the most common cause of death at age 3 and 4. Deaths from diseases of the central nervous system decreased from age 0 to 1 and then increased.

In all ethnic groups except Orang Asli, other Malaysian and non citizen, the most common cause of death was malformations, deformations and chromosomal abnormalities. In these 3 groups the most common cause of death was certain infectious and parasitic diseases. Diseases of the respiratory system which was mainly pneumonia was an important cause of death in the groups Orang Asli, Bumiputera Sabah, Bumiputera Sarawak and non citizen, and endocrine nutritional and metabolic diseases an important cause of death in the groups Orang Asli, Bumiputera Sabah, other Malaysians and non citizen. Death from injuries poisoning and external causes was highest in the Indians with a percentage of 13.2 compared to the national of 7.5.

Taking the ethnic group Malay as the reference group, children in the ethnic groups Orang Asli, non citizen, other Malaysian and Bumiputera Sabah had higher risk of dying from diarrhoea, 8.7, 2.9, 2.7 and 2.2 times respectively. Risk of death from pneumonia was higher in the groups Orang Asli, non citizen, Bumiputera Sabah and Bumiputera Sarawak, 4.7, 2.7, 1.6 and 1.5 times respectively.

58.1% of the deaths were associated with co-morbid condition(s). The most common co-morbid condition was congenital anomalies. Congenital heart disease was the second most common

co-morbid condition, malnutrition the third and conditions from the perinatal period the fourth most common.

58.5% of the children had received treatment for the current illness leading to death. Most of them received treatment from government hospitals, government clinics and private clinics.

426 (25.1%) children did not receive treatment for the illness leading to death. The most common reason (39.9%) given by the care giver for not seeking treatment was that he or she was not aware that the child was seriously ill. In the non hospital group, non availability of transport was the most important reason for not seeking treatment. Use of traditional or complementary treatment and self medication were also important reasons especially in the non hospital deaths.

Of the 1303 deaths in hospital, 220 (16.9%) died within 6 hours of admission and 437 (33.6%) died within 24 hours of admission. This probably represented a very ill group of patients and there might also be delay in coming to hospital. In addition 85 children (6.5%) died in the A&E Department. This might imply that there was delay in seeking care and/or lack of resuscitation facilities or personnel in the A&E Department.

62.2% of the children who died in hospital had received care in intensive care units, and 53.9% were in the PICU, NICU and PHDW. 77.9% of the children who died in hospital had received treatment from a specialist or consultant.

Most of the non hospital deaths (67.2%) occurred in the home. 18.0% died on the way to the hospital or clinic and 4.3% died in the clinic. This might imply that there was delay in seeking care and/or lack of resuscitation facilities or personnel in the clinic. 6 died in place of care which included welfare homes and nurseries.

Only 40.4% of the non hospital deaths were certified by medical personnel and 71.8 % of these were doctors. The majority of non medical personnel certifying non hospital deaths were the police (44.6%) followed by staff from the Orang Asli Department (19.6%) and family members (16.2%).

38% of the hospital deaths and 63% of the non hospital deaths were thought to be preventable by the attending doctors. The commonest reason for preventable deaths was attributed to patient and family factors (44.0%). 19.8% of the preventable deaths were thought to be due to department or treatment problems and 9.4% were thought to be due to peripheral or referral problems. Transport problem was responsible for 12.4% of the preventable deaths and was an important contributing factor in non hospital deaths.

The most common patient and family factor responsible for preventable deaths was the care giver was not aware that the child was seriously ill resulting in not seeking care or delay in seeking care, and the most common peripheral or referral problem was delayed referral. Department or treatment problems thought to be responsible for preventable deaths included delayed diagnosis and treatment, inadequate resuscitation, delayed and inadequate treatment, poor antenatal or perinatal care, poor monitoring and no expertise. Non availability of ICU or ventilator beds was thought to be responsible for 15 of the preventable deaths and 8 deaths from nosocomial infections were thought to be preventable.

## **Discussion and Conclusion**

There had been no such study on under 5 deaths in Malaysia. This was the first extensive prospective study on under five deaths looking at incidence rate and causes of death and their distribution by personal characteristics and geography, and circumstances leading to the death including pre and in hospital care.

In this study the death incidence rate was 0.6 per thousand age specific population and 3.5 per thousand life births. We excluded neonatal deaths in this study as these were captured in the system of rapid reporting of perinatal and neonatal deaths which was started in this country in 1998. If the 2006 neonatal mortality rate of 3.7 per thousand life births from this reporting system was added to the rate in our study, we had an under 5 mortality rate of 7.2 per thousand life births.<sup>2</sup>

Our under 5 mortality rate had been falling over the years and compared favourably with many countries in the region. In 2004 in Bangkok, referring to the global report Progress for Children, Dr Steve Atwood, UNICEF's Regional Advisor for Health and Nutrition, commended Malaysia for the progress it had made in reducing its under 5 mortality rate. The rate had fallen by 8 per cent from 1990 making it the second best rate of progress in the world. He added that the success of Malaysia was not only due to its relative economic prosperity but also enlightened leadership and political will to invest in providing basic healthcare to all citizens.

However this study had identified disparities among ethnic groups and regions and groups of children who were undernourished and died from 2 conditions, diarrhoea and pneumonia which were preventable and treatable at low cost. These underserved children would benefit from better access to appropriate services. When services were available, the study identified groups who did not avail themselves to the services in a timely manner due to lack of knowledge on childhood conditions. The study also found when these children presented to our health facilities, sometimes there were inadequacies in the management of these children, in the personnel as well as the facilities.

Since the two most common conditions that our children died of were conditions from the perinatal period and congenital malformations, deformations and chromosomal abnormalities, we need to have more local information on these two conditions so as to be able to manage them better. Facilities to diagnose and manage these two groups of conditions could also be further developed.

Finally as always, we found documentation and certification of deaths need to be improved on.

## **Recommendations**

### **1. Improve overall care**

- State and District Child Health Committees to be revived or formed, and to meet regularly 3 to 6 monthly.
- Paediatric Departments to outreach and network with A&E departments, outpatient and health clinics, private hospitals and clinics in their State or District.

### **2. Improve access to services**

- Access to care for the underserved population to be improved by strengthening the present system.
- The implementation of tele-primary care and the strategy integrated management of childhood illness for these children to be expanded.

### **3. Health education**

- Health care providers to counsel care givers on home care of sick children and also teach them to look for signs of serious illness in children so that they know when to take them to the health facility immediately.
- Health education to care givers to emphasise on prevention of home injuries in children especially drowning.

### **4. Train medical personnel**

- Pre service and in service training of doctors, nurses and medical assistants to include primary care of children, recognising signs of serious illness and resuscitation of children.
- More doctors, nurses and medical assistants to be trained in the neonatal resuscitation programme (NRP) and paediatric advanced life support (PALS).

### **5. Improve facilities**

- Facilities and equipment to manage sick children especially appropriate resuscitation equipment to be available in all clinics and A&E departments.
- Inpatient facilities and equipment for management of sick children especially intensive care to be improved.
- Facilities and equipment to diagnose and manage children with congenital malformations, deformations and chromosomal abnormalities to be developed further.

### **6. Improve documentation**

- All certification of deaths to be done by medical personnel.
- Doctors to be trained to document cause of death according to ICD-10 coding.
- Medical certification of cause of death to be standardised for the country.
- System for verbal autopsy for non hospital deaths to be developed.

### **7. Research**

- Research on conditions originating from the perinatal period and congenital malformations deformations and chromosomal abnormalities to be encouraged.
- This or similar study to be done every 5 years to monitor trends and progress and to identify areas for improvement and further research.

## **6. ETHICS AND REGULATORY CONSIDERATIONS**

### **6.1 Independent Ethics Committee**

This was an observational research and its conduct was unlikely to impact on the safety and well being of human subjects involved. However the protocol was still subjected to review and approval by the Medical Research & Ethics Committee (MREC) of the Ministry of Health (MOH).

### **6.2 Patient Information and Consent**

We did not request a written informed consent from the study subjects because it was not possible to do so even from the next of kin due to logistic difficulties. Our justifications were as follows:

1. This was an observational research and involved no risk to the late subjects.
2. This did not adversely affect the rights and welfare of the late subjects or the subjects' next of kin. No identifiable personal information on individuals would be captured and for publication purposes only aggregate results would be reported.

### **6.3 Patient Data Protection**

Deceased's anonymity was maintained at all times as no identifiable personal information on individuals was captured. This was to respect the privacy and confidentiality rules in accordance with applicable regulatory requirements.

All electronic data processed at the Clinical Research Centre of Hospital Kuala Lumpur (CRC HKL) were identified by patient number only, thereby ensuring that patient's identity remained unknown to the CRC staff.

## 7. INVESTIGATORS AND STUDY ADMINISTRATIVE STRUCTURE

|                                |                                    |  |
|--------------------------------|------------------------------------|--|
| <b>Principal Investigators</b> | Dr Hussain Imam<br>Muhammad Ismail | Head, Department of Paediatrics<br>Paediatric Institute, Hospital Kuala Lumpur.                  |
|                                | Dr Wong Swee Lan                   | Senior Consultant Paediatrician<br>Hospital Tuanku Jaafar, Seremban.                             |
| <b>Co-investigators</b>        | Dr Hung Liang Choo                 | Senior Consultant Paediatrician<br>Paediatric Institute, Hospital Kuala Lumpur.                  |
|                                | Dr Nur Rashidah<br>Mohd Zaini      | Paediatrician<br>Hospital Ampang, Selangor.  |
|                                | Dr Noor Khatijah Nurani            | Head, Department of Paediatrics<br>Hospital Sultanah Aminah, Johor Bahru.                        |
|                                | Dr Norsiah Ali                     | Family Medicine Consultant<br>Tampin Health District, Negeri Sembilan.                           |
|                                | Dr Hasri Hafidz                    | Head, Department of Paediatrics<br>Hospital Tuanku Ampuan Najihah<br>Negeri Sembilan.            |
|                                | Dato Dr Jimmy Lee<br>Kok Foo       | Head, Department of Paediatrics<br>Hospital Sultanah Nur Zahirah<br>Kuala Terengganu.            |
|                                | Dr Kuan Geok Lan                   | Head, Department of Paediatrics<br>Hospital Melaka.  |
|                                | Dr HSS Amar Singh                  | Head, Department of Paediatrics<br>Hospital Ipoh, Perak.   |
|                                | Dr Rohana Ismail                   | Senior Principal Assistant Director<br>Family Health Development Division<br>Ministry of Health. |
|                                | Dr Jafanita Jamaludin              | Assistant Director<br>Medical Development Division<br>Ministry of Health.                        |
| <b>Project Manager</b>         | Dr Jamaiah Haniff                  | Head, Clinical Epidemiology Unit<br>Clinical Research Centre<br>Hospital Kuala Lumpur.           |
| <b>Statistician</b>            | Lena Yeap Lay Ling                 | Clinical Research Centre<br>Hospital Pulau Pinang.   |
| <b>Data Manager</b>            | Ms Lim Jie Ying                    | Clinical Research Centre<br>Hospital Kuala Lumpur.   |

## Sponsor

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## Research Organisation

CRC HKL was the research organisation that managed, coordinated and monitored the progress of this study as follows:

- Managed the activities for initiating the study.
- Developed and validated the research database, and undertook data management.
- Assigned a statistician to be responsible for statistical analysis of the data from the study.

## Contributors

1. State Health Departments

2. Health Districts

|                       |                      |                    |
|-----------------------|----------------------|--------------------|
| DBKL                  | PKD Kota Samarahan   | PKD Rembau         |
| PKD Alor Gajah        | PKD Kota Setar       | PKD Rompin         |
| PKD Bachok            | PKD Kuala Krai       | PKD Saratok        |
| PKD Baling            | PKD Kuala Muda       | PKD Sarikei        |
| PKD Bandar Baharu     | PKD Kuala Pilah      | PKD Seberang Perai |
| PKD Batang Padang     | PKD Kuala Selangor   | Tengah             |
| PKD Batu Pahat        | PKD Kuala Terengganu | PKD Seberang Perai |
| PKD Beluran           | PKD Kuantan          | Utara              |
| PKD Bentong           | PKD Kubang Pasu      | PKD Segamat        |
| PKD Bera              | PKD Kuching          | PKD Sepang         |
| PKD Besut             | PKD Kulim            | PKD Seremban       |
| PKD Betong            | PKD Langkawi         | PKD Serian         |
| PKD Cameron Highlands | PKD Lawas            | PKD Setiu          |
| PKD Dungun            | PKD Lipis            | PKD Sibu           |
| PKD Gua Musang        | PKD Lubok Antu       | PKD Sik            |
| PKD Hilir Perak       | PKD Machang          | PKD Simunjan       |
| PKD Hulu Langat       | PKD Manjung          | PKD Sri Aman       |
| PKD Hulu Perak        | PKD Maran            | PKD Tambunan       |
| PKD Hulu Selangor     | PKD Marang           | PKD Tampin         |
| PKD Hulu Terengganu   | PKD Marudu           | PKD Temerloh       |
| PKD Jasin             | PKD Melaka Tengah    | PKD Tuaran         |
| PKD Jelebu            | PKD Miri             | PKD Yan            |
| PKD Jeli              | PKD Muar             |                    |
| PKD Jerantut          | PKD Mukah            |                    |
| PKD Kangar            | PKD Padang Terap     |                    |
| PKD Kapit             | PKD Pasir Mas        |                    |
| PKD Kemaman           | PKD Pasir Puteh      |                    |
| PKD Keningau          | PKD Pekan            |                    |
| PKD Kinta             | PKD Pendang          |                    |
| PKD Kluang            | PKD Pontian          |                    |
| PKD Kota Belud        | PKD Port Dickson     |                    |
| PKD Kota Bharu        | PKD Ranau            |                    |
| PKD Kota Kinabalu     | PKD Raub             |                    |

### 3. Hospitals

|                                 |  |
|---------------------------------|--|
| Hospital Alor Star              | Hospital Papar                                   |
| Hospital Angkatan Tentera       | Hospital Parit Buntar                            |
| Hospital Baling, Kedah          | Hospital Pekan                                   |
| Hospital Banting                | Hospital Port Dickson                            |
| Hospital Batu Pahat             | Hospital Pulau Pinang                            |
| Hospital Beluran                | Hospital Putrajaya                               |
| Hospital Bentong                | Hospital Queen Elizabeth                         |
| Hospital Besut                  | Hospital Raja Perempuan Zainab II                |
| Hospital Bintulu                | Hospital Ranau                                   |
| Hospital Changkat Melintang     | Hospital Raub                                    |
| Hospital Daro                   | Hospital Sarikei                                 |
| Hospital Duchess of Kent        | Hospital Seberang Jaya                           |
| Hospital Grik                   | Hospital Segamat                                 |
| Hospital Gua Musang             | Hospital Selayang                                |
| Hospital Hulu Terengganu        | Hospital Semporna                                |
| Hospital Ipoh                   | Hospital Serdang                                 |
| Hospital Jengka                 | Hospital Seremban                                |
| Hospital Kajang                 | Hospital Seri Manjung                            |
| Hospital Kapit                  | Hospital Serian                                  |
| Hospital Kemaman                | Hospital Sibu                                    |
| Hospital Keningau               | Hospital Sik, Kedah                              |
| Hospital Kinabatangan           | Hospital Sipitang                                |
| Hospital Kluang                 | Hospital Slim River                              |
| Hospital Kota Belud             | Hospital Sultan Ismail                           |
| Hospital Kota Marudu            | Hospital Sultanah Aminah                         |
| Hospital Kuala Kangsar          | Hospital Sungai Petani                           |
| Hospital Kuala Krai             | Hospital Sungai Siput                            |
| Hospital Kuala Lipis            | Hospital Taiping                                 |
| Hospital Kuala Lumpur           | Hospital Tambunan                                |
| Hospital Kuala Penyu            | Hospital Tampin                                  |
| Hospital Kuala Pilah            | Hospital Tanah Merah                             |
| Hospital Kuala Terengganu       | Hospital Tangkak                                 |
| Hospital Kudat                  | Hospital Tanjung Karang                          |
| Hospital Kulim                  | Hospital Tawau                                   |
| Hospital Kunak                  | Hospital Teluk Intan                             |
| Hospital Lahad Datu             | Hospital Temenggung Seri Maharaja<br>Tun Ibrahim |
| Hospital Lawas                  | Hospital Temerloh                                |
| Hospital Likas                  | Hospital Tengku Ampuan Afzan                     |
| Hospital Limbang                | Hospital Tengku Ampuan Jemaah                    |
| Hospital Lundu                  | Hospital Tengku Ampuan Rahimah                   |
| Hospital Machang                | Hospital Tenom                                   |
| Hospital Marudi                 | Hospital Tuanku Fauziah                          |
| Hospital Melaka                 | Hospital Umum Sarawak                            |
| Hospital Mersing                | Hospital Universiti Kebangsaan<br>Malaysia       |
| Hospital Miri                   | Hospital Yan, Kedah                              |
| Hospital Muadzam Shah           | Institut Jantung Negara                          |
| Hospital Mukah                  | Pusat Perubatan Universiti Malaya                |
| Hospital Pakar Sultanah Fatimah |  |
| Hospital Pantai                 |  |

#### 4. Paediatric Departments

|                                   |  |
|-----------------------------------|--|
| Hospital Alor Star                | Hospital Serdang                           |
| Hospital Batu Pahat               | Hospital Seremban                          |
| Hospital Duchess of Kent          | Hospital Seri Manjung                      |
| Hospital Ipoh                     | Hospital Sibul                             |
| Hospital Kajang                   | Hospital Slim River                        |
| Hospital Kemaman                  | Hospital Sultan Ismail                     |
| Hospital Kuala Kangsar            | Hospital Sultanah Aminah                   |
| Hospital Kuala Lumpur             | Hospital Sungai Petani                     |
| Hospital Kuala Pilah              | Hospital Taiping                           |
| Hospital Kuala Terengganu         | Hospital Tawau                             |
| Hospital Kulim, Kedah             | Hospital Teluk Intan                       |
| Hospital Likas                    | Hospital Temerloh                          |
| Hospital Melaka                   | Hospital Tengku Ampuan Afzan               |
| Hospital Miri                     | Hospital Tengku Ampuan Jemaah              |
| Hospital Pakar Sultanah Fatimah   | Hospital Tengku Ampuan Rahimah             |
| Hospital Pulau Pinang             | Hospital Tuanku Fauziah                    |
| Hospital Putrajaya                | Hospital Umum Sarawak                      |
| Hospital Queen Elizabeth          | Hospital Universiti Kebangsaan<br>Malaysia |
| Hospital Raja Perempuan Zainab II | Institut Jantung Negara                    |
| Hospital Seberang Jaya            | Pusat Perubatan Universiti Malaya          |
| Hospital Selayang                 |  |

## 8. BACKGROUND

Mortality statistics provide important indicators of the health status of the people in a community, as death is the most serious outcome of a morbid episode for an individual. The pattern of the causes of death in a community shows which diseases constitute the greatest threat to the survival of people, thereby pointing to the need for preventing such deaths. This becomes all the more important when effective measures are readily available in the community to prevent or successfully treat the diseases in question. Many infectious diseases, causes of much of childhood mortality, and injuries belong to this category. The information on the frequent causes of death occurring in a community also stimulates medical and public health research into these diseases and measures for controlling them.<sup>3</sup>

Substantial reductions in child mortality occurred in low income and middle income countries in the late 20<sup>th</sup> century, but more than ten million children younger than five still die every year.<sup>4</sup> About two thirds of these deaths can be prevented by interventions that are available today and are feasible for implementation in low income countries at high level of population coverage. About two million die from diarrhoea, which in most cases can be treated with simple oral rehydration therapy. Another two million die from pneumonia and a million die from malaria, which can be prevented by such simple measures as insecticide-treated bed nets or treatment with available anti-malarials. Hundreds of thousands die from measles for which there is a cheap, effective vaccine. The interventions are available but they are not being delivered to the mothers and children who need them most.<sup>5</sup>

In 2002, as part of the millennium development goals for health, nations pledged to ensure a two-thirds reduction in child mortality by 2015, from the base year 1990. In addition to setting such a goal, the global health community must critically assess how it can be accomplished. A realistic picture of the country's epidemiological profile and the capabilities of its health system is needed before appropriate public health interventions can be developed and implemented.<sup>4</sup>

Countries need sound epidemiological information to prioritise, plan, and implement public health interventions. Vital event registration that include cause of death data is used to establish the cause structure of mortality in high-income and middle-income countries but these are generally not available for the 42 countries where 90% of child deaths take place. Mortality statistics from vital event registration can be a reliable source of demographic, epidemiologic and medical information that can be used for research purposes, and also to address operational health service provision issues related to interventions, day to day service, deployment of health manpower and other logistical aspects of health strategy development and national health management. However fewer than half the world's countries and areas have death registration that can be defined as complete.<sup>4</sup> In many developing countries including Malaysia deaths especially in the rural areas may not be attended to by physicians and therefore are not medically certified. Even with the attendance of physicians the accuracy and precision of the recorded medical diagnosis can be further improved. The Arizona Child Fatality Review Teams (CFRT) reported that the cause of death was incorrect on 13% of all death certificates and, in a few cases, the teams disagreed with the medical examiner on the manner of death, natural or accidental or undetermined.<sup>6</sup>

Child health epidemiology is developing and increasingly can provide information useful for public health planning, monitoring, and evaluation. Ideally information on causes and determinants of death would be available for planning at national and sub national levels. Available epidemiological profiles show the extent of variation between major causes of death even within commonly used regional groupings and this highlights the need for desegregation at regional and global levels to allow public intervention efforts to be focused appropriately. The availability of valid epidemiological information at country level will be an important determinant of success in meeting and in measuring progress toward the millennium development goal for child survival.<sup>4</sup>

In Malaysia the perinatal, neonatal, infant and toddler mortality rates have been falling over the years. While improved access and quality of care are important factors contributing to this fall, improved nutrition with improved socio-economic development are also important contributing factors.

|                              | 1985 | 1990 | 1995 | 1998 | 2000 | 2004 |
|------------------------------|------|------|------|------|------|------|
| Perinatal mortality rate PMR | 19.3 | 15.8 | 10.6 | 10.4 | 10.4 | 6.8  |
| Neonatal mortality rate NNR  | 10.7 | 8.5  | 5.5  | 5.1  | 5.2  | 3.7  |
| Infant mortality rate IMR    | 17.0 | 13.0 | 8.2  | 7.7  | 7.5  | 6.5  |
| Toddler mortality rate TMR   | 1.4  | 0.8  | 0.5  | 0.4  | 0.3  | 0.4  |

As shown in the table above, the fall was dramatic in the ten years from 1985 to 1995, with the rates reduced to almost half in two and more than half in the other two. However the fall in the last decade has been slow.<sup>7,8,9</sup>

There had been a lot of interest in perinatal and neonatal deaths in this country. At present we have two systems of collection of data on neonates nationally, the Rapid Reporting System of Perinatal and Neonatal Deaths and the National Neonatal Registry. The former was started in the country in 1998 and is ongoing and the latter was piloted in 2002 and in 2006 had 30 hospitals participating in it.

There had been no such extensive data collection or study on children aged 28 days to five years. Information in this area would help us to select and target a cause or causes of death for intervention and to plan services for this age group. It would also help us to priorities areas for research on under five illnesses and their management.

## 9. OBJECTIVES

1. To determine the under five mortality rate in Malaysia, and its distribution by personal characteristics and geographic area for the year 2006.
2. To determine the common causes of under five deaths in Malaysia, and it's distribution by personal characteristics and geography.
3. To determine the circumstances leading to death including the pre- and in-hospital care, with view to identifying opportunities to improve our health care provision and processes.

## 10. STUDY METHODOLOGY

### 10.1 Study Design

Observational, epidemiological and clinical study.

#### 10.1.1 Sampling and Subjects

- All deaths in children aged 28 days up to five years (28-1824 days) in 2006 for estimating mortality rates, for personal characteristics, determining causes of death and circumstances leading to death.
- A sample size of 500 gives sufficiently precise estimate for outcome of interest with as low a frequency as 1%. The table below shows the precision to be expected in estimating outcomes of various frequencies based on a sample size of 500. Precision figures are reported in terms of 95% exact binomial confidence intervals. For example, with a sample size of 500, an outcome of 10% frequency can be estimated with a 95% confidence interval of 7.5 – 13.0%.

| Variable frequency            | 1%        | 5%        | 10%        | 20%         | 50%         |
|-------------------------------|-----------|-----------|------------|-------------|-------------|
| 95% CI for sample size of 500 | 0.3 – 2.3 | 3.3 – 7.3 | 7.5 – 13.0 | 16.6 – 23.8 | 45.5 – 54.5 |

However it was decided by the research team that all deaths would be studied.

### **10.1.2 Variables**

- State, District, Hospital.
- Name of patient, RN/MyKid/MIC, sex, ethnicity, date of birth, age.
- Date and time of admission, date and time of death, place of death.
- Cause of death (ICD 10 classification).
- Co-morbid conditions (specify conditions).
- Symptoms (fever, cough, diarrhoea, convulsion) and duration.
- Treatment: date, place, treatment received.
- Hospital treatment: place (ward, PHDW, PICU), person (HO, MO, specialist).
- Death preventable or not preventable.
- If preventable, was it patient, provider or system factor?
- Death not in a health facility: place of death, person who certified death, why not brought to hospital.

### **10.1.3 Key Data Sources**

Paediatric services of all health care institutions in the country, public and private, MOH and non-MOH.

### **10.1.4 Instruments**

Two case report forms (CRF) one for hospital deaths and one for non hospital deaths with definitions and guidelines on how to collect information and to fill up the forms (appendix 1 & 2).

Guidelines for face-to-face interview of care provider for non hospital deaths (appendix 3).

### **10.1.5 Activities and Process**

1. The research team developed the case recording forms (CRF) for hospital and non hospital deaths, and guidelines for data collection. For non hospital deaths guidelines in the English and Malay language for the interview of the care provider were also developed. The definition of hospital deaths and non hospital deaths and data collection flow charts for hospital and non hospital deaths were agreed on.

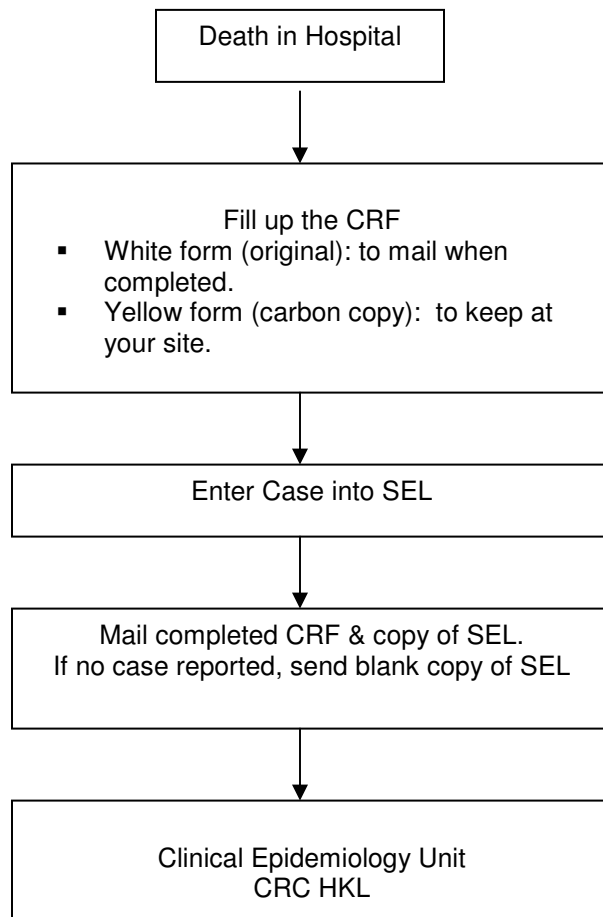


Figure 1: Data Collection Flow Chart for Hospital Deaths

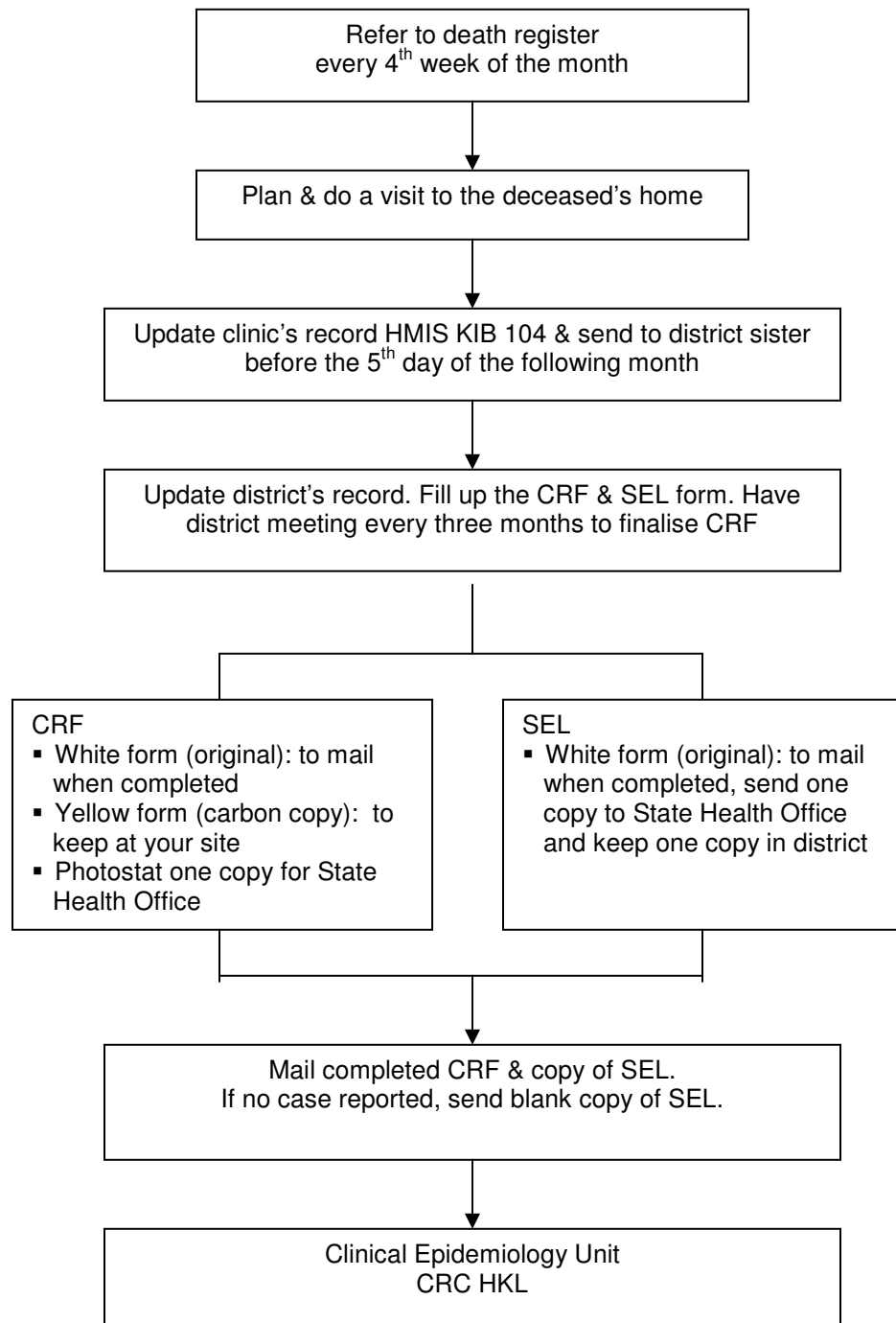


Figure 2: Data Collection Flow Chart for Non Hospital Deaths

2. The site organisation in the Hospital was also agreed on. The site supervisors were the paediatricians of the hospital. The site coordinator for hospital with paediatrician was the sister in charge of PICU or PHDW. If there was no PICU or PHDW in the hospital, then the coordinator was the sister in charge of the Paediatric medical ward. In hospital without paediatrician, the site coordinator was the sister in charge of the Paediatric ward. The responsibilities of the site coordinator were to identify all under five deaths in all disciplines in the hospital and obtain the case notes of these patients for the paediatrician (hospital with paediatrician) or medical officer (hospital without paediatrician) to fill in the CRF.
3. To ensure accuracy and completeness of the data, the research team agreed on the following. For hospital deaths with paediatricians the CRF would be filled up by the paediatrician who managed the case and in hospitals without a paediatrician by the medical officer who managed the case in consultation with the paediatrician who covered the hospital. For non hospital deaths the data would be reviewed at 3 monthly meetings at district level by a committee which would include the medical officer of health, the maternal and child health officer, the paediatrician covering the district and the health sisters and nurses.
4. All Heads of Paediatric Departments or representatives (including university and army hospitals and the National Heart Institute), state and municipal council maternal and child health officers and study sites coordinators were given a one day training. They were briefed on the study, the CRFs and data collection guidelines, the interview guidelines and the modified ICD 10 classification. There was also an exercise on the classification of deaths according to the modified ICD 10.
5. The participants were given the study materials as well as the training materials for them to brief and conduct training in their states or institutions. They were asked to invite representatives from the private hospitals in their states to their briefing and training sessions.
6. The study sites were asked to return the CRF to CRC HKL every 1-3 months. Even if there was no death in a particular time period, the sites were requested to send in a blank subject enrolment log (SEL).
7. At the CRC HKL, a research assistant visually reviewed the returned CRF for completeness. She then entered the data. Later the statistician produced a query listing for missing data or suspected data error i.e. out of range or inconsistent data.
8. The research team met at regular intervals to visually review the CRFs of all cases reported for completeness and appropriateness of the data. Any problems were queried back to the sites. During such meetings the team also reviewed the classification of the causes of death.
9. The 4 most common classifications of causes of death which were certain infectious and parasitic diseases, congenital malformations deformations and chromosomal abnormalities, injuries poisoning and external causes, and diseases of the respiratory system were further subclassified by the research team. The team also subclassified the reasons for preventable deaths according to family factors, peripheral and referral centre problems and department and treatment problems. Each of these subclassifications was then studied in more detail.
10. Data was analysed according to the objectives below:
  - (i) To determine the under five mortality rate in Malaysia, and its distribution by personal characteristics and geographic areas.
  - (ii) To determine the common causes of under five deaths in Malaysia, and its distribution by personal characteristics and geography.
  - (iii) To determine the circumstances leading to death including the pre- and in-hospital care.
11. Areas for health intervention and for further research on under five illnesses and their management were identified with the aim of reducing morbidity and mortality in these children.

## **10.2 Study Population and Subjects**

All deaths in the year 2006 (1.1.2006 - 31.12.2006) which satisfied the inclusion and exclusion criteria.

### **10.2.1 Inclusion and Exclusion Criteria**

#### Inclusion Criteria

Deaths that occurred at age 28 – 1824 days.

#### Exclusion Criteria

Deaths that occurred at age < 28 days and > 1824 days.

## **11. DATA MANAGEMENT AND DATA QUALITY ASSURANCE**

### **11.1 Data Management**

Data management was conducted by CRC HKL. CRC created the appropriate database and validation programs to manage the study data. The data was stored in Microsoft Access in a server located at CRC secured server room and was run in a networked environment.

#### **11.1.1 Data Sources**

The Source Data Providers (SDPs) were the Hospitals and District Health Offices throughout Malaysia.

Data derivation, data cleaning and data coding was done on this set of data.

### 11.1.2 Data Flow Process

The data management flow process of the study was as below:

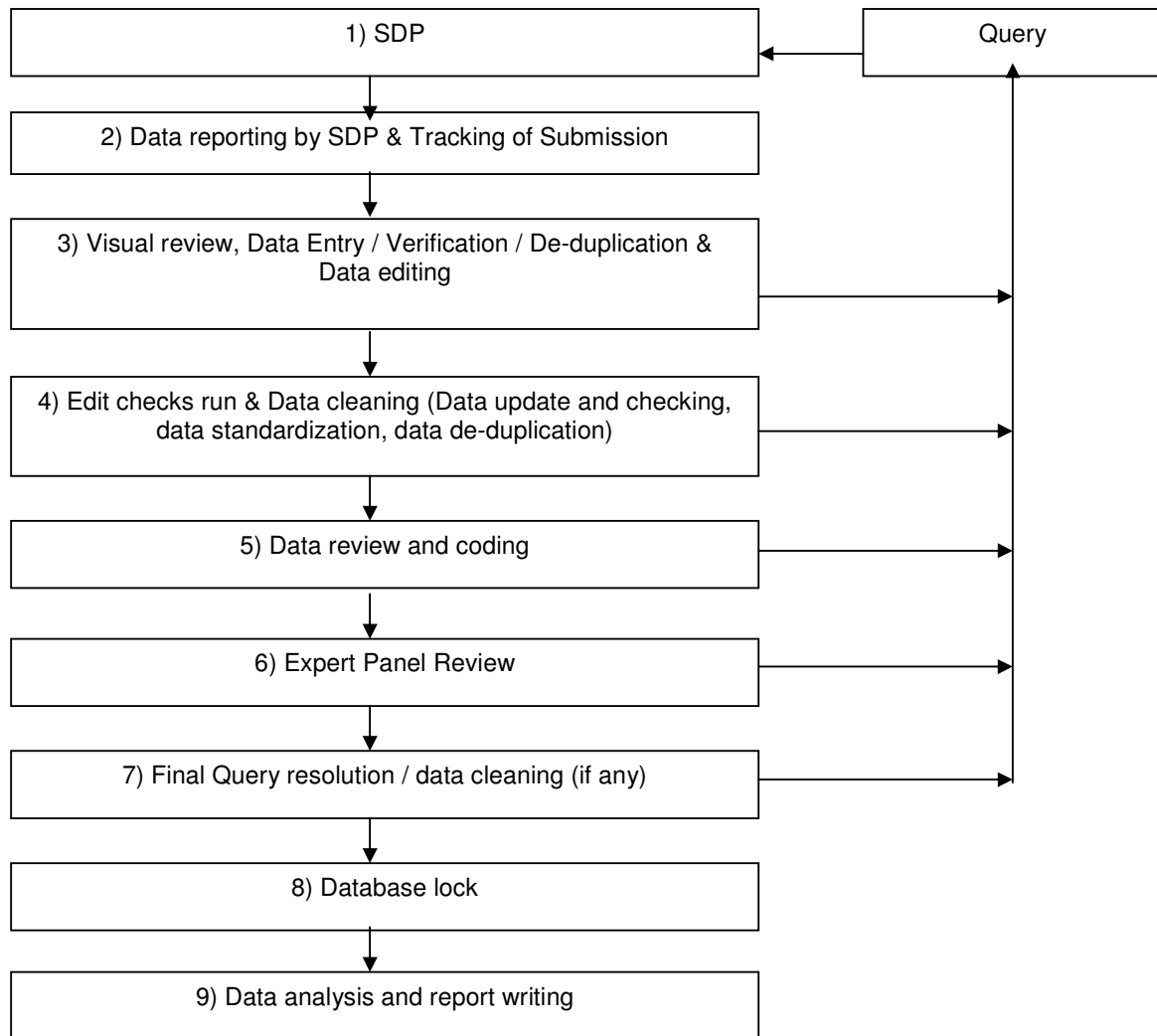


Figure 3: Data Management Flow Process

### 11.1.3 SDP Data Reporting and Tracking of Submission

Data reporting by the SDP was done via two Case Report Forms, i.e. Hospital Death Form and Non Hospital Death Form. The SDP reported data whenever there was a case. Data submission by SDP was tracked by the Under 5 CRF receipt tracking module in the system. Various reports were also provided for tracking purpose such as Total hospital death by place of death report, Total non hospital death by place of death report, Total deaths by form type, Total deaths by residence state, Total deaths by month by state, etc.

#### **11.1.4 Visual Review, Data Entry / Verification / De-duplication & Data Editing**

Data received were logged into the Under 5 system and manually reviewed to check for completeness and obvious errors or problems. Data without obvious problems were entered into the Under 5 system. Data with problems were sent to SDPs as queries. Prior to registering patient into the Under 5 system, verification process was done to ensure there were no duplicate patients. After verification, data was then entered into the Under 5 system.

#### **11.1.5 Edit Checks Run and Data Cleaning**

Edit check or data validation check was performed periodically to ensure data quality and to generate data queries on missing compulsory data, out of range values, inconsistent data, invalid values and error with de-duplication. Data cleaning was then performed based on either the results of edit checks or due to request by SDP. If the data manager could resolve the query(ies) and the answers or corrections did not imply change to the data on the subject's CRF, CRC was allowed to make the corrections without consulting the investigator. Otherwise, any other questions or queries arising from data validation checks would be printed and communicated to site. The Research Assistant would obtain or receive the resolution and forward it to the Clinical Data Management (CDM). The CDM would then perform data standardization and missing data were handled based on derivation from existing data. Data de-duplication was also performed to identify duplicate records in the database that might have been missed by data entry personnel.

#### **11.1.6 Data Review and Coding and Expert Panel Review**

A few different types of data coding were done. Data coding of free text cause of death to its ICD 10 Classification of cause of death was done by the researchers. Data coding of whether or not the death was preventable to the subcategories determined by the researchers was also done. The researchers who had expertise and knowledge in the area served the quality control function on the assessment of coding by the SDP. They ensured that complex medical data were reviewed and assessed to detect discrepancies in the data.

#### **11.1.7 Final Query Resolution / Data Cleaning and Database Lock**

A final edit check run was performed to ensure that data was clean. All queries were resolved before the database was locked to ensure data quality and integrity. The final dataset was subsequently locked and exported to the statistician for analysis.

#### **11.2 Data Quality Assurance**

There were two parts to the data quality check:

1. Checking that data entries were the same with that of the hardcopy.
2. Checking for reliability of the coding for cause of death.

It was decided that 5% (85) of the total of 1699 CRFs was randomly selected for checking. Five variables were chosen; namely Patient ID, Age Group, Place of Death, Cause of Death (free text) and ICD 10 Coding of cause of death. Data entry was checked against the hardcopy using the subject ID. The result showed correct entries in 83 out of 85 records (97.65%).

Verification of the coding for cause of death was done by one of the researchers. The dataset was checked to verify the coding of cause of death matched against the ICD 10 classification and coding. The results showed that out of 85 records, the agreement between the coders was in 65 records (76.5%).

## 12. STATISTICAL METHODS

The sample size for this study was not pre determined prior to the study. All children who died at age 28 to 1824 days in the year 2006 were included. All data obtained were used for analysis. Numerical data were analyzed for frequencies and rates, using the year 2006 population census as the denominator. The CRF received were reviewed for completeness and appropriateness by the researchers. Any incomplete or inappropriate data were queried back to the sites. The causes of death were also reviewed and re classified when necessary according to the modified International Statistical Classification of Diseases and Related Health Problems 10<sup>th</sup> Revision, ICD 10 (appendix 4) by the researchers and project manager and analyzed for frequencies. The classifications of the 4 most common causes of death which were certain infectious and parasitic diseases, congenital malformations deformations and chromosomal abnormalities, injury poisoning and external causes, and diseases of the respiratory system were further subclassified. Group comparison by odds ratio was also performed to see ethnic group differences for the four most common causes of death subclassification. The reasons for preventable death were also subclassified according to family factors, peripheral and referral centre problems and department and treatment problems. Each of these subclassifications was studied in more detail.

## 13. RESULTS

### 13.1 Death Incidence

#### 13.1.1 Overall Death Incidence Rate

A total of 1699 deaths in children aged 28 to 1824 days (under 5 years of age and excluding neonates) were reported by 96 hospitals and 86 health districts. Of these 1303 were hospital deaths and 396 were non hospital deaths. The overall under 5 death incidence rate was 0.6 per thousand age specific population and 3.5 per thousand live births as shown in Table 1.1.

Table 1.1: Under 5 death incidence rate, per thousand age specific population and per thousand live births, Malaysia 2006

| Total no deaths | Incidence rate per thousand age specific population | Incidence rate per thousand live births |
|-----------------|---|---|
| 1699            | 0.6   | 3.5                                     |

#### 13.1.2 Death Incidence Rate by State

The states with death incidence rate higher than the national rate of 0.6 per thousand age specific population were Sabah, Pahang, Kelantan, Wilayah Persekutuan Kuala Lumpur and Sarawak. The states with incidence rate lower than the national rate were Kedah, Terengganu, Pulau Pinang, Perak, Perlis, Melaka, Johor and Selangor. Sabah had the highest incidence rate of 1.1 and Selangor the lowest rate of 0.2 per thousand population.

Table 1.2: Under 5 death incidence rate by residence state, per thousand state specific population, Malaysia 2006

| State                            | Total no deaths | Incidence rate per thousand state specific population |
|----------------------------------|-----------------|---|
| Sabah                            | 378             | 1.1   |
| Pahang                           | 133             | 0.8   |
| Kelantan                         | 144             | 0.8   |
| Wilayah Persekutuan Kuala Lumpur | 152             | 0.8   |
| Sarawak                          | 207             | 0.7   |
| Negeri Sembilan                  | 60              | 0.6   |
| Kedah                            | 101             | 0.5   |
| Terengganu                       | 63              | 0.5   |
| Pulau Pinang                     | 69              | 0.5   |
| Perak                            | 119             | 0.5   |
| Perlis                           | 10              | 0.4   |
| Melaka                           | 37              | 0.4   |
| Johor                            | 121             | 0.3   |
| Selangor                         | 105             | 0.2   |

### 13.1.3 Death Incidence Rate by Age

Most of the under 5 deaths (61.8%) were in the first year of life. The death incidence rate decreased as the age increased, from a rate of 1.6 at age of zero to a rate of 0.1 at age of four.

Table 1.3: Death incidence rate by age, per thousand age specific population, Malaysia 2006

| Age          | Total no deaths | Percentage | Incidence rate per thousand age specific population |
|--------------|-----------------|------------|---|
| 0            | 1039            | 61.8       | 1.6   |
| 1            | 300             | 17.8       | 0.5   |
| 2            | 166             | 9.9        | 0.3   |
| 3            | 95              | 5.6        | 0.2   |
| 4            | 82              | 4.9        | 0.1   |
| <b>Total</b> | <b>1682 *</b>   | <b>100</b> |   |

\* exact age was not available in 17 cases

### 13.1.4 Death Incidence Rate by Gender

The death incidence rate was higher in males compared to females at a ratio of 1.2: 1

Table 1.4: Death incidence rate by gender per thousand gender specific population, Malaysia 2006

| Gender | Total no deaths | Incidence rate per thousand gender specific population |
|--------|-----------------|--|
| Male   | 953             | 0.6  |
| Female | 744             | 0.5  |

### 13.1.5 Death Incidence Rate by Ethnic Group

The highest death incidence rate was in the ethnic group 'other Malaysian', which included mainly the Orang Asli, Bumiputera Sabah and Bumiputera Sarawak children. The rate of 1.3 in this group was more than 2 times the national rate of 0.6. It was not possible to break down 'other Malaysian' to more specific groups due to the non availability of population data of these groups.

Table 1.5: Death incidence rate by ethnic group, per thousand ethnic group specific population, Malaysia 2006

| Ethnic Group    | Total no deaths | Incidence rate per thousand ethnic specific population |
|-----------------|-----------------|--|
| Malay           | 799             | 0.5  |
| Chinese         | 148             | 0.3  |
| Indian          | 76              | 0.4  |
| Other Malaysian | 500             | 1.3  |
| Non Citizen     | 170             | 0.6  |

## 13.2 Comparison between Hospital and Non Hospital Deaths

Out of the 1699 reported deaths, 1303 (76.7%) were hospital deaths and 396 (23.3%) were non hospital deaths.

### 13.2.1 Comparison between Hospital and Non Hospital Deaths by Age Group

The percentage of deaths in each age group did not differ in hospital and non hospital deaths. The highest number of deaths occurred in the first year of life in both hospital and non hospital deaths and in both groups the number of deaths decreased with age.

Table 2.1: Under 5 deaths by place of death according to age group, Malaysia 2006

| Age of death by Age Group (Months) | Hospital Deaths |            | Non Hospital Deaths |            | Total       |            |
|------------------------------------|-----------------|------------|---------------------|------------|-------------|------------|
|                                    | No              | %          | No                  | %          | No          | %          |
| 0 – 11                             | 795             | 61.0       | 195                 | 49.2       | 990         | 58.3       |
| 12 – 23                            | 225             | 17.3       | 98                  | 24.8       | 323         | 19.0       |
| 24 – 35                            | 135             | 10.4       | 44                  | 11.1       | 179         | 10.5       |
| 36 – 47                            | 70              | 5.4        | 31                  | 7.8        | 101         | 5.9        |
| 48 – <60                           | 66              | 5.1        | 23                  | 5.8        | 89          | 5.2        |
| Not Available                      | 12              | 0.8        | 5                   | 1.3        | 17          | 1.0        |
| <b>Total</b>                       | <b>1303</b>     | <b>100</b> | <b>396</b>          | <b>100</b> | <b>1699</b> | <b>100</b> |

### 13.2.2 Comparison between Hospital and Non Hospital Deaths by Gender

There was also no difference in the percentage of deaths according to gender in both hospital and non hospital deaths. There were more deaths in boys in both hospital and non hospital deaths.

Table 2.2: Under 5 deaths by place of death according to gender, Malaysia 2006

| Gender        | Hospital Deaths |            | Non Hospital Deaths |            | Total       |            |
|---------------|-----------------|------------|---------------------|------------|-------------|------------|
|               | No              | %          | No                  | %          | No          | %          |
| Male          | 733             | 56.3       | 220                 | 55.6       | 953         | 56.1       |
| Female        | 569             | 43.7       | 175                 | 44.2       | 744         | 43.8       |
| Not Available | 1               | 0.1        | 1                   | 0.3        | 2           | 0.1        |
| <b>Total</b>  | <b>1303</b>     | <b>100</b> | <b>396</b>          | <b>100</b> | <b>1699</b> | <b>100</b> |

### 13.2.3 Comparison between Hospital and Non Hospital Deaths by Ethnic Group

In all the ethnic groups except Orang Asli, more deaths occurred in hospitals. In Orang Asli children more than half the deaths (59.2%) did not occur in hospitals. In non citizens, there were very few non hospital deaths, possibly due to under reporting. Most of the deaths that occurred in the non citizen group were Filipino and Indonesian children and together they constituted 91.2% of all deaths in the non citizen group.

Table 2.3a: Under 5 deaths by place of death according to ethnicity, Malaysia 2006

| Ethnicity              | Hospital Deaths |            | Non Hospital Deaths |            | Total       |            |
|------------------------|-----------------|------------|---------------------|------------|-------------|------------|
|                        | No              | %          | No                  | %          | No          | %          |
| Malay                  | 600             | 46.1       | 199                 | 50.3       | 799         | 47.0       |
| Chinese                | 130             | 10.0       | 18                  | 4.6        | 148         | 8.7        |
| Indian                 | 61              | 4.7        | 15                  | 3.8        | 76          | 4.5        |
| Orang Asli             | 60              | 4.6        | 87                  | 22.0       | 147         | 8.7        |
| Bumiputera Sabah       | 157             | 12.1       | 32                  | 8.1        | 189         | 11.1       |
| Bumiputera Sarawak     | 87              | 6.7        | 35                  | 8.8        | 122         | 7.2        |
| Other Malaysian        | 39              | 3.0        | 3                   | 0.8        | 42          | 2.5        |
| Non Citizen            | 163             | 12.5       | 7                   | 1.8        | 170         | 10.0       |
| Indonesian             | 61              | 37.4       | 4                   | 57.1       | 65          | 38.2       |
| Filipino               | 89              | 54.6       | 1                   | 14.3       | 90          | 52.9       |
| Others & Not Available | 13              | 8.0        | 2                   | 28.6       | 15          | 8.8        |
| Not Available          | 6               | 0.5        | 0                   | 0.0        | 6           | 0.4        |
| <b>Total</b>           | <b>1303</b>     | <b>100</b> | <b>396</b>          | <b>100</b> | <b>1699</b> | <b>100</b> |

Using the ethnic group Malay as the reference group, the risk of non hospital death was higher in the Orang Asli and Bumiputera Sarawak children, 4.4 times and 1.2 times respectively.

Table 2.3b: Risk of non hospital death by ethnic group using odds ratio

| Ethnic group       | Odds Ratio | P-Value | 95% Confidence Interval |
|--------------------|------------|---------|-------------------------|
| Malay *            | 1.00       | -       | -                       |
| Chinese            | 0.42       | 0.001   | (0.25, 0.70)            |
| Indian             | 0.74       | 0.318   | (0.41, 1.33)            |
| Orang Asli         | 4.37       | 0.000   | (3.03, 6.30)            |
| Bumiputera Sabah   | 0.61       | 0.021   | (0.41, 0.93)            |
| Bumiputera Sarawak | 1.21       | 0.372   | (0.79, 1.85)            |
| Other Malaysian    | 0.23       | 0.016   | (0.07, 0.76)            |
| Non Citizen        | 0.13       | 0.000   | (0.06, 0.28)            |

\* Malay as the reference group

### 13.3 Causes of Death

#### 13.3.1 Overall Causes of Death

Overall, the 5 most common causes of deaths were in the ICD 10 classifications congenital malformations, deformations and chromosomal abnormalities (25.1%) followed by certain infectious and parasitic diseases (18.8%), diseases of the respiratory system (13.0%), diseases of the nervous system (8.2%) and injuries, poisoning and external causes (7.5%).

The most common causes of hospital deaths were in the classifications congenital malformations, deformations and chromosomal abnormalities (28.1%) followed by certain infectious and parasitic diseases (19.4%), diseases of the respiratory system (11.4%), diseases of the nervous system (9.7%) and endocrine, nutritional and metabolic diseases (8.3%).

The most common causes of non-hospital deaths were in the classifications diseases of the respiratory system (18.2%), certain Infectious & parasitic diseases (16.9%), congenital malformations, deformations & chromosomal abnormalities (15.2%), injuries, poisoning & external causes (15.2%), and signs and symptoms and abnormal findings not elsewhere classified (14.4%).

Table 2.4a: ICD 10 classification of causes of under 5 death by place of death, Malaysia 2006

| ICD classification of cause of death                               | Hospital Deaths |            | Non Hospital Deaths |            | Overall     |            |
|--|-----------------|------------|---------------------|------------|-------------|------------|
|  | No              | %          | No                  | %          | No          | %          |
| Certain Infectious & Parasitic Diseases                            | 253             | 19.4       | 67                  | 16.9       | 320         | 18.8       |
| Neoplasms  | 61              | 4.7        | 2                   | 0.5        | 63          | 3.7        |
| Diseases of Blood & Immune System                                  | 23              | 1.8        | 1                   | 0.3        | 24          | 1.4        |
| Endocrine, Nutritional, Metabolic Diseases                         | 108             | 8.3        | 8                   | 2.0        | 116         | 6.8        |
| Diseases of Nervous System   | 126             | 9.7        | 14                  | 3.5        | 140         | 8.2        |
| Diseases of Circulatory System                                     | 36              | 2.8        | 2                   | 0.5        | 38          | 2.2        |
| Diseases of Respiratory System                                     | 149             | 11.4       | 72                  | 18.2       | 221         | 13.0       |
| Diseases of Digestive System                                       | 23              | 1.8        | 12                  | 3.0        | 35          | 2.1        |
| Diseases of Genitourinary System                                   | 6               | 0.5        | 1                   | 0.3        | 7           | 0.4        |
| Conditions from Perinatal Period                                   | 61              | 4.7        | 15                  | 3.8        | 76          | 4.5        |
| Congenital Malformations, Deformations & Chromosomal Abnormalities | 366             | 28.1       | 60                  | 15.2       | 426         | 25.1       |
| Injuries, Poisoning & External Causes                              | 68              | 5.2        | 60                  | 15.2       | 128         | 7.5        |
| Symptoms, Signs & Abnormal Findings, NEC                           | 7               | 0.5        | 57                  | 14.4       | 64          | 3.8        |
| Others   | 16              | 1.2        | 25                  | 6.3        | 41          | 2.4        |
| <b>Total</b>   | <b>1303</b>     | <b>100</b> | <b>396</b>          | <b>100</b> | <b>1699</b> | <b>100</b> |

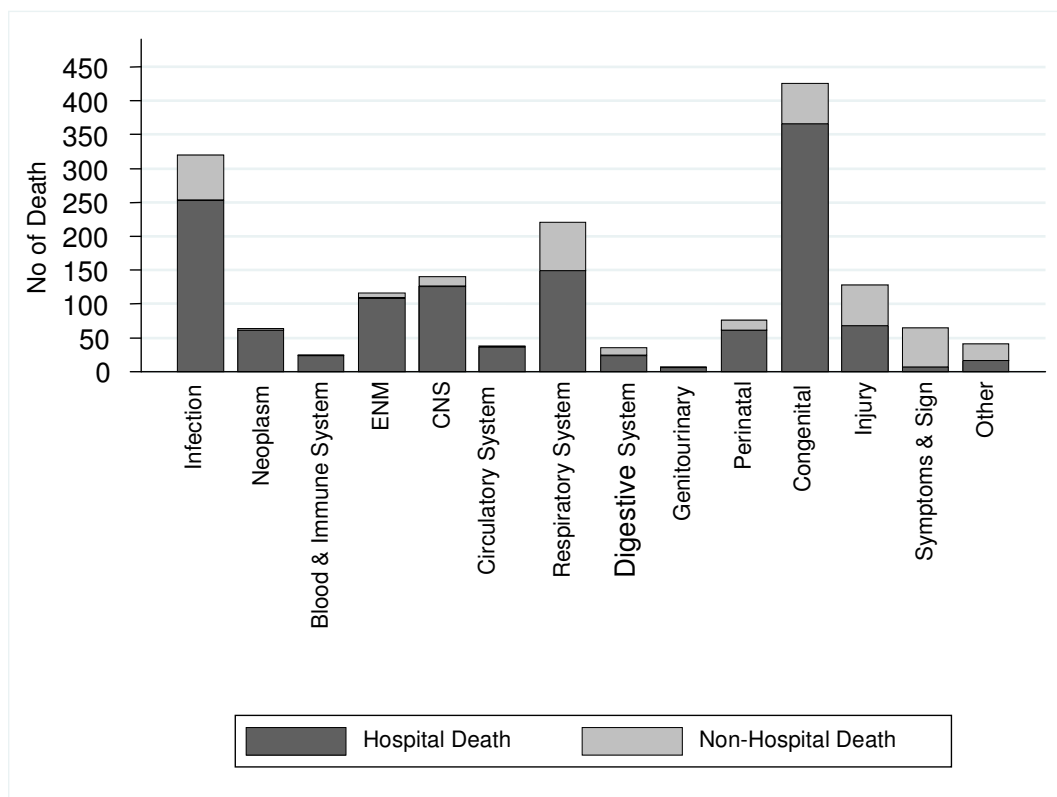


Figure 4: ICD 10 classification of causes of under 5 death by Location of Death

### 13.3.2 Subclassification of the 4 Common Causes of Death

The 4 common classifications of causes of death namely congenital malformations, deformations and chromosomal abnormalities, certain infectious and parasitic diseases, diseases of the respiratory system and injuries, poisoning and external causes were further subclassified.

In the classification congenital malformations, deformations and chromosomal abnormalities, 39.7% were congenital heart disease, 24.6% syndromes, 12.0% gastrointestinal system malformations and 10.6% central nervous system malformations .

Acute diarrhoeal disease made up 25.9% of the deaths in the classification certain infectious and parasitic diseases. Almost half (45.8%) of these deaths from acute diarrhoeal disease occurred outside the hospital. There were 19 deaths from HIV, 7 from dengue infection, 5 from tuberculosis, 3 from measles and 2 from malaria. There were 4 deaths from tetanus in the state of Sabah and 12 deaths from hand foot and mouth disease in the state of Sarawak.

Another infection responsible for many deaths in the children was pneumonia which made up 70.8% of the deaths in the classification diseases of the respiratory system. There were 4 deaths from asthma.

In the classification injuries, poisoning and external causes, drowning made up 25.0% of the deaths, motor vehicle accident 21.1%, burns 11.7% and poisoning 8.6%. There were 10 deaths from non accidental or suspected non accidental injury.

Table 2.4ai: Subclassifications of common causes of under 5 death, Malaysia 2006

| ICD Classification of Cause of Death  | Hospital Deaths |            | Non Hospital Deaths |            | Total      |            |
|---|-----------------|------------|---------------------|------------|------------|------------|
|   | No              | %          | No                  | %          | No         | %          |
| <b>Certain Infectious &amp; Parasitic Diseases</b>                            |                 |            |                     |            |            |            |
| Diarrhoea   | 45              | 17.8       | 38                  | 56.7       | 83         | 25.9       |
| Malaria   | 2               | 0.8        | 0                   | 0.0        | 2          | 0.6        |
| Measles   | 2               | 0.8        | 1                   | 1.5        | 3          | 0.9        |
| Tuberculosis  | 5               | 2.0        | 0                   | 0.0        | 5          | 1.6        |
| Dengue  | 7               | 2.8        | 0                   | 0.0        | 7          | 2.2        |
| Tetanus   | 4               | 1.6        | 0                   | 0.0        | 4          | 1.3        |
| HIV   | 17              | 6.7        | 2                   | 3.0        | 19         | 5.9        |
| Hand Foot Mouth   | 12              | 4.7        | 0                   | 0.0        | 12         | 3.8        |
| Others  | 159             | 62.8       | 26                  | 38.8       | 185        | 57.8       |
| <b>Total</b>  | <b>253</b>      | <b>100</b> | <b>67</b>           | <b>100</b> | <b>320</b> | <b>100</b> |
| <b>Congenital Malformations, Deformations &amp; Chromosomal Abnormalities</b> |                 |            |                     |            |            |            |
| Congenital Heart Disease  | 156             | 42.6       | 13                  | 21.7       | 169        | 39.7       |
| Centre Nervous System   | 34              | 9.3        | 11                  | 18.3       | 45         | 10.6       |
| Gastrointestinal system   | 46              | 12.5       | 5                   | 8.3        | 51         | 12.0       |
| Syndromes *   | 89              | 24.3       | 16                  | 26.7       | 105        | 24.6       |
| Others  | 41              | 11.2       | 15                  | 25.0       | 56         | 13.1       |
| <b>Total</b>  | <b>366</b>      | <b>100</b> | <b>60</b>           | <b>100</b> | <b>426</b> | <b>100</b> |
| <b>Diseases of Respiratory System</b>   |                 |            |                     |            |            |            |
| Pneumonia   | 105             | 70.5       | 51                  | 70.8       | 156        | 70.6       |
| Asthma  | 3               | 2.0        | 1                   | 1.4        | 4          | 1.8        |
| Others  | 41              | 27.5       | 20                  | 27.8       | 61         | 27.6       |
| <b>Total</b>  | <b>149</b>      | <b>100</b> | <b>72</b>           | <b>100</b> | <b>221</b> | <b>100</b> |
| <b>Injuries, Poisoning &amp; External Causes</b>                              |                 |            |                     |            |            |            |
| Drowning  | 7               | 10.3       | 25                  | 41.7       | 32         | 25.0       |
| Motor Vehicle Accident  | 16              | 23.5       | 11                  | 18.3       | 27         | 21.1       |
| Burn  | 12              | 17.6       | 3                   | 5.0        | 15         | 11.7       |
| Choking   | 2               | 2.9        | 5                   | 8.3        | 7          | 5.5        |
| Poisoning   | 9               | 13.2       | 2                   | 3.3        | 11         | 8.6        |
| Non Accidental Injury /<br>suspect NAI  | 10              | 14.7       | 0                   | 0.0        | 10         | 7.8        |
| Others  | 12              | 17.6       | 14                  | 23.3       | 26         | 20.3       |
| <b>Total</b>  | <b>68</b>       | <b>100</b> | <b>60</b>           | <b>100</b> | <b>128</b> | <b>100</b> |

\* Congenital malformations with recognisable syndrome were subclassified under syndromes eg Down Syndrome, Digeorge Syndrome whereas those without the word syndrome in the name of the condition such as CHARGE association were classified under others.

### 13.3.3 Causes of Death by State of Residence

Tables 2.4bi, 2.4bii and 2.4biii showed the causes of death by state of residence, overall, hospital and non hospital deaths respectively. Except for 4 states the most common cause of death was in the classification congenital malformations, deformations and congenital abnormalities. The most common cause of death in these 4 states namely Kelantan, Pahang, Perlis and Sabah was in the classification certain infectious and parasitic diseases. In 3 of these 4 states, the second most common cause of death was in the classification diseases of the respiratory system which was mainly pneumonia. In two states, Perak and Sabah, an important cause of death was in the classification endocrine, nutritional and metabolic diseases.

Table 2.4bi: The number and percentage of under 5 deaths (overall) according to ICD 10 classification of causes of death by state of residence, Malaysia 2006

| ICD classification of Cause of Death \ State | JOH          | KED          | KEL          | MEL         | NS         | PHG          | PRK          | PLS         | PP         | SAB          | SRW          | SLG          | TGG         | WPKL         |
|--|--------------|--------------|--------------|-------------|------------|--------------|--------------|-------------|------------|--------------|--------------|--------------|-------------|--------------|
| Certain Infectious & Parasitic Diseases      | 26<br>(21.5) | 12<br>(11.9) | 44<br>(30.6) | 8<br>(21.6) | 5<br>(8.3) | 36<br>(27.1) | 22<br>(18.5) | 3<br>(30.0) | 4<br>(5.8) | 87<br>(23.0) | 30<br>(14.5) | 16<br>(15.2) | 7<br>(11.1) | 19<br>(12.5) |
| Neoplasms                                    | 6<br>(5.0)   | 13<br>(12.9) | 1<br>(0.7)   | 0<br>(0.0)  | 1<br>(1.7) | 0<br>(0.0)   | 1<br>(0.8)   | 0<br>(0.0)  | 6<br>(8.7) | 7<br>(1.9)   | 14<br>(6.8)  | 3<br>(2.9)   | 0<br>(0.0)  | 11<br>(7.2)  |
| Diseases of Blood & Immune System            | 2<br>(1.7)   | 2<br>(2.0)   | 0<br>(0.0)   | 0<br>(0.0)  | 0<br>(0.0) | 0<br>(0.0)   | 2<br>(1.7)   | 0<br>(0.0)  | 4<br>(5.8) | 4<br>(1.1)   | 5<br>(2.4)   | 4<br>(3.8)   | 0<br>(0.0)  | 1<br>(0.7)   |
| Endocrine, Nutritional, Metabolic Diseases   | 5<br>(4.1)   | 5<br>(5.0)   | 5<br>(3.5)   | 0<br>(0.0)  | 1<br>(1.7) | 0<br>(0.0)   | 23<br>(19.3) | 0<br>(0.0)  | 1<br>(1.4) | 54<br>(14.3) | 6<br>(2.9)   | 6<br>(5.7)   | 4<br>(6.3)  | 6<br>(3.9)   |
| Diseases of Nervous System                   | 14<br>(11.6) | 6<br>(5.9)   | 6<br>(4.2)   | 3<br>(8.1)  | 3<br>(5.0) | 9<br>(6.8)   | 7<br>(5.9)   | 2<br>(20.0) | 6<br>(8.7) | 49<br>(13.0) | 12<br>(5.8)  | 5<br>(4.8)   | 8<br>(12.7) | 10<br>(6.6)  |
| Diseases of Circulatory System               | 2<br>(1.7)   | 2<br>(2.0)   | 1<br>(0.7)   | 2<br>(5.4)  | 1<br>(1.7) | 5<br>(3.8)   | 4<br>(3.4)   | 1<br>(10.0) | 1<br>(1.4) | 7<br>(1.9)   | 6<br>(2.9)   | 2<br>(1.9)   | 2<br>(3.2)  | 2<br>(1.3)   |

| ICD classification of Cause of Death                               | State | JOH                  | KED                  | KEL                  | MEL                 | NS                   | PHG                  | PRK                  | PLS                 | PP                  | SAB                  | SRW                  | SLG                  | TGG                 | WPKL                 |
|--|-------|----------------------|----------------------|----------------------|---------------------|----------------------|----------------------|----------------------|---------------------|---------------------|----------------------|----------------------|----------------------|---------------------|----------------------|
|  |       |                      |                      |                      |                     |                      |                      |                      |                     |                     |                      |                      |                      |                     |                      |
| Diseases of Respiratory System                                     |       | 6<br>(5.0)           | 5<br>(5.0)           | 26<br>(18.1)         | 5<br>(13.5)         | 7<br>(11.7)          | 36<br>(27.1)         | 17<br>(14.3)         | 1<br>(10.0)         | 3<br>(4.3)          | 58<br>(15.3)         | 35<br>(16.9)         | 8<br>(7.6)           | 3<br>(4.8)          | 11<br>(7.2)          |
| Diseases of Digestive System                                       |       | 2<br>(1.7)           | 3<br>(3.0)           | 3<br>(2.1)           | 1<br>(2.7)          | 2<br>(3.3)           | 2<br>(1.5)           | 2<br>(1.7)           | 1<br>(10.0)         | 0<br>(0.0)          | 4<br>(1.1)           | 5<br>(2.4)           | 2<br>(1.9)           | 2<br>(3.2)          | 6<br>(3.9)           |
| Diseases of Genitourinary System                                   |       | 0<br>(0.0)           | 0<br>(0.0)           | 0<br>(0.0)           | 1<br>(2.7)          | 0<br>(0.0)           | 0<br>(0.0)           | 0<br>(0.0)           | 0<br>(0.0)          | 1<br>(1.4)          | 2<br>(0.5)           | 1<br>(0.5)           | 0<br>(0.0)           | 0<br>(0.0)          | 2<br>(1.3)           |
| Conditions from Perinatal Period                                   |       | 5<br>(4.1)           | 13<br>(12.9)         | 5<br>(3.5)           | 3<br>(8.1)          | 1<br>(1.7)           | 5<br>(3.8)           | 5<br>(4.2)           | 1<br>(10.0)         | 11<br>(15.9)        | 5<br>(1.3)           | 6<br>(2.9)           | 10<br>(9.5)          | 2<br>(3.2)          | 4<br>(2.6)           |
| Congenital Malformations, Deformations & Chromosomal Abnormalities |       | 41<br>(33.9)         | 21<br>(20.8)         | 27<br>(18.8)         | 9<br>(24.3)         | 27<br>(45.0)         | 20<br>(15.0)         | 23<br>(19.3)         | 0<br>(0.0)          | 19<br>(27.5)        | 67<br>(17.7)         | 50<br>(24.2)         | 38<br>(36.2)         | 21<br>(33.3)        | 63<br>(41.4)         |
| Injuries, Poisoning & External Causes                              |       | 4<br>(3.3)           | 12<br>(11.9)         | 5<br>(3.5)           | 5<br>(13.5)         | 9<br>(15.0)          | 15<br>(11.3)         | 9<br>(7.6)           | 1<br>(10.0)         | 8<br>(11.6)         | 19<br>(5.0)          | 16<br>(7.7)          | 5<br>(4.8)           | 8<br>(12.7)         | 12<br>(7.9)          |
| Symptoms, Signs & Abnormal Findings, NEC                           |       | 4<br>(3.3)           | 7<br>(6.9)           | 19<br>(13.2)         | 0<br>(0.0)          | 2<br>(3.3)           | 2<br>(1.5)           | 1<br>(0.8)           | 0<br>(0.0)          | 2<br>(2.9)          | 7<br>(1.9)           | 10<br>(4.8)          | 2<br>(1.9)           | 6<br>(9.5)          | 2<br>(1.3)           |
| Others   |       | 4<br>(3.3)           | 0<br>(0.0)           | 2<br>(1.4)           | 0<br>(0.0)          | 0<br>(0.0)           | 3<br>(2.3)           | 3<br>(2.5)           | 0<br>(0.0)          | 3<br>(4.3)          | 8<br>(2.1)           | 11<br>(5.3)          | 4<br>(3.8)           | 0<br>(0.0)          | 3<br>(2.0)           |
| <b>Total</b>   |       | <b>121<br/>(100)</b> | <b>101<br/>(100)</b> | <b>144<br/>(100)</b> | <b>37<br/>(100)</b> | <b>59<br/>(98.3)</b> | <b>133<br/>(100)</b> | <b>119<br/>(100)</b> | <b>10<br/>(100)</b> | <b>69<br/>(100)</b> | <b>378<br/>(100)</b> | <b>207<br/>(100)</b> | <b>105<br/>(100)</b> | <b>63<br/>(100)</b> | <b>152<br/>(100)</b> |

Table 2.4bii: The number and percentage of under 5 hospital deaths according to ICD 10 classification of causes of death by state, Malaysia 2006

| ICD classification of Cause of Death       | State        |              |              |             |             |              |              |             |             |              |              |              |             |             |  |
|--|--------------|--------------|--------------|-------------|-------------|--------------|--------------|-------------|-------------|--------------|--------------|--------------|-------------|-------------|--|
|  | JOH          | KED          | KEL          | MEL         | NS          | PHG          | PRK          | PLS         | PP          | SAB          | SRW          | SLG          | TGG         | WPKL        |  |
| Certain Infectious & Parasitic Diseases    | 25<br>(24.3) | 10<br>(13.9) | 23<br>(29.5) | 8<br>(26.7) | 4<br>(8.5)  | 22<br>(27.5) | 13<br>(15.9) | 2<br>(40.0) | 2<br>(3.3)  | 85<br>(24.9) | 27<br>(18.5) | 15<br>(15.6) | 5<br>(12.5) | 11<br>(9.0) |  |
| Neoplasms                                  | 6<br>(5.8)   | 11<br>(15.3) | 1<br>(1.3)   | 0<br>(0.0)  | 1<br>(2.1)  | 0<br>(0.0)   | 1<br>(1.2)   | 0<br>(0.0)  | 6<br>(10.0) | 7<br>(2.0)   | 14<br>(9.6)  | 3<br>(3.1)   | 0<br>(0.0)  | 11<br>(9.0) |  |
| Diseases of Blood & Immune System          | 2<br>(1.9)   | 2<br>(2.8)   | 0<br>(0.0)   | 0<br>(0.0)  | 0<br>(0.0)  | 0<br>(0.0)   | 1<br>(1.2)   | 0<br>(0.0)  | 4<br>(6.7)  | 4<br>(1.2)   | 5<br>(3.4)   | 4<br>(4.2)   | 0<br>(0.0)  | 1<br>(0.8)  |  |
| Endocrine, Nutritional, Metabolic Diseases | 5<br>(4.9)   | 5<br>(6.9)   | 5<br>(6.4)   | 0<br>(0.0)  | 1<br>(2.1)  | 0<br>(0.0)   | 17<br>(20.7) | 0<br>(0.0)  | 1<br>(1.7)  | 54<br>(15.8) | 6<br>(4.1)   | 6<br>(6.3)   | 2<br>(5.0)  | 6<br>(4.9)  |  |
| Diseases of Nervous System                 | 11<br>(10.7) | 6<br>(8.3)   | 6<br>(7.7)   | 2<br>(6.7)  | 2<br>(4.3)  | 8<br>(10.0)  | 6<br>(7.3)   | 1<br>(20.0) | 5<br>(8.3)  | 47<br>(13.7) | 10<br>(6.8)  | 5<br>(5.2)   | 8<br>(20.0) | 9<br>(7.4)  |  |
| Diseases of Circulatory System             | 2<br>(1.9)   | 1<br>(1.4)   | 1<br>(1.3)   | 2<br>(6.7)  | 1<br>(2.1)  | 4<br>(5.0)   | 4<br>(4.9)   | 1<br>(20.0) | 1<br>(1.7)  | 7<br>(2.0)   | 6<br>(4.1)   | 2<br>(2.1)   | 2<br>(5.0)  | 2<br>(1.6)  |  |
| Diseases of Respiratory System             | 3<br>(2.9)   | 4<br>(5.6)   | 13<br>(16.7) | 3<br>(10.0) | 5<br>(10.6) | 21<br>(26.3) | 11<br>(13.4) | 0<br>(0.0)  | 2<br>(3.3)  | 53<br>(15.5) | 20<br>(13.7) | 7<br>(7.3)   | 2<br>(5.0)  | 5<br>(4.1)  |  |
| Diseases of Digestive System               | 2<br>(1.9)   | 1<br>(1.4)   | 2<br>(2.6)   | 0<br>(0.0)  | 1<br>(2.1)  | 1<br>(1.3)   | 1<br>(1.2)   | 0<br>(0.0)  | 0<br>(0.0)  | 3<br>(0.9)   | 3<br>(2.1)   | 2<br>(2.1)   | 1<br>(2.5)  | 6<br>(4.9)  |  |
| Diseases of Genitourinary System           | 0<br>(0.0)   | 0<br>(0.0)   | 0<br>(0.0)   | 1<br>(3.3)  | 0<br>(0.0)  | 0<br>(0.0)   | 0<br>(0.0)   | 0<br>(0.0)  | 1<br>(1.7)  | 2<br>(0.6)   | 1<br>(0.7)   | 0<br>(0.0)   | 0<br>(0.0)  | 1<br>(0.8)  |  |

| ICD classification of Cause of Death \ State                       | JOH                  | KED                 | KEL                 | MEL                 | NS                 | PHG                 | PRK                 | PLS                | PP                  | SAB                  | SRW                  | SLG                 | TGG                 | WPKL                 |
|--|----------------------|---------------------|---------------------|---------------------|--------------------|---------------------|---------------------|--------------------|---------------------|----------------------|----------------------|---------------------|---------------------|----------------------|
| Conditions from Perinatal Period                                   | 4<br>(3.9)           | 12<br>(16.7)        | 3<br>(3.8)          | 2<br>(6.7)          | 0<br>(0.0)         | 4<br>(5.0)          | 2<br>(2.4)          | 1<br>(20.0)        | 11<br>(18.3)        | 4<br>(1.2)           | 3<br>(2.1)           | 10<br>(10.4)        | 1<br>(2.5)          | 4<br>(3.3)           |
| Congenital Malformations, Deformations & Chromosomal Abnormalities | 37<br>(35.9)         | 17<br>(23.6)        | 19<br>(24.4)        | 8<br>(26.7)         | 26<br>(55.3)       | 13<br>(16.3)        | 19<br>(23.2)        | 0<br>(0.0)         | 19<br>(31.7)        | 61<br>(17.8)         | 39<br>(26.7)         | 34<br>(35.4)        | 14<br>(35.0)        | 60<br>(49.2)         |
| Injuries, Poisoning & External Causes                              | 2<br>(1.9)           | 3<br>(4.2)          | 3<br>(3.8)          | 4<br>(13.3)         | 4<br>(8.5)         | 5<br>(6.3)          | 7<br>(8.5)          | 0<br>(0.0)         | 6<br>(10.0)         | 12<br>(3.5)          | 8<br>(5.5)           | 4<br>(4.2)          | 5<br>(12.5)         | 5<br>(4.1)           |
| Symptoms, Signs & Abnormal Findings, NEC                           | 2<br>(1.9)           | 0<br>(0.0)          | 0<br>(0.0)          | 0<br>(0.0)          | 1<br>(2.1)         | 0<br>(0.0)          | 0<br>(0.0)          | 0<br>(0.0)         | 0<br>(0.0)          | 0<br>(0.0)           | 3<br>(2.1)           | 0<br>(0.0)          | 0<br>(0.0)          | 1<br>(0.8)           |
| Others   | 2<br>(1.9)           | 0<br>(0.0)          | 2<br>(2.6)          | 0<br>(0.0)          | 0<br>(0.0)         | 2<br>(2.5)          | 0<br>(0.0)          | 0<br>(0.0)         | 2<br>(3.3)          | 3<br>(0.9)           | 1<br>(0.7)           | 4<br>(4.2)          | 0<br>(0.0)          | 0<br>(0.0)           |
| <b>Total</b>   | <b>103<br/>(100)</b> | <b>72<br/>(100)</b> | <b>78<br/>(100)</b> | <b>30<br/>(100)</b> | <b>46<br/>(98)</b> | <b>80<br/>(100)</b> | <b>82<br/>(100)</b> | <b>5<br/>(100)</b> | <b>60<br/>(100)</b> | <b>342<br/>(100)</b> | <b>146<br/>(100)</b> | <b>96<br/>(100)</b> | <b>40<br/>(100)</b> | <b>122<br/>(100)</b> |

Table 2.4biii: The number and percentage of under 5 non hospital deaths according to ICD 10 classification of causes of death by state, Malaysia 2006.

| ICD classification of Cause of Death \ State | JOH         | KED        | KEL          | MEL         | NS          | PHG          | PRK         | PLS         | PP          | SAB         | SRW          | SLG         | TGG        | WPKL        |
|--|-------------|------------|--------------|-------------|-------------|--------------|-------------|-------------|-------------|-------------|--------------|-------------|------------|-------------|
| Certain Infectious & Parasitic Diseases      | 1<br>(5.6)  | 2<br>(6.9) | 21<br>(31.8) | 0<br>(0.0)  | 1<br>(7.7)  | 14<br>(26.4) | 9<br>(24.3) | 1<br>(20.0) | 2<br>(22.2) | 2<br>(5.6)  | 3<br>(4.9)   | 1<br>(11.1) | 2<br>(8.7) | 8<br>(26.7) |
| Neoplasms                                    | 0<br>(0.0)  | 2<br>(6.9) | 0<br>(0.0)   | 0<br>(0.0)  | 0<br>(0.0)  | 0<br>(0.0)   | 0<br>(0.0)  | 0<br>(0.0)  | 0<br>(0.0)  | 0<br>(0.0)  | 0<br>(0.0)   | 0<br>(0.0)  | 0<br>(0.0) | 0<br>(0.0)  |
| Diseases of Blood & Immune System            | 0<br>(0.0)  | 0<br>(0.0) | 0<br>(0.0)   | 0<br>(0.0)  | 0<br>(0.0)  | 0<br>(0.0)   | 1<br>(2.7)  | 0<br>(0.0)  | 0<br>(0.0)  | 0<br>(0.0)  | 0<br>(0.0)   | 0<br>(0.0)  | 0<br>(0.0) | 0<br>(0.0)  |
| Endocrine, Nutritional, Metabolic Diseases   | 0<br>(0.0)  | 0<br>(0.0) | 0<br>(0.0)   | 0<br>(0.0)  | 0<br>(0.0)  | 0<br>(0.0)   | 6<br>(16.2) | 0<br>(0.0)  | 0<br>(0.0)  | 0<br>(0.0)  | 0<br>(0.0)   | 0<br>(0.0)  | 2<br>(8.7) | 0<br>(0.0)  |
| Diseases of Nervous System                   | 3<br>(16.7) | 0<br>(0.0) | 0<br>(0.0)   | 1<br>(14.3) | 1<br>(7.7)  | 1<br>(1.9)   | 1<br>(2.7)  | 1<br>(20.0) | 1<br>(11.1) | 2<br>(5.6)  | 2<br>(3.3)   | 0<br>(0.0)  | 0<br>(0.0) | 1<br>(3.3)  |
| Diseases of Circulatory System               | 0<br>(0.0)  | 1<br>(3.4) | 0<br>(0.0)   | 0<br>(0.0)  | 0<br>(0.0)  | 1<br>(1.9)   | 0<br>(0.0)  | 0<br>(0.0)  | 0<br>(0.0)  | 0<br>(0.0)  | 0<br>(0.0)   | 0<br>(0.0)  | 0<br>(0.0) | 0<br>(0.0)  |
| Diseases of Respiratory System               | 3<br>(16.7) | 1<br>(3.4) | 13<br>(19.7) | 2<br>(28.6) | 2<br>(15.4) | 15<br>(28.3) | 6<br>(16.2) | 1<br>(20.0) | 1<br>(11.1) | 5<br>(13.9) | 15<br>(24.6) | 1<br>(11.1) | 1<br>(4.3) | 6<br>(20.0) |
| Diseases of Digestive System                 | 0<br>(0.0)  | 2<br>(6.9) | 1<br>(1.5)   | 1<br>(14.3) | 1<br>(7.7)  | 1<br>(1.9)   | 1<br>(2.7)  | 1<br>(20.0) | 0<br>(0.0)  | 1<br>(2.8)  | 2<br>(3.3)   | 0<br>(0.0)  | 1<br>(4.3) | 0<br>(0.0)  |
| Diseases of Genitourinary System             | 0<br>(0.0)  | 0<br>(0.0) | 0<br>(0.0)   | 0<br>(0.0)  | 0<br>(0.0)  | 0<br>(0.0)   | 0<br>(0.0)  | 0<br>(0.0)  | 0<br>(0.0)  | 0<br>(0.0)  | 0<br>(0.0)   | 0<br>(0.0)  | 0<br>(0.0) | 1<br>(3.3)  |

| ICD classification of Cause of Death                               | State               |                     |                     |                    |                     |                     |                     |                    |                    |                     |                     |                    |                     |                     |  |
|--|---------------------|---------------------|---------------------|--------------------|---------------------|---------------------|---------------------|--------------------|--------------------|---------------------|---------------------|--------------------|---------------------|---------------------|--|
|  | JOH                 | KED                 | KEL                 | MEL                | NS                  | PHG                 | PRK                 | PLS                | PP                 | SAB                 | SRW                 | SLG                | TGG                 | WPKL                |  |
| Conditions from Perinatal Period                                   | 1<br>(5.6)          | 1<br>(3.4)          | 2<br>(3.0)          | 1<br>(14.3)        | 1<br>(7.7)          | 1<br>(1.9)          | 3<br>(8.1)          | 0<br>(0.0)         | 0<br>(0.0)         | 1<br>(2.8)          | 3<br>(4.9)          | 0<br>(0.0)         | 1<br>(4.3)          | 0<br>(0.0)          |  |
| Congenital Malformations, Deformations & Chromosomal Abnormalities | 4<br>(22.2)         | 4<br>(13.8)         | 8<br>(12.1)         | 1<br>(14.3)        | 1<br>(7.7)          | 7<br>(13.2)         | 4<br>(10.8)         | 0<br>(0.0)         | 0<br>(0.0)         | 6<br>(16.7)         | 11<br>(18.0)        | 4<br>(44.4)        | 7<br>(30.4)         | 3<br>(10.0)         |  |
| Injuries, Poisoning & External Causes                              | 2<br>(11.1)         | 9<br>(31.0)         | 2<br>(3.0)          | 1<br>(14.3)        | 5<br>(38.5)         | 10<br>(18.9)        | 2<br>(5.4)          | 1<br>(20.0)        | 2<br>(22.2)        | 7<br>(19.4)         | 8<br>(13.1)         | 1<br>(11.1)        | 3<br>(13.0)         | 7<br>(23.3)         |  |
| Symptoms, Signs & Abnormal Findings, NEC                           | 2<br>(11.1)         | 7<br>(24.1)         | 19<br>(28.8)        | 0<br>(0.0)         | 1<br>(7.7)          | 2<br>(3.8)          | 1<br>(2.7)          | 0<br>(0.0)         | 2<br>(22.2)        | 7<br>(19.4)         | 7<br>(11.5)         | 2<br>(22.2)        | 6<br>(26.1)         | 1<br>(3.3)          |  |
| Others   | 2<br>(11.1)         | 0<br>(0.0)          | 0<br>(0.0)          | 0<br>(0.0)         | 0<br>(0.0)          | 1<br>(1.9)          | 3<br>(8.1)          | 0<br>(0.0)         | 1<br>(11.1)        | 5<br>(13.9)         | 10<br>(16.4)        | 0<br>(0.0)         | 0<br>(0.0)          | 3<br>(10.0)         |  |
| <b>Total</b>   | <b>18<br/>(100)</b> | <b>29<br/>(100)</b> | <b>66<br/>(100)</b> | <b>7<br/>(100)</b> | <b>13<br/>(100)</b> | <b>53<br/>(100)</b> | <b>37<br/>(100)</b> | <b>5<br/>(100)</b> | <b>9<br/>(100)</b> | <b>36<br/>(100)</b> | <b>61<br/>(100)</b> | <b>9<br/>(100)</b> | <b>23<br/>(100)</b> | <b>30<br/>(100)</b> |  |

### 13.3.4 Causes of Death by Age Group

Table 2.4c and figure 5 showed the causes of death by age groups. Figure 5 showed the 5 most common causes of death, congenital malformations deformations and chromosomal abnormalities, certain infectious and parasitic diseases, diseases of the respiratory system, injuries poisoning and external causes and diseases of the nervous system. Death from congenital malformations, deformations and chromosomal abnormalities was highest in the first year of life and decreased with age. Death from certain infectious and parasitic diseases increased from age 0 to peak at 2 years of age and then decreased. Death from injuries, poisoning and external causes was low at 0 and 1 year of age and increased with age becoming the most common cause of death at age 3 and 4. Deaths from diseases of the central nervous system decreased from age 0 to 1 and then increased.

Table 2.4c: ICD 10 classification of causes of under 5 death by age, Malaysia 2006.

| ICD classification of Cause of Death       | Age |      | 0  |      | 1  |      | 2  |      | 3  |      | 4   |      | Total |   |
|--|-----|------|----|------|----|------|----|------|----|------|-----|------|-------|---|
|  | No  | %    | No | %    | No | %    | No | %    | No | %    | No  | %    | No    | % |
| Certain Infectious & Parasitic Diseases    | 176 | 16.9 | 61 | 20.3 | 47 | 28.3 | 17 | 17.9 | 14 | 17.1 | 319 | 18.8 |       |   |
| Neoplasms                                  | 15  | 1.4  | 24 | 8.0  | 7  | 4.2  | 8  | 8.4  | 9  | 11.0 | 63  | 3.7  |       |   |
| Diseases of Blood & Immune System          | 12  | 1.2  | 5  | 1.7  | 4  | 2.4  | 1  | 1.1  | 2  | 2.4  | 24  | 1.4  |       |   |
| Endocrine, Nutritional, Metabolic Diseases | 59  | 5.7  | 30 | 10.0 | 14 | 8.4  | 8  | 8.4  | 2  | 2.4  | 116 | 6.8  |       |   |
| Diseases of Nervous System                 | 87  | 8.4  | 18 | 6.0  | 14 | 8.4  | 10 | 10.5 | 11 | 13.4 | 140 | 8.2  |       |   |
| Diseases of Circulatory System             | 25  | 2.4  | 2  | 0.7  | 3  | 1.8  | 2  | 2.1  | 6  | 7.3  | 38  | 2.2  |       |   |
| Diseases of Respiratory System             | 131 | 12.6 | 45 | 15.0 | 22 | 13.3 | 12 | 12.6 | 7  | 8.5  | 221 | 13.0 |       |   |

| ICD classification of Cause of Death                               | Age         |             | 0          |              | 1          |              | 2         |              | 3         |              | 4           |             | Total |   |
|--|-------------|-------------|------------|--------------|------------|--------------|-----------|--------------|-----------|--------------|-------------|-------------|-------|---|
|  | No          | %           | No         | %            | No         | %            | No        | %            | No        | %            | No          | %           | No    | % |
| Diseases of Digestive System                                       | 25          | 2.4         | 4          | 1.3          | 3          | 1.8          | 2         | 2.1          | 1         | 1.2          | 35          | 2.1         |       |   |
| Diseases of Genitourinary System                                   | 5           | 0.5         | 1          | 0.3          | 0          | 0.0          | 1         | 1.1          | 0         | 0.0          | 7           | 0.4         |       |   |
| Conditions from Perinatal Period                                   | 66          | 6.4         | 7          | 2.3          | 0          | 0.0          | 2         | 2.1          | 1         | 1.2          | 76          | 4.5         |       |   |
| Congenital Malformations, Deformations & Chromosomal Abnormalities | 328         | 31.6        | 53         | 17.7         | 25         | 15.1         | 12        | 12.6         | 8         | 9.8          | 426         | 25.1        |       |   |
| Injuries, Poisoning & External Causes                              | 37          | 3.6         | 33         | 11.0         | 22         | 13.3         | 17        | 17.9         | 15        | 18.3         | 128         | 7.5         |       |   |
| Symptoms, Signs & Abnormal Findings, NEC                           | 39          | 3.8         | 16         | 5.3          | 3          | 1.8          | 2         | 2.1          | 4         | 4.9          | 64          | 3.8         |       |   |
| Others   | 33          | 3.2         | 1          | 0.3          | 2          | 1.2          | 1         | 1.1          | 2         | 2.4          | 41          | 2.4         |       |   |
| <b>Total</b>   | <b>1038</b> | <b>99.9</b> | <b>300</b> | <b>100.0</b> | <b>166</b> | <b>100.0</b> | <b>95</b> | <b>100.0</b> | <b>82</b> | <b>100.0</b> | <b>1698</b> | <b>99.9</b> |       |   |

\* The denominator for the percentage is the total number of deaths by age group (Column Total)

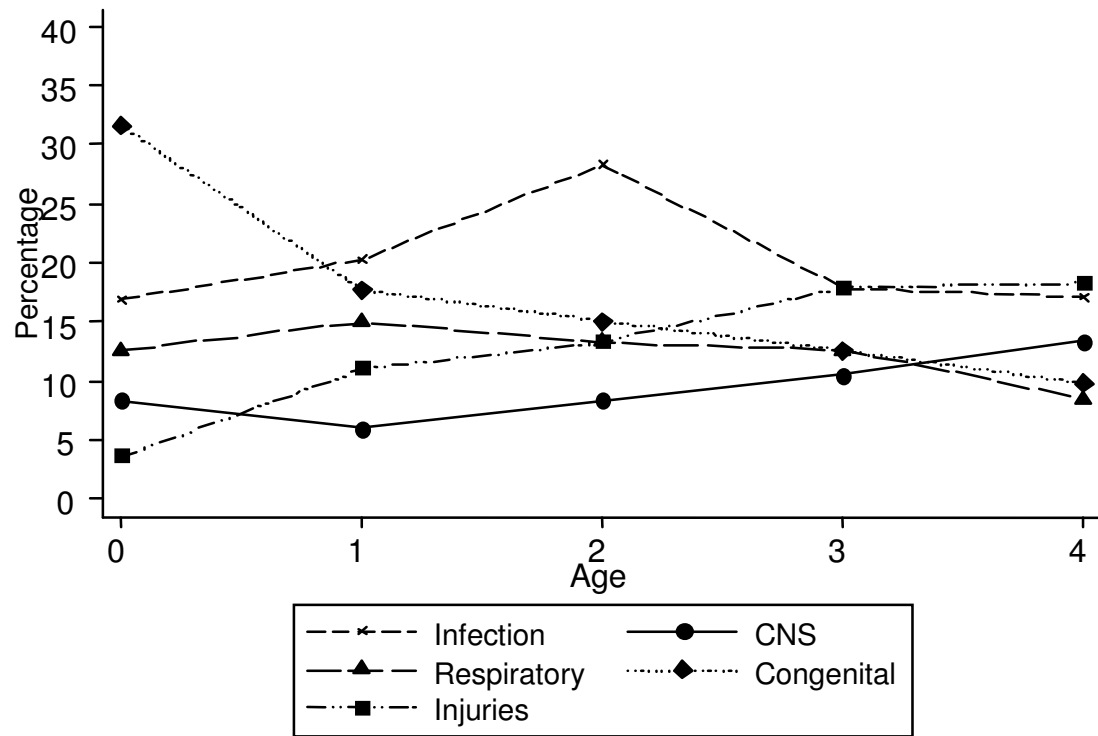


Figure 5: ICD 10 classification of 5 most common causes of under 5 death by age.

### 13.3.5 Causes of Death by Gender

Overall, there was no difference in the number of deaths in all the causes of death in both sexes.

Table 2.4d: ICD 10 classification of causes of under 5 death by gender, Malaysia 2006.

| ICD classification of Cause of Death                               | Gender |  | Male       |            | Female     |            | Total       |            |
|--|--------|--|------------|------------|------------|------------|-------------|------------|
|  |        |  | No         | %          | No         | %          | No          | %          |
|  |        |  |            |            |            |            |             |            |
| Certain Infectious & Parasitic Diseases                            |        |  | 181        | 19.0       | 136        | 18.3       | 319         | 18.8       |
| Neoplasms  |        |  | 38         | 4.0        | 25         | 3.4        | 63          | 3.7        |
| Diseases of Blood & Immune System                                  |        |  | 13         | 1.4        | 11         | 1.5        | 24          | 1.4        |
| Endocrine, Nutritional, Metabolic Diseases                         |        |  | 70         | 7.3        | 46         | 6.2        | 116         | 6.8        |
| Diseases of Nervous System   |        |  | 82         | 8.6        | 58         | 7.8        | 140         | 8.2        |
| Diseases of Circulatory System                                     |        |  | 17         | 1.8        | 21         | 2.8        | 38          | 2.2        |
| Diseases of Respiratory System                                     |        |  | 121        | 12.7       | 100        | 13.4       | 221         | 13.0       |
| Diseases of Digestive System                                       |        |  | 19         | 2.0        | 16         | 2.2        | 35          | 2.1        |
| Diseases of Genitourinary System                                   |        |  | 3          | 0.3        | 4          | 0.5        | 7           | 0.4        |
| Conditions from Perinatal Period                                   |        |  | 45         | 4.7        | 31         | 4.2        | 76          | 4.5        |
| Congenital Malformations, Deformations & Chromosomal Abnormalities |        |  | 239        | 25.1       | 187        | 25.1       | 426         | 25.1       |
| Injuries, Poisoning & External Causes                              |        |  | 74         | 7.8        | 54         | 7.3        | 128         | 7.5        |
| Symptoms, Signs & Abnormal Findings, NEC                           |        |  | 36         | 3.8        | 28         | 3.8        | 64          | 3.8        |
| Others   |        |  | 15         | 1.6        | 26         | 3.5        | 41          | 2.4        |
| <b>Total</b>   |        |  | <b>953</b> | <b>100</b> | <b>743</b> | <b>100</b> | <b>1698</b> | <b>100</b> |

### 13.3.6 Causes of Death by Ethnic Group

In all ethnic groups except Orang Asli, other Malaysian and non citizen, the most common cause of death was malformations, deformations and chromosomal abnormalities. In these 3 groups the most common cause of death was certain infectious and parasitic diseases. Diseases of the respiratory system which was mainly pneumonia was an important cause of death in the groups Orang Asli, Bumiputera Sabah, Bumiputera Sarawak and non citizen, and endocrine nutritional and metabolic diseases an important cause of death in the groups Orang Asli, Bumiputera Sabah, other Malaysians and non citizen. Death from injuries poisoning and external causes was highest in the Indians with a percentage of 13.2 compared to the national of 7.5.

Table 2.4e: ICD 10 classification of causes of under 5 death by ethnic group, Malaysia 2006.

| ICD Classification of Cause of Death       | Malay |      | Chinese |      | Indian |      | Orang Asli |      | Bumiputera Sabah |      | Bumiputera Sarawak |      | Other Malaysian |      | Non Citizen |      | Total |      |
|--|-------|------|---------|------|--------|------|------------|------|------------------|------|--------------------|------|-----------------|------|-------------|------|-------|------|
|  | No    | %    | No      | %    | No     | %    | No         | %    | No               | %    | No                 | %    | No              | %    | No          | %    | No    | %    |
| Certain Infectious & Parasitic Diseases    | 123   | 15.4 | 27      | 18.2 | 14     | 18.4 | 53         | 36.1 | 32               | 16.9 | 14                 | 11.5 | 13              | 31.0 | 43          | 25.3 | 319   | 18.8 |
| Neoplasms                                  | 40    | 5.0  | 7       | 4.7  | 2      | 2.6  | 0          | 0.0  | 3                | 1.6  | 6                  | 4.9  | 2               | 4.8  | 3           | 1.8  | 63    | 3.7  |
| Diseases of Blood & Immune system          | 9     | 1.1  | 6       | 4.1  | 1      | 1.3  | 1          | 0.7  | 2                | 1.1  | 2                  | 1.6  | 1               | 2.4  | 2           | 1.2  | 24    | 1.4  |
| Endocrine, Nutritional, Metabolic Diseases | 29    | 3.6  | 10      | 6.8  | 2      | 2.6  | 18         | 12.2 | 19               | 10.1 | 3                  | 2.5  | 5               | 11.9 | 29          | 17.1 | 116   | 6.8  |
| Diseases of Nervous System                 | 61    | 7.6  | 10      | 6.8  | 8      | 10.5 | 0          | 0.0  | 19               | 10.1 | 8                  | 6.6  | 5               | 11.9 | 28          | 16.5 | 140   | 8.2  |
| Diseases of Circulatory System             | 17    | 2.1  | 5       | 3.4  | 3      | 3.9  | 3          | 2.0  | 6                | 3.2  | 3                  | 2.5  | 0               | 0.0  | 1           | 0.6  | 38    | 2.2  |
| Diseases of Respiratory System             | 78    | 9.8  | 10      | 6.8  | 7      | 9.2  | 42         | 28.6 | 34               | 18.0 | 23                 | 18.9 | 2               | 4.8  | 24          | 14.1 | 221   | 13.0 |

| ICD Classification<br>Of Cause of Death                            | Ethnic Group |            | Malay      |            | Chinese   |           | Indian     |            | Orang Asli |            | Bumiputera Sabah |            | Bumiputera Sarawak |            | Other Malaysian |            | Non Citizen |            | Total |   |
|--|--------------|------------|------------|------------|-----------|-----------|------------|------------|------------|------------|------------------|------------|--------------------|------------|-----------------|------------|-------------|------------|-------|---|
|  | No           | %          | No         | %          | No        | %         | No         | %          | No         | %          | No               | %          | No                 | %          | No              | %          | No          | %          | No    | % |
| Diseases of Digestive System                                       | 19           | 2.4        | 6          | 4.1        | 1         | 1.3       | 2          | 1.4        | 2          | 1.1        | 3                | 2.5        | 2                  | 4.8        | 0               | 0.0        | 35          | 2.1        |       |   |
| Diseases of Genitourinary System                                   | 4            | 0.5        | 0          | 0.0        | 0         | 0.0       | 0          | 0.0        | 2          | 1.1        | 1                | 0.8        | 0                  | 0.0        | 0               | 0.0        | 7           | 0.4        |       |   |
| Conditions from Perinatal Period                                   | 44           | 5.5        | 10         | 6.8        | 6         | 7.9       | 4          | 2.7        | 4          | 2.1        | 5                | 4.1        | 1                  | 2.4        | 1               | 0.6        | 76          | 4.5        |       |   |
| Congenital Malformations, Deformations & Chromosomal Abnormalities | 259          | 32.4       | 39         | 26.4       | 18        | 23.7      | 6          | 4.1        | 44         | 23.3       | 31               | 25.4       | 9                  | 21.4       | 18              | 10.6       | 426         | 25.1       |       |   |
| Injuries, Poisoning & External Causes                              | 68           | 8.5        | 13         | 8.8        | 10        | 13.2      | 1          | 0.7        | 11         | 5.8        | 9                | 7.4        | 2                  | 4.8        | 14              | 8.2        | 128         | 7.5        |       |   |
| Symptoms, Signs & Abnormal Findings, NEC                           | 30           | 3.8        | 3          | 2.0        | 1         | 1.3       | 15         | 10.2       | 5          | 2.6        | 7                | 5.7        | 0                  | 0.0        | 3               | 1.8        | 64          | 3.8        |       |   |
| Others   | 18           | 2.3        | 2          | 1.4        | 2         | 2.6       | 2          | 1.4        | 6          | 3.2        | 7                | 5.7        | 0                  | 0.0        | 4               | 2.4        | 41          | 2.5        |       |   |
| <b>Total</b>   | <b>799</b>   | <b>100</b> | <b>148</b> | <b>100</b> | <b>75</b> | <b>99</b> | <b>147</b> | <b>100</b> | <b>189</b> | <b>100</b> | <b>122</b>       | <b>100</b> | <b>42</b>          | <b>100</b> | <b>170</b>      | <b>100</b> | <b>1698</b> | <b>100</b> |       |   |

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The most common cause of death in each of the four common ICD classifications (refer Table 2.4i) diarrhoea, pneumonia, congenital heart disease and drowning were further analysed for ethnic differences using odds ratio.

Taking the ethnic group Malay as the reference group, children in the ethnic groups Orang Asli, non citizen, other Malaysian and Bumiputera Sabah had higher risk of dying from diarrhoea, 8.7, 2.9, 2.7 and 2.2 times respectively. Risk of death from pneumonia was higher in the groups Orang Asli, non citizen, Bumiputera Sabah and Bumiputera Sarawak, 4.7, 2.7, 1.6 and 1.5 times respectively. For congenital heart disease, the ethnic group Malay has a higher risk than all the other groups. For drowning, the risk is much lower in the groups Orang Asli and non citizen, probably because of under reporting. The risk is high in other Malaysian.

**Table 2.4f: Risk of Diarrhoea death by ethnic group using odds ratio**

| <b>Ethnic group</b> | <b>Odds Ratio</b> | <b>P-Value</b> | <b>95% Confidence Interval</b> |
|---------------------|-------------------|----------------|--------------------------------|
| Malay *             | 1.00              | -              | -                              |
| Chinese             | 0.24              | 0.165          | (0.03, 1.80)                   |
| Indian              | 0.47              | 0.465          | (0.06, 3.54)                   |
| Orang Asli          | 8.68              | 0.000          | (4.83, 15.61)                  |
| Bumiputera Sabah    | 2.18              | 0.039          | (1.04, 4.58)                   |
| Bumiputera Sarawak  | 0.89              | 0.852          | (0.26, 3.02)                   |
| Other Malaysian     | 2.72              | 0.117          | (0.78, 9.47)                   |
| Non Citizen         | 2.92              | 0.003          | (1.44, 5.93)                   |

\* Malay as the reference group

**Table 2.4g: Risk of Pneumonia death by ethnic group using odds ratio**

| <b>Ethnic group</b> | <b>Odds Ratio</b> | <b>P-Value</b> | <b>95% Confidence Interval</b> |
|---------------------|-------------------|----------------|--------------------------------|
| Malay *             | 1.00              | -              | -                              |
| Chinese             | 0.67              | 0.333          | (0.30, 1.50)                   |
| Indian              | 0.56              | 0.332          | (0.17, 1.82)                   |
| Orang Asli          | 4.72              | 0.000          | (2.98, 7.47)                   |
| Bumiputera Sabah    | 1.60              | 0.087          | (0.93, 2.74)                   |
| Bumiputera Sarawak  | 1.48              | 0.245          | (0.77, 2.84)                   |
| Other Malaysian     | 0.33              | 0.278          | (0.04, 2.44)                   |
| Non Citizen         | 2.71              | 0.058          | (0.98, 2.95)                   |

\* Malay as the reference group

**Table 2.4h: Risk of Congenital Heart Disease death by ethnic group using odds ratio**

| <b>Ethnic group</b> | <b>Odds Ratio</b> | <b>P-Value</b> | <b>95% Confidence Interval</b> |
|---------------------|-------------------|----------------|--------------------------------|
| Malay *             | 1.00              | -              | -                              |
| Chinese             | 0.24              | 0.001          | (0.10, 0.56)                   |
| Indian              | 0.15              | 0.010          | (0.04, 0.64)                   |
| Orang Asli          | 0.08              | 0.000          | (0.02, 0.32)                   |
| Bumiputera Sabah    | 0.60              | 0.057          | (0.36, 1.02)                   |
| Bumiputera Sarawak  | 0.40              | 0.016          | (0.19, 0.84)                   |
| Other Malaysian     | 0.60              | 0.342          | (0.21, 1.72)                   |
| Non Citizen         | 0.32              | 0.001          | (0.16, 0.64)                   |

\* Malay as the reference group

Table 2.4i: Risk of Drowning death by ethnic group using odds ratio

| Ethnic group       | Odds Ratio | P-Value | 95% Confidence Interval |
|--------------------|------------|---------|-------------------------|
| Malay *            | 1.00       | -       | -                       |
| Chinese            | 0.95       | 0.938   | (0.28, 3.29)            |
| Indian             | 0.61       | 0.637   | (0.08, 4.67)            |
| Orang Asli         | 0.32       | 0.264   | (0.04, 2.39)            |
| Bumiputera Sabah   | 0.99       | 0.992   | (0.33, 2.99)            |
| Bumiputera Sarawak | 1.16       | 0.815   | (0.33, 4.01)            |
| Other Malaysian    | 2.30       | 0.276   | (0.51, 10.30)           |
| Non Citizen        | 0.27       | 0.208   | (0.04, 2.06)            |

\* Malay as the reference group

### 13.4 Co-morbid Conditions

64% of hospital deaths and 38% of non hospital deaths were associated with co-morbid condition(s). The most common co-morbid condition was congenital anomalies. Congenital heart disease was the second most common co-morbid condition and was associated with 22.5% of hospital and 17.0% of non hospital deaths. Malnutrition was the third and conditions from perinatal period the fourth most common co-morbid conditions. More non-hospital deaths were associated with cerebral palsy and malnutrition.

Malignancy and immunodeficiency diseases which were reported as co-morbid conditions were more likely to be underlying causes of death.

Table 2.5: Under 5 deaths by place of death according to co-morbid condition, Malaysia 2006.

| Presence & types of Co-morbid Condition | Hospital Death |            | Non Hospital Death |            | Total       |            |
|---|----------------|------------|--------------------|------------|-------------|------------|
|   | No             | %          | No                 | %          | No          | %          |
| <b>Present</b>                          | 834            | 64.0       | 153                | 38.6       | 987         | 58.1       |
| Cerebral Palsy                          | 40             | 4.8        | 19                 | 12.4       | 59          | 6.0        |
| Chronic Lung Disease                    | 64             | 7.7        | 6                  | 3.9        | 70          | 7.1        |
| Malnutrition                            | 155            | 18.6       | 40                 | 26.1       | 195         | 19.8       |
| Congenital Anomaly                      | 266            | 31.9       | 40                 | 26.1       | 306         | 31.0       |
| Congenital heart Disease                | 188            | 22.5       | 26                 | 17.0       | 214         | 21.7       |
| Malignancy                              | 41             | 4.9        | 0                  | 0.0        | 41          | 4.2        |
| Conditions from perinatal period        | 110            | 13.2       | 21                 | 13.7       | 131         | 13.3       |
| Immunodeficiency                        | 26             | 3.1        | 3                  | 2.0        | 29          | 2.9        |
| Others                                  | 255            | 30.6       | 47                 | 30.7       | 302         | 30.6       |
| <b>Not present</b>                      | 438            | 33.6       | 217                | 54.8       | 655         | 38.6       |
| <b>Not available</b>                    | 31             | 2.4        | 26                 | 6.6        | 57          | 3.3        |
| <b>Total</b>                            | <b>1303</b>    | <b>100</b> | <b>396</b>         | <b>100</b> | <b>1699</b> | <b>100</b> |

### 13.5 Treatment History

Treatment history included treatment received for the current illness leading to death. For hospital deaths it included only pre admission treatment.

Overall 58.5% of the children had received treatment for the current illness leading to death and 25.1% did not receive any treatment. This was not applicable in 14.9% because the deaths occurred suddenly such as in drowning and motor vehicle accident. 63.7% of the children who died in hospital and 41.2% who died outside the hospital had received treatment. Of those who received treatment from hospitals, most (87.9%) sought treatment from government hospitals and of those who received treatment from clinics, about half sought treatment from private clinics.

Table 2.6: Under 5 deaths by place of death according to treatment(s) received and location(s)\* for the current illness leading to death, Malaysia 2006

| Treatment and Location | Hospital Deaths (N=830) |              | Non Hospital Deaths (N=163) |              | Total (N=993) |              |
|------------------------|-------------------------|--------------|-----------------------------|--------------|---------------|--------------|
|                        | No                      | %            | No                          | %            | No            | %            |
| Received treatment     | 830                     | 63.7         | 163                         | 41.2         | 993           | 58.5         |
| No treatment           | 279                     | 21.4         | 147                         | 37.1         | 426           | 25.1         |
| Not applicable         | 180                     | 13.8         | 73                          | 18.4         | 253           | 14.9         |
| Not Available          | 14                      | 1.1          | 13                          | 3.3          | 27            | 1.6          |
| <b>Total</b>           | <b>1303</b>             | <b>100.0</b> | <b>396</b>                  | <b>100.0</b> | <b>1699</b>   | <b>100.0</b> |
| <b>Hospital</b>        | 594                     | 71.6         | 93                          | 57.1         | 687           | 69.2         |
| Government             | 527                     | 88.7         | 77                          | 82.8         | 604           | 87.9         |
| University             | 21                      | 3.5          | 8                           | 8.6          | 29            | 4.2          |
| Private                | 52                      | 8.8          | 14                          | 15.1         | 66            | 9.6          |
| Others                 | 13                      | 2.2          | 2                           | 2.2          | 15            | 2.2          |
| <b>Clinic</b>          | 292                     | 35.2         | 105                         | 64.4         | 397           | 40.0         |
| Government             | 136                     | 46.6         | 73                          | 69.5         | 209           | 52.6         |
| University             | 2                       | 0.7          | 1                           | 1.0          | 3             | 0.8          |
| Private                | 164                     | 56.2         | 38                          | 36.2         | 202           | 50.9         |
| Others                 | 9                       | 3.1          | 8                           | 7.6          | 17            | 4.3          |
| <b>Unknown</b>         | 16                      | 1.9          | 1                           | 0.6          | 17            | 1.7          |

\* Can be more than one location of treatment

### 13.5.1 Reasons for Not Receiving Treatment

426 (25.1%) children did not receive treatment for the illness leading to death. Overall the most common reason (39.9%) given by the care giver for not seeking treatment was that he or she was not aware that the child was seriously ill. However in the non hospital deaths, non availability of transport was the most important reason for not seeking treatment. Use of traditional or complementary treatment and self medication were also important reasons especially in the non hospital deaths.

Table 2.7: Under 5 deaths by place of death according to reason(s) for not receiving treatment for the current illness leading to death, Malaysia 2006.

| Reason(s) of Not Receiving Treatment   | Hospital Death (N=279) |      | Non Hospital Death (N=147) |      | Total (N=426) |      |
|--|------------------------|------|----------------------------|------|---------------|------|
|  | No                     | %    | No                         | %    | No            | %    |
| Self-medication                        | 28                     | 10.0 | 32                         | 21.8 | 60            | 14.1 |
| Traditional or complementary treatment | 24                     | 8.6  | 47                         | 32.0 | 71            | 16.7 |
| No transport                           | 19                     | 6.8  | 54                         | 36.7 | 73            | 17.1 |
| Unaware child is seriously ill         | 122                    | 43.7 | 48                         | 32.7 | 170           | 39.9 |
| Others                                 | 51                     | 18.3 | 23                         | 15.7 | 74            | 17.4 |

\* Can be more than one reason for not receiving treatment

### 13.6 Hospital Deaths

#### 13.6.1 Time Interval between Admission and Death

Of the 1303 deaths in hospital, 220 (16.9%) died within 6 hours of admission and 437 (33.6%) died within 24 hours of admission. This probably represented a very ill group of patients and there might be delay in coming to hospital.

Table 2.8: Time Interval between admission and death for hospital deaths, Malaysia 2006.

| Hospitalization duration | No          | %          |
|--------------------------|-------------|------------|
| 0-6 Hours                | 220         | 16.9       |
| 7-24 Hours               | 217         | 16.7       |
| 1-3 Days                 | 214         | 16.4       |
| 4-7 Days                 | 158         | 12.1       |
| >7 Days                  | 494         | 37.9       |
| <b>Total</b>             | <b>1303</b> | <b>100</b> |

### 13.6.2 Location of Death

Of the hospital deaths, only 37.6% died in the PICU and PHDW. 30% died in the paediatric medical ward, 14.4% in NICU and 8.1% in the main or other ICU. 85 children (6.5%) died in the A&E Department. This might imply that there was delay in seeking care and/or lack of resuscitation facilities or personnel in the A&E Department.

Table 2.9: Under 5 hospital death according to location of hospital deaths, Malaysia 2006

| Location of Hospital Deaths | No          | %          |
|-----------------------------|-------------|------------|
| PICU                        | 324         | 24.9       |
| PHDW                        | 165         | 12.7       |
| NICU                        | 187         | 14.4       |
| Main ICU                    | 101         | 7.8        |
| Other ICU                   | 4           | 0.3        |
| Paediatric Medical Ward     | 390         | 30.0       |
| Paediatric Surgical Ward    | 41          | 3.2        |
| A & E                       | 85          | 6.5        |
| Others                      | 2           | 0.2        |
| Not Available               | 4           | 0.3        |
| <b>Total</b>                | <b>1303</b> | <b>100</b> |

### 13.6.3 Highest Level of Care Received

62.2% of the children who died in hospital had received care in intensive care units, and 53.9% were in the PICU, NICU and PHDW. The highest level of care received by 28.3% of the children was in the paediatric medical wards and 3.2% in the paediatric surgical wards. The reason for this could be due to lack of or inadequate paediatric intensive care facilities in some of the hospitals.

Some patients who were considered to have poor prognosis or treatment would be futile, were sent back to the wards from the intensive care facilities, thus the number that had intensive care as the highest level of care received was more than the number who died in intensive care facilities.

77.9% of the children who died in hospital had received treatment from specialists or consultants. Those who did not receive treatment from specialist or consultant might have died in the A&E, hospitals without paediatricians or died soon after admission.

Table 2.10: Under 5 hospital deaths according to highest level of care received by location and category of medical practitioner, Malaysia 2006

| Highest Level Care Received                | No          | %          |
|--|-------------|------------|
| <b>By location</b>                         |             |            |
| PICU                                       | 346         | 26.6       |
| PHDW                                       | 168         | 12.9       |
| NICU                                       | 188         | 14.4       |
| Main ICU                                   | 104         | 8.0        |
| Other ICU                                  | 4           | 0.3        |
| Paediatric Medical Ward                    | 369         | 28.3       |
| Paediatric Surgical Ward                   | 41          | 3.2        |
| A & E                                      | 80          | 6.1        |
| Not Available                              | 3           | 0.2        |
| <b>By category of medical practitioner</b> |             |            |
| HO   | 2           | 0.2        |
| MO   | 278         | 21.3       |
| Specialist                                 | 380         | 29.2       |
| Consultant                                 | 636         | 48.8       |
| Not Available                              | 7           | 0.5        |
| <b>Total</b>                               | <b>1303</b> | <b>100</b> |

## 13.7 Non Hospital Deaths

### 13.7.1 Location of Death

Most of the non hospital deaths (67.2%) occurred in the home. 18.0% died on the way to the hospital or clinic and 4.3% died in the clinic. This might imply that there was delay in seeking care and/or lack of resuscitation facilities or personnel in the clinic. 6 died in place of care which included welfare homes and nurseries.

Table 2.11: Under 5 non hospital deaths according to location of death, Malaysia 2006

| Location of Non Hospital Deaths         | No         | %          |
|---|------------|------------|
| Home                                    | 266        | 67.2       |
| Clinic                                  | 17         | 4.3        |
| On the way to hospital                  | 62         | 15.7       |
| On the way to clinic                    | 9          | 2.3        |
| On the way home from hospital or clinic | 5          | 1.3        |
| Site of accident                        | 6          | 1.5        |
| Pond, river, etc.                       | 12         | 3.0        |
| Place of care                           | 6          | 1.5        |
| Others                                  | 9          | 2.3        |
| Not Available                           | 4          | 1.0        |
| <b>Total</b>                            | <b>396</b> | <b>100</b> |

### 13.7.2 Personnel Certifying Death

Only 40.4% of the non hospital deaths were certified by medical personnel and 71.9 % of these were doctors. The majority of non medical personnel certifying non hospital deaths were the police (44.6%) followed by staff from the Orang Asli Department (19.6%) and family members (16.2%).

Table 2.12: Under 5 non hospital deaths according to personnel certifying death, Malaysia 2006

| Personnel Certifying Death   | No         | %          |
|------------------------------|------------|------------|
| <b>Medical</b>               | 160        | 40.4       |
| Doctors                      | 115        | 71.9       |
| Medical Assistant            | 18         | 11.3       |
| Others/ Missing              | 27         | 16.8       |
| <b>Non Medical</b>           | 204        | 51.5       |
| Police                       | 91         | 44.6       |
| Family                       | 33         | 16.2       |
| Department of Orang Asli     | 40         | 19.6       |
| Religious Head/ Village Head | 8          | 3.9        |
| Others/ Missing              | 32         | 15.7       |
| <b>Not Available</b>         | 32         | 8.1        |
| <b>Total</b>                 | <b>396</b> | <b>100</b> |

### 13.8 Preventable Deaths

#### 13.8.1 Factors for Preventable Deaths

38.1% of the hospital deaths and 63.4% of the non hospital deaths were thought to be preventable by the attending doctors. The commonest reason for preventable deaths was attributed to patient and family factors (58.0%). It was important to note that 19.8% of the preventable deaths were thought to be due to department or treatment problems and 9.4% were thought to be due to peripheral or referral problems. Transport problem was responsible for 12.4% of the deaths and was an important contributing factor in non hospital deaths.

Table 2.13: Under 5 deaths by place of death according to whether death was preventable, Malaysia 2006

| Was Death Preventable?          | Hospital Deaths |            | Non Hospital Deaths |            | Total       |            |
|---------------------------------|-----------------|------------|---------------------|------------|-------------|------------|
|                                 | No              | %          | No                  | %          | No          | %          |
| <b>Preventable</b>              | 496             | 38.1       | 251                 | 63.4       | 747         | 44.0       |
| Patient & family factor         | 272             | 54.8       | 161                 | 64.1       | 433         | 58.0       |
| Peripheral or referral centre   | 57              | 11.5       | 13                  | 5.2        | 70          | 9.4        |
| Transport problem               | 27              | 5.4        | 66                  | 26.3       | 93          | 12.4       |
| Department or treatment problem | 126             | 25.4       | 22                  | 8.8        | 148         | 19.8       |
| Others                          | 10              | 2.0        | 21                  | 8.4        | 31          | 4.1        |
| <b>Not preventable</b>          | 552             | 42.4       | 59                  | 14.9       | 611         | 36.0       |
| <b>Not sure</b>                 | 217             | 16.7       | 59                  | 14.9       | 276         | 16.2       |
| <b>Not Available</b>            | 38              | 2.8        | 27                  | 6.8        | 65          | 3.8        |
| <b>Total</b>                    | <b>1303</b>     | <b>100</b> | <b>396</b>          | <b>100</b> | <b>1699</b> | <b>100</b> |

### 13.8.2 Preventable Deaths, Patient and Family Factors

The most common patient and family factor that was responsible for preventable hospital and non hospital deaths (53.6%) was the care giver was not aware that the child was seriously ill resulting in not seeking care or delay in seeking care. Other reasons given were refusing, defaulting and not complying to care, use of self medication and traditional or complementary medication. 28 home accidents were thought to be preventable. The reason 'not immunised or missed immunisation' was given for 29 deaths but there were only 12 deaths from infections preventable by immunisation, 5 from tuberculosis, 3 from measles and 4 from tetanus.

Table 2.13a: Under 5 deaths by place of death according to reason(s) for preventable death due to patient & family factor, Malaysia 2006

| Reasons due to Patient & Family Factor | Hospital Death |            | Non Hospital Death |            | Total      |            |
|--|----------------|------------|--------------------|------------|------------|------------|
|  | No             | %          | No                 | %          | No         | %          |
| Unaware of patients illness            | 153            | 56.3       | 79                 | 49.1       | 232        | 53.6       |
| Traditional Medicine                   | 10             | 3.7        | 5                  | 3.1        | 15         | 3.5        |
| Refusal                                | 14             | 5.1        | 9                  | 5.6        | 23         | 5.3        |
| Poor compliance or defaulted treatment | 6              | 2.2        | 3                  | 1.9        | 9          | 2.1        |
| Not immunised or missed Immunisation   | 27             | 9.9        | 2                  | 1.2        | 29         | 6.7        |
| Home accident                          | 9              | 3.3        | 19                 | 11.8       | 28         | 6.5        |
| Others                                 | 50             | 18.4       | 43                 | 26.7       | 93         | 21.5       |
| Missing                                | 3              | 1.1        | 1                  | 0.6        | 4          | 0.9        |
| <b>Total</b>                           | <b>272</b>     | <b>100</b> | <b>161</b>         | <b>100</b> | <b>433</b> | <b>100</b> |

### 13.8.3 Preventable Deaths, Department or Treatment Problems

Department or treatment problems were thought to be responsible for 148 of the preventable deaths. Treatment problems were thought to be responsible for 103 of these deaths. These included delayed or wrong diagnosis 18, inadequate resuscitation 17, delayed treatment 14, inadequate treatment 15, poor antenatal or perinatal care 12, underassessment 11, poor monitoring 8 and no expertise 6. Only 1 death was thought to be due to postponement of surgery.

Non availability of ICU or ventilator beds was thought to be responsible for 15 of the preventable deaths and 8 deaths from nosocomial infections were thought to be preventable.

Table 2.13b: Under 5 deaths by place of death by reason(s) for preventable death due to department or treatment problem, Malaysia 2006

| Reasons due to Department or Treatment Problem | Hospital Deaths |            | Non Hospital Deaths |            | Total      |            |
|--|-----------------|------------|---------------------|------------|------------|------------|
|  | No              | %          | No                  | %          | No         | %          |
| <b>Treatment problems</b>                      | 87              | 69.0       | 16                  | 72.7       | 103        | 69.6       |
| Inadequate resuscitation                       | 16              | 18.4       | 1                   | 6.3        | 17         | 16.5       |
| Inadequate treatment                           | 11              | 12.6       | 4                   | 25.0       | 15         | 14.6       |
| Underassessment                                | 8               | 9.2        | 3                   | 18.8       | 11         | 10.7       |
| No expertise                                   | 6               | 6.9        | 0                   | 0          | 6          | 5.8        |
| Delayed or wrong diagnosis                     | 14              | 16.1       | 4                   | 25         | 18         | 17.5       |
| Poor antenatal or perinatal care               | 11              | 12.6       | 1                   | 6.3        | 12         | 11.7       |
| Poor monitoring                                | 7               | 8.0        | 1                   | 6.3        | 8          | 7.8        |
| Delayed Treatment                              | 12              | 13.8       | 2                   | 12.5       | 14         | 13.6       |
| Postponed surgery                              | 1               | 1.1        | 0                   | 0.0        | 1          | 1.0        |
| Others   | 1               | 1.1        | 0                   | 0.0        | 1          | 1.0        |
| Sub Total                                      | 87              | 100        | 16                  | 100        | 103        | 100        |
| <b>No ICU bed or ventilator</b>                | 15              | 11.9       | 0                   | 0.0        | 15         | 10.1       |
| <b>Nosocomial Infection</b>                    | 8               | 6.3        | 0                   | 0.0        | 8          | 5.4        |
| <b>Iatrogenic</b>                              | 3               | 2.4        | 0                   | 0.0        | 3          | 2.0        |
| <b>Inadequate Counselling</b>                  | 4               | 3.2        | 5                   | 22.7       | 9          | 6.1        |
| <b>No health staff available</b>               | 1               | 0.8        | 0                   | 0.0        | 1          | 0.7        |
| <b>Others</b>                                  | 7               | 5.6        | 1                   | 4.5        | 8          | 5.4        |
| <b>Missing</b>                                 | 1               | 0.8        | 0                   | 0.0        | 1          | 0.7        |
| <b>Total</b>                                   | <b>126</b>      | <b>100</b> | <b>22</b>           | <b>100</b> | <b>148</b> | <b>100</b> |

### 13.8.4 Preventable Deaths, Peripheral or Referral Problems

Peripheral or referral problems were thought to be responsible for 70 of the preventable deaths. Most of these peripheral or referral centres were government hospitals and clinics and thought to be responsible for 32 and 21 preventable deaths. The most common reason was delayed referral. Management problems like underassessment, delayed or wrong diagnosis, poor management, poor stabilisation were other reasons given. One government clinic did not have adequate resuscitation facilities. Private hospitals and clinics were thought to be responsible for 11 of the preventable deaths and the main reason was delayed referral.

Table 2.13c: Under 5 deaths by place of death by reason(s) for preventable death according peripheral or referral centre, Malaysia 2006

| Peripheral or referral centre             | Hospital Deaths |            | Non Hospital Deaths |            | Total     |            |
|---|-----------------|------------|---------------------|------------|-----------|------------|
|   | No              | %          | No                  | %          | No        | %          |
| <b>Private Clinic</b>                     | 8               | 14         | 1                   | 7.7        | 9         | 12.9       |
| Delayed referral                          | 8               | 100        | 0                   | 0          | 8         | 88.9       |
| Underassessment                           | 0               | 0          | 1                   | 100        | 1         | 11.1       |
| <b>Government Clinic</b>                  | 13              | 22.8       | 8                   | 61.5       | 21        | 30         |
| Delayed referral                          | 5               | 38.5       | 4                   | 50         | 9         | 42.9       |
| No or Inadequate resuscitation facilities | 1               | 7.7        | 1                   | 12.5       | 2         | 9.5        |
| Poor management                           | 1               | 7.7        | 0                   | 0          | 1         | 4.8        |
| Poor stabilization                        | 1               | 7.7        | 1                   | 12.5       | 2         | 9.5        |
| Underassessment                           | 5               | 38.5       | 2                   | 25         | 7         | 33.3       |
| <b>Government Hospital</b>                | 30              | 52.6       | 2                   | 15.4       | 32        | 45.7       |
| Delayed referral                          | 14              | 46.7       | 0                   | 0          | 14        | 43.8       |
| Poor management                           | 5               | 16.7       | 0                   | 0          | 5         | 15.6       |
| Poor stabilization                        | 6               | 20         | 0                   | 0          | 6         | 18.8       |
| Delayed or wrong diagnosis                | 4               | 13.3       | 0                   | 0          | 4         | 12.5       |
| Underassessment                           | 1               | 3.3        | 2                   | 100        | 3         | 9.4        |
| <b>Private Hospital</b>                   | 1               | 1.8        | 1                   | 7.7        | 2         | 2.9        |
| Delayed referral                          | 1               | 100        | 1                   | 100        | 2         | 100        |
| <b>Others</b>                             | 3               | 5.3        | 1                   | 7.7        | 4         | 5.7        |
| <b>Missing</b>                            | 2               | 3.5        | 0                   | 0          | 2         | 2.9        |
| <b>Total</b>                              | <b>57</b>       | <b>100</b> | <b>13</b>           | <b>100</b> | <b>70</b> | <b>100</b> |

## 14. LIMITATIONS

The incidence rates in this study are to be interpreted with caution because the denominator which was the 2006 population included neonates aged 0-27 days, whereas our study population, the numerator, excluded this group.

Not all deaths were reported and therefore were not included in the study. Most private hospitals and one University Hospital did not participate in the study. Hospital deaths that occurred in the A&E and disciplines other than paediatrics might have been missed and not reported. Non-hospital deaths which the health staff might not know of, such as due to motor vehicle accidents, might not have been reported.

In spite of the one day briefing and training of the site contributors, the data reported in some of the CRFs were incomplete and/or inaccurate. Effort to rectify these problems were attempted but were hampered by logistic problems especially in the larger states or remote areas.

Some of the CRFs were completed by medical officers. Some centres did not follow the study guidelines where it was stipulated that the CRFs should be completed by the paediatrician who managed the patient and if filled by the medical officer, the death should be discussed with a paediatrician.

In most states the recommendation that 3 monthly meetings at state level be held to discuss and to determine the causes of non hospital deaths was also not followed. The circumstances surrounding many of the home deaths had limited information which made it difficult for accurate ICD-10 coding.

Due to financial and other logistic constraints there was no site monitoring by the investigators.

Inter- and intra-coder reliability for coding of the causes of death by the researchers had been verified in the retrospective study on under 5 deaths done by the same researchers.<sup>10</sup>

## 15. DISCUSSION

### Incidence

There had been no such study on under 5 deaths in Malaysia. This was the first extensive prospective study on under five deaths looking at incidence rate and causes of death and their distribution by personal characteristics and geography, and circumstances leading to the death including pre and in hospital care.

In this study the death incidence rate was 0.6 per thousand age specific population and 3.5 per thousand life births. We excluded neonatal deaths in this study as these were captured in the system of rapid reporting of perinatal and neonatal deaths which was started in this country in 1998. In our retrospective study on under 5 deaths in Malaysia using data from the National Registration Department, in 2003 the death incidence rate was 0.82 and 1.4 (if neonates included) per thousand age specific population and 8.8 (neonates included) per thousand life births.<sup>10</sup> If the 2006 neonatal mortality rate of 3.7

per 1000 life births was added to the rate in our study, we had an under 5 mortality rate of 7.2 per thousand life births.<sup>2</sup>

Data from the National Registration Department showed that in 2003 there were 2421 deaths and 56.2% were hospital and 43.8% were non hospital deaths whereas in our 2006 study there were 1699 deaths and 76.7% were hospital and 23.3% were non hospital deaths. In 2003 the five most common causes of death were infectious and parasitic diseases (17.4%), congenital malformations, deformations and chromosomal abnormalities (15.2%), injuries poisoning and external causes (13.5%), diseases of the respiratory system (13.5%) and signs and symptoms and abnormal findings NEC (11.5%) whereas in 2006 the five most common causes were congenital malformations, deformations and chromosomal abnormalities (25.1%), certain infectious and parasitic disease (18.8%), diseases of respiratory system (13.0%), diseases of nervous system (8.2%) and injuries, poisoning and external causes (7.5%). In the year 2003, injuries poisoning and external causes were the third commonest cause of death (13.5%) as compared to the year 2006, where injuries poisoning and external causes were the fifth commonest cause of death (7.5%). From these comparisons, it could be concluded that there was very likely under reporting of non hospital deaths especially in the classification injuries, poisoning and external cause; hence a lower percentage of non hospital deaths in our study.

### Risk Factors

This study identified children in this country who were at higher risk of dying before the fifth birthday. These were children who lived in the states of Sabah, Pahang, Kelantan, WPKL and Sarawak, who were less than 1 year old, of male gender, of ethnicity 'other Malaysian' ie Orang Asli, Bumiputera Sabah and Bumiputera Sarawak and with one or more of the co-morbid conditions congenital anomalies, congenital heart disease, malnutrition and conditions from the perinatal period. Overall they were more likely to die from congenital malformations, deformations and chromosomal abnormalities but children in the ethnic groups Orang Asli, Bumiputera Sabah and Bumiputera Sarawak and non citizen were more likely to die from infections like acute gastroenteritis and pneumonia and nutritional problems.

### Quality of Medical Care

Accessibility to medical care was generally satisfactory with 58.5% of the children having received outpatient and/or preadmission treatment for the illness leading to the death, and for children who died in hospital, 62.2% had received care in intensive care units and 79.9% had received care from specialist or consultant. However non availability of transport was thought to be responsible for 12.4% of all preventable deaths and 26.3% of preventable non hospital deaths and was the most important reason for preventability of non hospital deaths. For hospital deaths, non availability of ICU or ventilator bed was thought to be responsible for 15 and no expertise for 6 of the preventable deaths.

A number of findings in this study indicated delay in seeking or receiving appropriate treatment. 71 children died while on the way to hospital or clinic, 17 died in the clinic and 85 in the A&E Department and 220 (16.9%) deaths in hospitals occurred within 6 hours and 437 (33.6%) deaths within 24 hours of admission. Although a large number of caregivers, 232 admitted to not being aware that the child was seriously ill, we also wondered if our primary care providers were able to identify the seriously ill child as

58.5% of the children had received treatment. We were also uncertain if the peripheral or referral centres were equipped and had trained personnel to manage and resuscitate children. For preventable deaths due to peripheral or referral centres which included clinics and smaller hospitals, the most common reason given was delayed referral. Other reasons given were poor stabilisation and one clinic did not have resuscitation facilities. Reasons given for preventable deaths due to treatment problems which included underassessment, delayed or wrong diagnosis, inadequate resuscitation, inadequate or delayed treatment, poor antenatal or perinatal care and poor monitoring suggested there was room for improvement in our medical services for these children.

### Compared with other countries

For the year 2006 the under 5 mortality rate for the world was 72 per thousand live births. It ranged from a low of 6 for industrialized countries to a high of 186 in West and Central Africa. The rate for East Asia and Pacific was 29 and for South Asia 83.<sup>11</sup> According to the report 'The State of the World's Children 2008 - Child Survival', Malaysia ranked number 138 out of 189 for under 5 survival, where the best ranking was 189 and included the countries Sweden, Singapore, San Marino, Iceland and Andorra. Sierra Leone ranked number 1.

In our study, the 5 most common causes of death, excluding neonates were:

1. congenital malformations, deformations and chromosomal abnormalities
2. certain infectious and parasitic diseases
3. diseases of the respiratory system
4. diseases of the nervous system and
5. injuries, poisoning and external causes.

The World Health Organisation population bureau in 2006 listed the 10 leading causes of death in children 0-14years in low and middle income countries and high income countries.<sup>12</sup>

For low and middle income countries they were

1. perinatal conditions
2. lower respiratory infections
3. diarrhoeal diseases
4. malaria
5. measles
6. HIV or AIDS
7. congenital anomalies
8. whooping cough
9. tetanus
10. road traffic accidents

For high income countries, they were

1. perinatal conditions
2. congenital anomalies
3. road traffic accidents
4. lower respiratory infections
5. endocrine disorders
6. drowning
7. leukaemia

8. violence
9. fires
10. meningitis

Conditions from the perinatal period was the most common cause of death regardless of income. In low and middle income countries 7 of the 10 leading causes of death were infections whereas in high income countries congenital anomalies and injuries were more important causes of death. In Malaysia, congenital anomalies and injuries were important causes of death but infections still remained as important causes as well.

#### Preventable factors

Analysis of deaths of children <18 years old between 1995-1999 using the data collected by the Arizona Child Fatality Review Program (ACFRP) determined that 29% of the deaths could have been prevented and preventability increased with the age of the child. Only 5% of neonatal deaths were considered preventable, whereas the deaths of 38% of all children older than 28 days were considered preventable. After MVA deaths, medical conditions were the second most common cause of preventable deaths and most of these occurred in the first year of life. Some of the reasons why the CFRTs believed a medical death was preventable included inadequate emergency medical services, poor continuity of care, and delay in seeking care because of lack of health insurance. There were 4 deaths resulting from infections that were vaccine-preventable. Strategies recommended to prevent these deaths include better access to medical care and better training of emergency medical personnel in the diagnosis and management of paediatric patients.<sup>6</sup>

Many of the reasons for preventable deaths found in the ACFRP were also found in our study. Strategies recommended to prevent these deaths would also be applicable to us.

#### Accuracy in determination and documentation of cause of death

Certification of deaths should be done by doctors or other trained medical personnel. For hospital deaths, it was assumed all causes of death were appropriately determined and documented by medical personnel. But studies had shown that errors in death certification were still very high even among doctors ranging from 25-78% in hospital based studies.<sup>6,13</sup> In a study done in Kuala Lumpur Hospital in 1999, a high percentage (75%) of cause of death was not appropriately documented by medical officers.<sup>14</sup>

For non-hospital deaths in our study, 60% of the cause of death were certified by non-medical personnel and a large proportion were grouped under signs and symptoms. This manner of reporting cause of death was not systematic and lacked accuracy. Verbal autopsy algorithm had been shown to be accurate with a sensitivity and specificity for a fairly common cause of death of about 70%.<sup>15</sup> Verbal autopsy had been used as a tool in some under 5 years old mortality studies.<sup>16</sup>

## 16. CONCLUSION

Our under 5 mortality rate had been falling over the years and compared favourably with many countries in the region. In 2004 in Bangkok, referring to the global report Progress for Children, Dr Steve Atwood UNICEF's Regional Advisor for Health and Nutrition commended Malaysia for the progress it had made in reducing its under 5 mortality rate. The rate had fallen by 8 per cent from 1990 making it the second best rate of progress in the world. He added that the success of Malaysia, and other countries in the region, namely Brunei Darussalam, Republic of Korea and Singapore, that had done well was not only due to their relative economic prosperity but also enlightened leadership and political will to invest in providing basic healthcare to all citizens.<sup>17</sup>

However this study identified disparities among ethnic groups and regions, and groups of children who were often malnourished and who died from two conditions, diarrhoea and pneumonia, which were preventable and treatable at low cost. When services were available, the study identified groups who did not avail themselves to the services in a timely manner due to lack of knowledge on childhood conditions. The study also found when these children presented to our health facilities, sometimes there were inadequacies in the management of these children, in the personnel as well as the facilities.

Since the two most common conditions that our children died of were conditions from the perinatal period and congenital malformations, deformations and chromosomal abnormalities, we need to have more local information on these two conditions so as to be able to manage them better. Facilities to diagnose and manage these two groups of conditions could also be further developed.

Finally as always, we found documentation and certification of deaths need to be improved on.

## **17. RECOMMENDATIONS**

### **1. Improve overall care**

- State and District Child Health Committees to be revived or formed and to meet regularly 3 to 6 monthly.
- Paediatric Departments to outreach and network with A&E departments, outpatient and health clinics, private hospitals and clinics in their State or District.

### **2. Improve access to services**

- Access to care for underserved population to be improved by strengthening the present system.
- The implementation of tele-primary care and the strategy integrated management of childhood illness for these children to be expanded.

### **3. Health education**

- Health care providers to counsel care givers on home care of sick children and also teach them to look for signs of serious illness so that they know when to take them to the health facility immediately.
- Health education to care givers to emphasise on prevention of home injuries in children especially drowning.

### **4. Train medical personnel**

- Pre service and in service training of doctors, nurses and medical assistants to include primary care of children, recognising signs of serious illness and resuscitation of children.
- More doctors, nurses and medical assistants to be trained in the neonatal resuscitation programme (NRP) and paediatric advanced life support (PALS).

### **5. Improve facilities**

- Facilities and equipment to manage sick children especially appropriate resuscitation equipment to be available in all clinics and A&E departments.
- Inpatient facilities and equipment for management of sick children especially intensive care to be improved.
- Facilities and equipment to diagnose and manage children with congenital malformations, deformations and chromosomal abnormalities to be developed further.

### **6. Improve documentation**

- All certification of deaths to be done by medical personnel.
- Doctors to be trained to document cause of death according to ICD-10 coding.
- Medical certification of cause of death to be standardised in the country.
- System for verbal autopsy for non hospital deaths to be developed.

### **7. Research**

- Research on conditions originating from the perinatal period and congenital malformations deformations and chromosomal abnormalities to be encouraged.
- This or similar study to be done every 5 years to monitor trends and progress and to identify areas for improvement and further research.

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# **APPENDICES**



**Appendix 1:**  
**HOSPITAL DEATH:**  
**CRF and Guidelines for Data**  
**Collection**





**KEMENTERIAN KESIHATAN MALAYSIA**

**STUDY ON UNDER FIVE DEATHS IN MALAYSIA**

**Protocol No CE04-02**

**Site No**

**Date Commenced**

**Book Number**

**HOSPITAL DEATH FORM  
&  
GUIDELINES FOR DATA COLLECTION**

# SUBJECT ENROLMENT LOG

**SEL**

Site Name: \_\_\_\_\_

Site Code: \_\_\_\_\_

Book No: \_\_\_\_\_

| #  | <u>Date of Enroll</u> | <u>Child's Name</u> | <b>Initial</b> | <b>MyKid No</b> | <b>Telephone No.</b> |
|----|-----------------------|---------------------|----------------|-----------------|----------------------|
| 1  |                       |                     |                |                 |                      |
| 2  |                       |                     |                |                 |                      |
| 3  |                       |                     |                |                 |                      |
| 4  |                       |                     |                |                 |                      |
| 5  |                       |                     |                |                 |                      |
| 6  |                       |                     |                |                 |                      |
| 7  |                       |                     |                |                 |                      |
| 8  |                       |                     |                |                 |                      |
| 9  |                       |                     |                |                 |                      |
| 10 |                       |                     |                |                 |                      |
| 11 |                       |                     |                |                 |                      |
| 12 |                       |                     |                |                 |                      |
| 13 |                       |                     |                |                 |                      |
| 14 |                       |                     |                |                 |                      |
| 15 |                       |                     |                |                 |                      |
| 16 |                       |                     |                |                 |                      |
| 17 |                       |                     |                |                 |                      |
| 18 |                       |                     |                |                 |                      |



|            |          |             |
|------------|----------|-------------|
| Site Code: | Book No: | Patient ID: |
|            |          |             |

|   |   |  |
|---|---|--|
| 13. Co-Morbid Condition:<br><br>(Tick (✓) one)<br><input type="checkbox"/> Yes →<br><br><input type="checkbox"/> No | <b>If Yes, state condition(s):</b> (Tick (✓) one or more boxes below)   |  |
|   | <input type="checkbox"/> Cerebral Palsy<br><input type="checkbox"/> Chronic Lung Disease<br><input type="checkbox"/> Malnutrition<br><input type="checkbox"/> Congenital Anomaly, specify: .....<br><input type="checkbox"/> Cardiac Disease, specify: .....<br><input type="checkbox"/> Malignancy, specify: .....<br><input type="checkbox"/> Condition from perinatal period, specify: .....<br><input type="checkbox"/> Immunodeficiency, specify: .....<br><input type="checkbox"/> Others, specify: ..... |  |

|                     |   |
|---------------------|---|
| 14. Cause of Death: | a. IMMEDIATE CAUSE (final disease or condition resulting in death)  |
|                     | b. Sequentially list conditions if any leading to the cause listed in a. Enter the UNDERLYING CAUSE (disease or injury that initiated the events resulting in death) LAST |

|   |  |                  |
|---|--|------------------|
| 15. ICD Classification of Cause of Death:<br><br>(Tick (✓) one) | <input type="checkbox"/> Infection & Parasitic Disease, specify:<br><input type="checkbox"/> Neoplasm, specify:<br><input type="checkbox"/> Disease of Blood & Immune system, specify:<br><input type="checkbox"/> Endocrine, Nutritional, Metabolic, specify:<br><input type="checkbox"/> CNS, specify:<br><input type="checkbox"/> Circulatory System, specify:<br><input type="checkbox"/> Respiratory, specify:<br><input type="checkbox"/> Gastro-Intestinal, specify:<br><input type="checkbox"/> Genitourinary Tract, specify:<br><input type="checkbox"/> Conditions from Perinatal Period, specify:<br><input type="checkbox"/> Congenital Malformation, specify:<br><input type="checkbox"/> Injuries & External Causes, specify:<br><input type="checkbox"/> Symptoms, signs & abnormal findings, NEC (Not elsewhere classified), specify:<br><input type="checkbox"/> Others, specify: | Specify Details: |
|   |  |                  |

|   |  |                  |
|---|--|------------------|
| 16. Is Death Preventable?<br><br>(Tick (✓) one)<br><input type="checkbox"/> Yes →<br><br><input type="checkbox"/> No<br><br><input type="checkbox"/> Not Sure | <b>If Yes, state reason(s):</b> (Tick (✓) one or more boxes)   |                  |
|   | <input type="checkbox"/> Patient and Family Factor, specify details<br><input type="checkbox"/> Peripheral / Referral Centre, specify details<br><input type="checkbox"/> Transport Problem, specify details<br><input type="checkbox"/> Department / Treatment Problem, specify details<br><input type="checkbox"/> Others, specify details | Specify Details: |

|               |
|---------------|
| 17. Comments: |
|               |

|              |                         |  |
|--------------|-------------------------|--|
| Reported by: | Name (in BLOCK LETTERS) |  |
|              | Designation:            |  |

## GUIDELINES FOR DATA COLLECTION

### **Part 1: Definition of Cases**

#### **Hospital Death:**

Is defined as death in a patient who arrived at the hospital with signs of life and had treatment whether in A & E, ward, intensive care, etc, before he died. Includes death occurring in all disciplines in the hospital including during ambulance transportation from one hospital to another.

For non-hospital death, fill up the Non-Hospital Death Form.

#### **Non-Hospital Death:**

Is defined as death that occurs outside the hospital, which also includes.

- a. That brought in dead to the hospital
- b. Death while on the way to care / hospital
- c. Death in clinics / polyclinics
- d. Death at home or elsewhere

### **Part 2: Study Synopsis**

|                           |   |
|---------------------------|---|
| <i>Title</i>              | Study On Under Five Death In Malaysia   |
| <i>Objectives</i>         | To determine the causes of under five deaths in Malaysia, and its distribution by personal characteristics and geography<br><br>To determine the circumstances leading to these deaths including the pre- and in-hospital care, with view to identifying opportunities to improve our health care provision and processes |
| <i>Study Population</i>   | The study population includes children aged 28 days up to 5 years old who died in Malaysia either in the hospital or outside of the hospital starting from 1.1.2006 to 31.12.2006   |
| <i>Sample</i>             | All children who fit the study inclusion criteria and who died during the study period  |
| <i>Inclusion Criteria</i> | Children aged 28 days up to 5 years old. Include Malaysians and non-Malaysians  |
| <i>Exclusion Criteria</i> | Neonates (0-27 days), as data is captured in rapid reporting format for perinatal and neonatal deaths.<br><br>Children aged 5 years and above   |

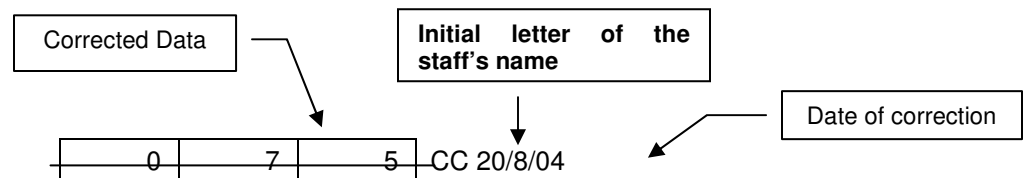
## Part 3: Guidelines on Data Collection

### 3.1 General Guidelines

- Paper is NCR, so please **use the flap** provided in the booklet to protect the adjacent pages.
- Use **black** ball pen
- The date must be written in **day/month/year** format (eg. 030405 for 3 April 2005)
- Please put staff initials and date for any correction done:

Example of a correction:

( Strike out the wrong data by drawing one straight line cross the data and then write down the corrected data beside it )

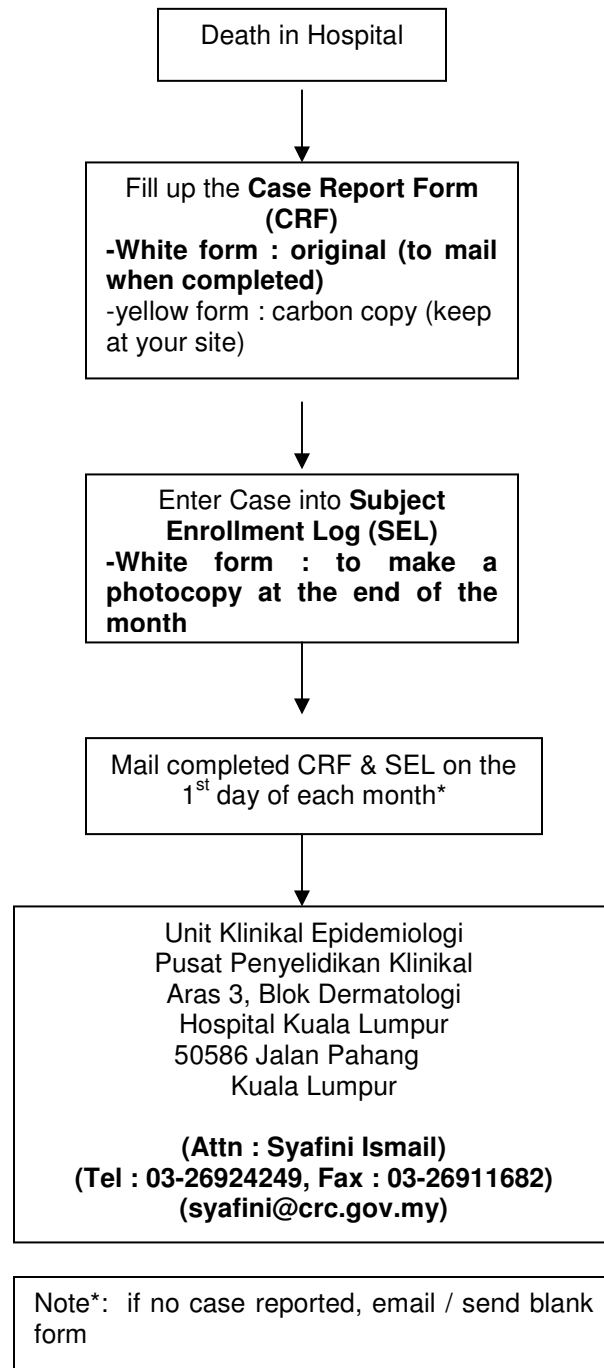


Examples of how to write initial letter of the staff's name:

**W**an **C**ik binti Abdullah = WC  
**K**aren **A**nne **M**artin = KAM  
**K**amala **D**evi A/P Arumugam = KD

- Tick  at the relevant box
- Hospital with Paediatrician :  
Form to be filled up by **Paediatrician** who managed the care.
- Hospital without Paediatrician :  
Form to be filled up by **MO in consultation with Paediatrician** who covers the region.

### 3.2 Data Collection Flow Chart (Hospital Death)



### 3.3 Site Organisation

| Co-investigator                     | Paediatricians  |  |   |
|-------------------------------------|---|--|---|
| <p><b>Site Coordinator (SC)</b></p> | <p><b><u>Hospital with Paediatrician</u></b></p> <p>Sister in charge of PICU / PHDW ; if no PICU / PHDW in hospital, then Sister in charge of Paediatric medical ward</p> | <p><b><u>Hospital without Paediatrician</u></b></p> <p>Sister in charge of Paediatric ward</p> | <p><b><u>Role &amp; Responsibilities</u></b></p> <ul style="list-style-type: none"> <li>- Identify all deaths in all disciplines in hospital</li> <li>- Obtain case notes for Paediatrician (hospital with Paediatrician) and MO (hospital without Paediatrician) to fill in forms</li> </ul> |

### 3.4 Specific Guidelines - Definitions and Data Collection

| <b>SECTION 1: PATIENT DETAILS</b>         |                                       |                                   |   |   |
|---|---------------------------------------|-----------------------------------|---|---|
| #   | <u>Item/ Variable Name</u>            | <b>Definition of Variable</b>     | <u>How/ where to capture Information from</u> | <u>Details</u>  |
| 1   | <b>Name</b>                           | Name of child who died            | MyKid / case notes                            |   |
| 2   | <b>MyKid Number / Other ID Number</b> | MyKid no or other ID number       | Case notes                                    | Please use this order:<br>i. MyKid no. / passport<br>ii. mother's ic / passport<br>iii. father's ic / passport<br>iv. guardian's ic / passport  |
| 3   | <b>RN No</b>                          | Child's hospital registration no. | Case notes                                    |   |
| 4   | <b>Residence</b>                      | Usual residence                   | Case notes                                    |   |
| 5   | <b>Ethnicity</b>                      | Race                              | Case notes                                    | Please use the ethnicity of:<br>i. father, or if unavailable then<br>ii. mother   |
| 6   | <b>Gender</b>                         |                                   | Case notes                                    |   |
| 7   | <b>Date of birth</b>                  |                                   | Case notes                                    |   |
| 8   | <b>Date and time of admission</b>     |                                   | Case notes                                    |   |
| <b>SECTION 2: PATIENT'S DEATH DETAILS</b> |                                       |                                   |   |   |
| #   | <u>Item/ Variable Name</u>            | <b>Definition of Variable</b>     | <u>How/ where to capture information from</u> | <u>Details</u>  |
| 9   | <b>Date and time of death</b>         |                                   | Case notes                                    |   |
| 10  | <b>Place of death</b>                 |                                   | Case notes                                    | <b>Tick only one</b><br><b>PICU</b> –Pediatric Intensive Care Unit<br><b>PHDW</b> –Pediatric High Dependency Ward<br><b>Main ICU</b> – Main Intensive Care Unit<br><b>A&amp;E</b> – Accident & Emergency<br><b>Paed Medical Ward</b> – Paediatric ward<br><b>Paed Surgical Ward</b> – please specify<br><i>E.g : neurosurgical</i><br><b>Others</b> – please specify<br><i>E.g : Operation Theatre (OT)</i> |
| 11a                                       | <b>Hospital Treatment</b>             | Highest level care received       | Case notes                                    | As in (10) above  |

|     |   |   |   |   |
|-----|---|---|---|---|
| 11b | <b>Person Managing</b>  | Highest level of person managing                                |   | <b>Tick only one</b><br><b>HO</b> – House Officer<br><b>MO</b> – Medical Officer<br><b>Specialist</b> – doctor with a post basic qualification and has been gazetted as a specialist<br><b>Consultant</b> – Specialist on Grade U54 and above   |
| 12a | <b>Symptom(s) of the current illness leading to death</b><br><b>Duration</b>              | Duration of symptoms of current illness <b>before</b> admission | Case notes / interview parents<br><br>Case notes / interview parents                  | <b>'Not applicable'</b> – for sudden death<br><i>E.g : Motor vehicle accident or drowning</i><br><br>If less than 1 day state number of hours   |
| 12b | <b>Treatments(s) received for current illness?</b>  | The place of any <b>pre hospital</b> treatment                  | Case notes / interview parents  | <b>Treatment:</b> does not include self-medication & traditional / complementary medication<br><b>Government Hospital:</b> includes army hospital, estate hospital  |
| 13  | <b>Co-morbid condition</b>  |   | Case notes  | Tick one or more boxes  |
| 14  | a) <b>Immediate cause of death</b><br><br>b) <b>Condition predisposing cause of death</b> |   | Case notes<br><br>Case notes  | a) <b>Enter only 1 cause. Do not</b> enter terminal events such as cardiac arrest or respiratory arrest. <b>Do not abbreviate</b><br><i>E.g : Pneumonia</i><br>b) Enter only 1 cause on a line. Add additional lines if necessary<br><i>E.g : Malnutrition</i><br><i>Spastic quadriplegia</i> |
| 15  | <b>ICD classification of cause of death</b>   |   | Case notes  | Tick only 1 & specify. See handout  |
| 16  | <b>Is death preventable</b>   |   | Subjective judgment based on case notes, nursing notes and other relevant information | Specify details – give details on why death is considered preventable or not preventable  |
| 17  | <b>Comments</b>   |   |   | Any other relevant information  |

**Appendix 2:**

**NON HOSPITAL DEATH:  
CRF and Guidelines for Data  
Collection**





**KEMENTERIAN KESIHATAN MALAYSIA**

**STUDY ON UNDER FIVE DEATHS IN MALAYSIA**

**Protocol No CE04-02**

**Site No**

**Date Commenced**

**Book Number**

**NON-HOSPITAL DEATH FORMS  
&  
GUIDELINES FOR DATA COLLECTION**

# SUBJECT ENROLMENT LOG

**SEL**

Site Name: \_\_\_\_\_

Site Code: \_\_\_\_\_

Book No: \_\_\_\_\_

| #  | <u>Date of Enroll</u> | <u>Child's Name</u> | <b>Initial</b> | <b>MyKid No</b> | <b>Telephone No.</b> |
|----|-----------------------|---------------------|----------------|-----------------|----------------------|
| 1  |                       |                     |                |                 |                      |
| 2  |                       |                     |                |                 |                      |
| 3  |                       |                     |                |                 |                      |
| 4  |                       |                     |                |                 |                      |
| 5  |                       |                     |                |                 |                      |
| 6  |                       |                     |                |                 |                      |
| 7  |                       |                     |                |                 |                      |
| 8  |                       |                     |                |                 |                      |
| 9  |                       |                     |                |                 |                      |
| 10 |                       |                     |                |                 |                      |
| 11 |                       |                     |                |                 |                      |
| 12 |                       |                     |                |                 |                      |
| 13 |                       |                     |                |                 |                      |
| 14 |                       |                     |                |                 |                      |
| 15 |                       |                     |                |                 |                      |
| 16 |                       |                     |                |                 |                      |
| 17 |                       |                     |                |                 |                      |
| 18 |                       |                     |                |                 |                      |

### NON HOSPITAL DEATH FORM

|                                 |  |                                  |
|---------------------------------|--|----------------------------------|
| Site Code: <input type="text"/> | Book No: <input type="text"/>  | Patient ID: <input type="text"/> |
| A. District: _____              | B. Date of Interview: <input type="text"/> / <input type="text"/> / <input type="text"/> |                                  |

#### SECTION 1 : PATIENT DETAILS

|   |  |                                   |   |
|---|--|-----------------------------------|---|
| 1. Name:  | <input style="width:100%;" type="text"/>   |                                   |   |
| 2. MyKid No / Other ID No:  | <input type="text"/>   | <input type="checkbox"/> MyKid No | <input type="checkbox"/> Other ID document<br>No, specify: (eg. passport) |
|   | <small>(Please fill in the MyKid number. If there is no MyKid no, fill in new or old IC of mother or father or guardian or any other identification document number. Please tick (✓) the ID document for the ID no given.)</small> |                                   |   |
| 3. Residence:   | a. State: <input type="text"/>   | b. District: <input type="text"/> | c. City/Town: <input type="text"/>  |
|   | 4. Ethnicity: (Tick (✓) one)   |                                   |   |
| <input type="checkbox"/> Malay <input type="checkbox"/> Orang Asli <input type="checkbox"/> Other Malaysian, specify: _____<br><input type="checkbox"/> Chinese <input type="checkbox"/> Bumiputra Sabah, specify: _____ <input type="checkbox"/> Non Citizen, specify: _____<br><input type="checkbox"/> Indian <input type="checkbox"/> Bumiputra Sarawak, specify: _____ |  |                                   |   |
| 5. Gender: (Tick (✓) one)   | <input type="checkbox"/> Male <input type="checkbox"/> Female <input type="checkbox"/> Indeterminate <input type="checkbox"/> Unknown  |                                   |   |
| 6. Date of Birth: (dd/mm/yy)  | <input type="text"/>   |                                   |   |

#### SECTION 2 : PATIENT'S DEATH DETAILS

|  |  |   |
|--|--|---|
| 7. Date and Time of Death:   | a. Date: (dd/mm/yy) <input type="text"/>   | b. Time: <input type="text"/> : <input type="text"/> AM / PM    |
| 8. Place of Death: (Tick (✓) one)  | <input type="checkbox"/> Home <input type="checkbox"/> On way to hospital<br><input type="checkbox"/> Clinic <input type="checkbox"/> Others, specify: _____ |   |
|  | 9. Person Certifying Death: (Tick (✓) one)   |   |
| <input type="checkbox"/> Medical, specify: _____ <input type="checkbox"/> Non-medical, specify: _____  |  |   |
| 10a. Symptom(s) of current illness leading to death:   | <small>(Tick (✓) one or more boxes below)</small>  |   |
|  | <input type="checkbox"/> Not Applicable  | <small>Duration (day(s) OR hour(s) if less than a day):</small> |
| <input type="checkbox"/> Fever<br><input type="checkbox"/> Cough<br><input type="checkbox"/> Difficult breathing<br><input type="checkbox"/> Diarrhoea<br><input type="checkbox"/> Convulsion<br><input type="checkbox"/> Lethargy<br><input type="checkbox"/> Unconsciousness<br><input type="checkbox"/> Not able to drink / feed<br><input type="checkbox"/> Others, specify: _____ |  |   |

**Please complete (10b) below ONLY IF you check (✓) one or more boxes in 10(a) (Except Not Applicable).**

|   |  |   |              |
|---|--|---|--------------|
| 10b. Treatment(s) received for current illness?         | <small>(Tick (✓) one)</small>                          | Place of Treatment: <small>(Tick (✓) one or more boxes)</small>   | No of times: |
|   | <input type="checkbox"/> Yes →                         | <input type="checkbox"/> a. Hospital <input type="checkbox"/> Government<br><input type="checkbox"/> University<br><input type="checkbox"/> Private<br><input type="checkbox"/> Others, specify: _____<br><input type="checkbox"/> b. Clinic <input type="checkbox"/> Government<br><input type="checkbox"/> University<br><input type="checkbox"/> Private<br><input type="checkbox"/> Others, specify: _____<br><input type="checkbox"/> c. Unknown |              |
| <input type="checkbox"/> No →                           | Reason(s): <small>(Tick (✓) one or more boxes)</small> | <input type="checkbox"/> Self-medication<br><input type="checkbox"/> Traditional / complementary treatment<br><input type="checkbox"/> No transport<br><input type="checkbox"/> Unaware child is seriously ill<br><input type="checkbox"/> Others, specify: _____   |              |
| <input type="checkbox"/> Not Applicable, specify: _____ |  |   |              |



## GUIDELINES FOR DATA COLLECTION

### Part 1: Definition of Cases

#### **Non-Hospital Death:**

Is defined as death that occurs outside the hospital which also includes

- e. That brought in dead to the hospital
- f. Death while on the way to care / hospital
- g. Death in clinics/ polyclinics (which do not have in-patient care facilities)
- h. Death at home or elsewhere

For hospital death, fill up the Hospital Death Form

#### **Hospital Death:**

Is defined as patients who arrived at the hospital with signs of life and had treatment whether in A & E, ward, intensive care, etc, before he died. Includes death occurring in all disciplines in the hospital including during ambulance transportation from one hospital to another.

### Part 2: Study Synopsis

|   |   |
|---|---|
| <i>Title</i>                            | Study On Under Five Death In Malaysia   |
| <i>Objectives distribution</i>          | To determine the causes of under five deaths in Malaysia, and its distribution by personal characteristics and geography<br><br>To determine the circumstances leading to these deaths including the pre- and in-hospital care, with view to identifying opportunities to improve our health care provision and processes |
| <i>Study Population</i>                 | The study population includes children aged 28 days up to 5 years old who died in Malaysia either in the hospital or outside of the hospital starting from 1.1.2006 to 31.12.2006   |
| <i>Sample</i>                           | All children who fit the study inclusion criteria and who died during the study period  |
| <i>Inclusion Criteria</i><br>Malaysians | Children aged 28 days up to 5 years old. Include Malaysians and non-Malaysians  |
| <i>Exclusion Criteria</i>               | Neonates (0-27 days), as data is captured in rapid reporting format for perinatal and neonatal deaths<br>Children aged 5 years and above  |

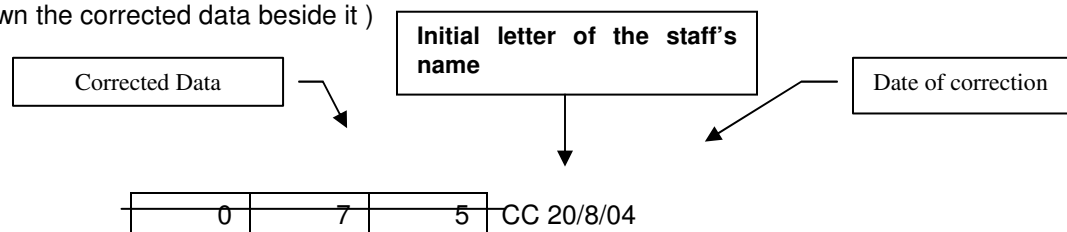
### Part 3: Guidelines on Data Collection

#### General Guidelines

- Paper is NCR, so **please use the flap** provided in this booklet to protect the adjacent pages.
- Use **black** ball pen
- The date must be written in **day/month/year** format (eg. 03/04/05 for 3 April 2005)
- Please put staff initials and date for any correction done:

Example of a correction:

( Strike out the wrong data by drawing one straight line cross the data and then write down the corrected data beside it )



Examples of how to write initial letter of the staff's name:

**W**an **C**ik binti Abdullah = WC  
**K**aren **A**nne **M**artin = KAM  
**K**amala **D**evi A/P Arumugam = KD

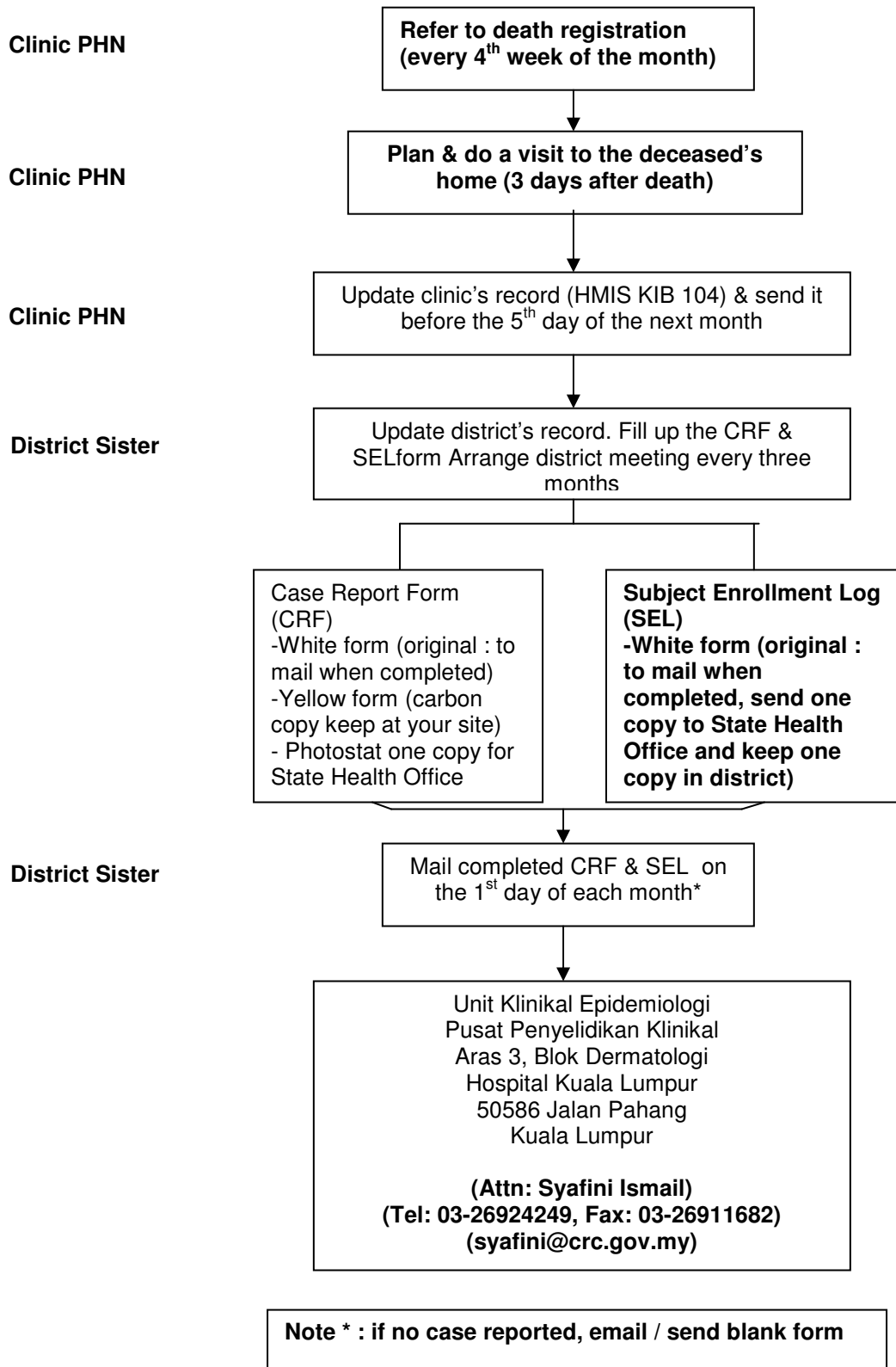
- Tick  at the relevant box
- Interview & form to be done by **Health Nurse** or **doctor**
- Data to be reviewed at 3 monthly meetings at district level. Committee to include Medical Officer of Health (MOH), Maternal and Child Health (MCH) officer, Paediatrician covering the region, Health Sister and nurse(s)

### 3.2 Specific Guidelines - Definitions and Data Collection

| SECTION 1: PATIENT DETAILS         |   |  |   |  |
|------------------------------------|---|--|---|--|
| #                                  | <u>Item/ Variable Name</u>                            | <b>Definition of Variable</b>                        | <u>How/ where to capture Information from</u>   | <u>Details</u>   |
| 1                                  | <b>Name</b>   | Name of child who died                               | MyKid   |  |
| 2                                  | <b>MyKid no/ other ID no</b>                          | MyKid no or other ID number                          |   | Please use this order:<br>i. MyKid no. / passport<br>ii. mother's ic / passport<br>iii. father's ic / passport<br>iv. guardian's ic / passport |
| 3                                  | <b>Residence</b>                                      | Usual residence                                      | Interview / IC / Birth certificate              |  |
| 4                                  | <b>Ethnicity</b>                                      | Race   | Interview / IC / Birth certificate              | Please use the ethnicity of:<br>i. father, or if unavailable then<br>ii. mother  |
| 5                                  | <b>Gender</b>   |  | Interview / IC / Birth certificate              |  |
| 6                                  | <b>Date of birth</b>                                  |  | Interview / IC / Birth certificate              |  |
| SECTION 2: PATIENT'S DEATH DETAILS |   |  |   |  |
| #                                  | <u>Item/ Variable Name</u>                            | <b>Definition of Variable</b>                        | <u>How/ where to capture Information from</u>   | <u>Details</u>   |
| 7                                  | <b>Date and time of death</b>                         | Date and time of death                               | Interview / Death certificate                   |  |
| 8                                  | <b>Place of death</b>                                 | Place where child died                               | Interview                                       | <b>Tick only one</b><br><b>Home Clinic</b><br><b>On way to hospital</b><br><b>Others</b> : eg; swimming pool,etc                               |
| 9                                  | <b>Person certifying Death</b>                        | Person who certified the death                       | Death certificate / police station              | <b>Tick only one</b><br><b>e.g Medical: <u>Doctor, MA</u></b><br><b>Non-Medical :</b><br>Policeman   |
| 10a                                | <b>Symptom(s) of current illness leading to death</b> |  | <b>Interview / home based child health card</b> | <b>'Not applicable'</b> – for sudden death<br><b>A. E.g: Motor vehicle accident or drowning</b>  |
|                                    | <b>Duration</b>                                       | Duration of symptoms of current illness before death | <b>Interview / home based child health card</b> | In days and if less than 1 day, state no. of hours   |
| 10b                                | <b>Treatment(s) received for current illness</b>      | The place of any treatment received                  | <b>Interview / home based child health card</b> | <b>Treatment:</b> does not include self-medication & traditional / complementary medication<br><b>Government Hospital:</b>                     |

|    |   |  |  |  |
|----|---|--|--|--|
|    |   |  |  | includes army, estate hospital   |
| 11 | <b>Co-morbid condition</b>  |  | Interview / home based child health card                               | Tick one or more boxes   |
| 12 | <b>Certified cause of death in death certificate</b>                                    |  | Death certificate / police station                                     | E. g : Cause of death given by police  |
| 13 | <b>a)Immediate cause of death</b><br><br><b>b)Condition predisposing cause of death</b> |  |  | <b>a)Enter only 1 cause. Do not enter terminal events such as cardiac arrest or respiratory arrest. Do not abbreviate</b><br><i>E.g : Pneumonia`</i><br><br><b>b)Enter only 1 cause on a line. Add additional lines if necessary</b><br><i>E.g : Malnutrition</i><br><i>Spastic quadriplegia</i> |
| 14 | <b>ICD classification of cause of death</b>   |  |  | Tick one box only & specify. See handout   |
| 15 | <b>Is death preventable</b>   |  | Subjective judgement based on interview and other relevant information | Specify details – give details on why death is considered preventable or not preventable   |
| 16 | <b>Comments</b>   |  |  | Any other relevant information   |

### 3.3 Data Collection Flow Process (Non-Hospital Death)





## **Appendix 3**

**3.1: NON HOSPITAL DEATH:  
Guideline for Interview (English)**

**3.2: NON HOSPITAL DEATH:  
Guideline for Interview (Malay)**



## A study on death occurring among children below five years old in Malaysia

### Introduction

Children aged one month to five years old are exposed to various risks that can cause death. In Malaysia, data regarding the exact number of death and the actual causes of death among children in this age group are not available. The purpose of the study is to determine the causes of death and identify steps that can be taken to prevent the same incident from happening.

*The guide is prepared to:*

1. Facilitate health staff to carry out the interview.
2. Ensure sensitive aspects are dealt with carefully.
3. Ensure health staff can express empathy during interview hence having good rapport with the person been interviewed.
4. Obtain accurate data.

*Steps to be followed during the interview:*

| No. | Steps  | Responsible person                                   |
|-----|--|--|
| 1.  | Review death registered in every police station in the district every fourth week of the month.  | District Health Sister<br>Clinic Public Health Nurse |
| 2.  | Arrange home visit. The most suitable time is three days after the death.  | Clinic Public Health Nurse<br>Clinic Health Nurse    |
| 3.  | <p>Visit the family on the scheduled date. Follow these steps:</p> <ol style="list-style-type: none"> <li>a. Greet and express condolence</li> <li>b. Express empathy to what had happened</li> <li>c. Tell the family that you come to visit them.</li> <li>d. In the beginning, listen more to them than asking question</li> <li>e. Assess whether the family is prepared to talk about the death. If yes, get their permission to ask several questions regarding the death.</li> <li>f. Explain about the study and its purpose:               <ul style="list-style-type: none"> <li>- To identify the cause of death</li> <li>- To improve health system</li> <li>- To obtain lessons learnt from the incident so that it can be a useful guidance for the community in future.</li> <li>-</li> </ul> </li> </ol> <p>During the interview you must always show empathy and willing to help</p> <p>Make sure that you are not blaming anybody or make any conclusion regarding the death. Be sensitive to non-verbal communication.</p> <p>Explain to them that their information is very useful to health care system in Malaysia.</p> <p>Fill-up the questionnaire form as complete as you can. Questions no. 13,14 and 15 are to be answered during</p> | Clinic Public Health Nurse<br>Clinic Health Nurse    |

|    |   |  |
|----|---|--|
|    | <p>group discussion at district level conducted every three months.</p> <p>When the interview ends, give moral support to the family. If necessary, arrange referral to see doctor.</p>   |  |
| 4. | <p>Update clinic record (HMIS KIB 104 )</p> <p>Collect all questionnaire forms and submit to District Sister before the fifth of the following month.</p>   | Clinic Public Health Nurse   |
| 5. | <p>Collect all questionnaire forms from all clinics in the district. Make sure the forms are complete. Record the forms (SEL forms)</p>   | District Health Sister   |
| 6. | <p>Arrange district meeting every three month to discuss any doubts regarding survey forms. The committee members comprise of health staff representing each clinic, Medical and Health Officers, Family Medicine Specialist, District Health Officer and Pediatrician. (Suggested before 5<sup>th</sup> day of each month)</p>   | District Health Sister   |
| 7. | <p>Survey forms must be completed before the meeting ends</p>   | <p>Representative from each clinic</p> <p>District Health Sister</p> |
| 8. | <p>Send completed survey forms to:</p> <p>Clinical Epidemiology Unit<br/> Clinical Research Centre<br/> 3<sup>rd</sup> Floor, Dermatology Block,<br/> Kuala Lumpur Hospital,<br/> 50586 Jalan Pahang,<br/> Kuala Lumpur.<br/> (attn: Miss Jauharatuddini Binti Hanafi)<br/> Tel: 03-4044 3070/ 03-4044 3060</p> <p>Original copy of completed forms and SEL form must be sent immediately after the district meeting (before or on the 5<sup>th</sup> of each month). Keep a copy at district for reference. Photocopy a copy to be sent to Ketua Penolong Pengarah Kesihatan Keluarga at State Health Department.</p> <p>If no case, send or e-mail blank SEL form</p> | District Health Sister   |

## Kajian Kematian Kanak-Kanak Bawah Umur Lima Tahun di Malaysia.

### Pengenalan

Kanak-kanak dalam lingkungan umur sebulan hingga lima tahun adalah terdedah kepada pelbagai risiko yang boleh menyebabkan kematian. Di Malaysia, data terperinci tentang jumlah dan penyebab sebenar kanak-kanak dalam lingkungan umur ini yang meninggal dunia adalah masih belum dapat diperolehi. Tujuan kajian ini diadakan adalah untuk mengkaji penyebab kematian kanak-kanak dalam lingkungan umur ini dan langkah-langkah yang boleh diambil bagi mengelakkan kejadian yang sama berulang.

### *Panduan ini disediakan untuk:*

1. Memudahkan anggota kesihatan melakukan temubual.
2. Memastikan aspek-aspek yang sensitif dijaga.
3. Memastikan anggota kesihatan dapat melahirkan rasa empati semasa temubual sekaligus menjalin kerjasama yang baik dengan orang yang ditemubual.
4. Memastikan maklumat yang dikehendaki dapat diperolehi dengan tepat.

### *Langkah-langkah yang perlu diikuti semasa menjalankan temubual:*

| Bil. | Langkah-langkah   | Tugasan   |
|------|---|---|
| 1.   | Semak daftar kematian kanak-kanak di setiap balai polis atau pondok polis dalam daerah jagaan pada minggu keempat setiap bulan  | Ketua Jururawat Kesihatan Daerah<br>Jururawat Kesihatan Umum Klinik |
| 2.   | Aturkan tarikh lawatan ke rumah apabila mendapat berita kematian. Masa yang sesuai adalah sekurang-kurangnya selepas tiga hari kematian.  | Jururawat Kesihatan Umum Klinik<br>Jururawat Kesihatan              |
| 3.   | Lakukan lawatan ke rumah pada tarikh yang dijadualkan. Sila gunakan kaedah berikut: <ol style="list-style-type: none"> <li>a. Beri salam atau ucap takziah.</li> <li>b. Lahirkan rasa empati anda terhadap kejadian yang menimpa.</li> <li>c. Nyatakan tujuan kedatangan anda adalah untuk menziarahi keluarga si mati.</li> <li>d. Lebih banyak mendengar dari bertanya.</li> <li>e. Buat penilaian tentang kesediaan keluarga si mati untuk ditemubual.</li> </ol> Sekiranya keluarga si mati didapati bersedia, minta izin untuk menanyakan beberapa soalan berkaitan kematian.  | Jururawat Kesihatan Umum Klinik<br>Jururawat Kesihatan              |
| Bil. | Langkah-langkah   | Tugasan   |
|      | f. Terangkan tentang kajian dan tujuannya: <ul style="list-style-type: none"> <li>- Mengenalpasti punca-punca kematian .</li> <li>- Memperbaiki sistem kesihatan</li> <li>- Mendapatkan pelajaran yang boleh dijadikan panduan kepada seluruh masyarakat di masa yang akan datang.</li> </ul> Anda hendaklah sentiasa bersikap ingin membantu dan empati di sepanjang temubual.<br>Pastikan anda tidak bersikap menuduh sesiapa dan membuat rumusan sendiri. Anda hendaklah peka terhadap tanda-tanda bukan verbal dari keluarga si- mati.<br><br>Terangkan maklumat yang diberikan adalah satu sumbangan bermakna terhadap sistem penjagaan pesakit di Malaysia. | Jururawat Kesihatan Umum Klinik<br>Jururawat Kesihatan              |

|             |  |  |
|-------------|--|--|
|             | <p>Isi borang kajian selengkap yang anda boleh. Soalan 13, 14 dan 15 perlu dijawab semasa perbincangan kumpulan di daerah setiap tiga bulan.</p> <p>Setelah tamat temubual, berilah sokongan moral kepada keluarga pesakit. Jika perlu, aturkan rujukan ibu / ayah si-mati berjumpa doktor.</p>  |  |
| 4.          | Kemaskini rekod klinik (HMIS KIB 104 ). Kumpulkan borang kajian dan serah kepada Ketua Jururawat Daerah sebelum 5hb bulan yang berikutnya.   | Jururawat Kesihatan Umum                                     |
| 5.          | Kumpulkan borang kajian dan kemaskini rekod daerah (Borang SEL).   | Ketua Jururawat Kesihatan Daerah                             |
| 6.          | Aturkan mesyuarat bersama sejurus selepas setiap tiga bulan antara anggota kesihatan yang mewakili setiap klinik, Pegawai Perubatan dan Kesihatan, Pakar Perubatan Keluarga Daerah, Pegawai Kesihatan Daerah dan Pakar Pediatrik untuk membincangkan sebarang kemusykilan berkenaan borang kajian. Tarikh mesyuarat yang dicadangkan adalah sebelum 5 haribulan.   | Ketua Jururawat Kesihatan Daerah                             |
| 7.          | Lengkapkan borang kajian mestilah dilengkapkan sebelum mesyuarat berakhir  | Wakil dari setiap klinik<br>Ketua Jururawat Kesihatan Daerah |
| <b>Bil.</b> | <b>Langkah-langkah</b>   | <b>Tugasan</b>   |
| 8.          | <p>Pos borang kajian yang lengkap kepada :</p> <p>Unit Klinikal Epidemiologi,<br/>Pusat Penyelidikan Klinikal,<br/>Aras 3, Blok Dermatologi,<br/>Hospital Kuala Lumpur,<br/>50586 Jalan Pahang,<br/>Kuala Lumpur.<br/>( U/P: Syafini Ismail, tel 03-26924249, fax 03- 26911682 )<br/>syafini@crc.gov.my</p> <p>Salinan asal borang –borang kajian yang lengkap dan borang SEL hendaklah dipos sejurus selepas mesyuarat dijalankan (sebelum atau pada 5 haribulan). Simpan salinan di daerah untuk rujukan. Photostat satu salinan untuk diserahkan kepada Ketua Penolong Pengarah Kesihatan Keluarga di Jabatan Kesihatan Negeri masing-masing.</p> <p>Jika tiada kes, pos atau e-mail borang SEL sahaja.</p> | Ketua Jururawat Kesihatan Daerah                             |

**Appendix 4:**  
**Guidelines for**  
**Classification of Deaths**



**International Statistical Classification of Disease and Related Health Problems Revision 10, ICD 10 (modified)**

Note: When a single condition is given on the death certificate, select that condition as the underlying cause. When several conditions are reported, select the originating antecedent cause of the sequence of events leading to death and this is the underlying cause of death.

| <b>No</b> | <b>Cause of Death</b>                              | <b>Comments</b>  | <b>Examples</b>  |
|-----------|--|--|--|
| 1         | <b>Certain Infectious &amp; Parasitic Diseases</b> | Specific communicable/transmissible disease<br><b>Exclusion:</b> Local infections of skin, respiratory system (eg: pneumonia), certain bacterial meningitis<br><b>Inclusion:</b> STD & HIV   | Acute gastroenteritis<br>Tuberculosis<br>Meningococcaemia<br>Viral meningitis<br>Dengue Haemorrhagic fever<br>HIV<br>Tetanus neonatorum  |
| 2         | <b>Neoplasms</b>                                   | Functional activity, morphology & sites<br><b>Includes</b> all malignant, in situ neoplasms & benign neoplasms   | Hepatocellular carcinoma<br>Retinoblastoma<br>Acute Lymphoblastic leukaemia<br>Cerebellar tumours<br>Osteosarcoma  |
| 3         | <b>Diseases of Blood &amp; Immune System</b>       | <b>Excludes</b> auto-immune, congenital malformations, endocrine/ metabolic, neoplasm, HIV, Poisoning & signs & symptoms with abnormal clinical & lab finding NEC                            | Beta thalassaemia<br>Haemolytic Uraemic Syndrome<br>Haemophilia A & B<br>Agammaglobulinaemia<br>Severe Combined Immunodeficiency   |
| 4         | <b>Endocrine, Nutritional, Metabolic Diseases</b>  | <b>Excludes</b> signs & symptoms & abnormal clinical & lab findings NEC transient disorder in newborn  | Congenital Hypothyroidism<br>Insulin Dependent Diabetes Mellitus<br>Marasmic Kwashiokor<br>Mucopolysaccharidosis<br>Cysts fibrosis<br>Hyperkalemia<br>Fluid overload   |
| 5         | <b>Diseases of the Nervous System</b>              | <b>Excludes</b> perinatal origin, congenital malformations, endocrine, neoplasm, signs & symptoms with abnormal clinical & lab finding NEC<br><b>Also excludes</b> causes in 1, 2, & 4 above | Hemophilus meningitis<br>Acute Transverse myelitis<br>Spinal muscular atrophy<br>Cord Compression<br>Spastic cerebral palsy<br>Acquired hydrocephalus<br>Toxic Encephalopathy<br>Meningitis, Encephalitis, Dystrophy |

|    |  |   |   |
|----|--|---|---|
| 6  | <b>Diseases of the Circulatory System</b>                                      | <b>Excludes</b> 1, 2, 4, perinatal origin, congenital malformations, connective tissue & signs & symptoms with abnormal clinical & lab finding NEC<br>Note: congenital heart lesions excluded           | Rheumatic Valvular Disease<br>Hypertension<br>Primary pulmonary Hypertension<br>Infective pericarditis<br>Acute Myocarditis<br>Cardiomyopathy<br>Cerebral infarction  |
| 7  | <b>Diseases of the Respiratory System</b>                                      | <b>Excludes</b> 1, 2, 4, perinatal origin, congenital malformations, injury/ poisoning & signs & symptoms with abnormal clinical & lab finding NEC  | Pneumonia due to <i>Streptococcal Pneumoniae</i><br>Retropharyngeal abscess<br>Pulmonary Oedema<br>Lung abscess with pneumonia<br>Adult Respiratory Distress Syndrome |
| 8  | <b>Diseases of the Digestive System</b>  | <b>Excludes</b> 1,2, 4 perinatal origin, congenital malformation, injury/ poisoning & signs & symptoms with abnormal clinical & lab finding NEC   | Acute appendicitis peritonitis,<br>Intestinal perforation<br>Intussuception<br>Toxic liver disease<br>Acute Pancreatitis  |
| 9  | <b>Diseases of the Genitourinary System</b>                                    | <b>Excludes</b> 1,2, 4 perinatal origin, congenital malformation, injury/ poisoning & signs & symptoms with abnormal clinical & lab finding NEC   | Acute Nephritic syndrome<br>Chronic Renal failure<br>Obstructive Uropathy<br>Acute Renal Failure  |
| 10 | <b>Conditions from Perinatal Period</b>  | <b>Includes</b> conditions that have their origin in perinatal period though death or morbidity occurs later.<br><b>Excludes</b> 2, 4, congenital malformations, injury/ poisoning & tetanus neonatorum | Extremely low birth weight<br>Severe birth asphyxia<br>Intraventricular haemorrhage<br>Congenital rubella syndrome<br>Kernicterus<br>Bronchopulmonary dysplasia       |
| 11 | <b>Congenital Malformations, Deformations, &amp; Chromosomal Abnormalities</b> | <b>Excludes</b> inborn errors of metabolism<br><b>Includes</b> congenital heart disease   | Congenital hydrocephalus<br>Spina Bifida<br>Ebstein anomaly<br>Diaphragmatic hernia<br>Biliary atresia<br>Edwards syndrome<br>Epidermolysis Bullosa                   |
| 12 | <b>Injuries, Poisoning &amp; External Causes</b>                               | <b>Excludes</b> Birth trauma  | Fracture of base of skull<br>Injury of spleen<br>Burns & Corrosions<br>Carbon Monoxide poisoning<br>Anaphylactic shock<br>Bone marrow transplant<br>Rejection         |

|    |  |   |   |
|----|--|---|---|
|    |  |   | Assault<br>Accidental drowning  |
| 13 | <b>Symptoms &amp; Signs &amp; Abnormal Findings Not Elsewhere Classified (NEC)</b> | <b>Excludes</b> perinatal origin, Symptoms & signs of various organ systems but unspecified   | Cardiogenic shock<br>Respiratory arrest<br>Sudden Infant Death Syndrome<br>Unattended death   |
| 14 | <b>Others</b>  | Mental & Behavioural disorders<br>Disease of eye & Adnexae<br>Disease of ear & mastoid process<br>Disease of skin & subcutaneous tissue<br>Diseases of of musculoskeletal & connective tissue | Severe mental retardation<br>Developmental dyslexia<br>Optic neuritis<br>Purulent endophthalmitis<br>Acute mastoiditis<br>Suppurative otitis media<br>Staphylococcal scalded skin syndrome<br>Seropositive rheumatoid arthritis<br>Systemic lupus erythematosus |



# **Appendix 5: Data Quality Report**



|  | Hospital Death<br>N = 1303 |      | Non Hospital Death<br>N = 396 |      |
|--|----------------------------|------|-------------------------------|------|
|  | No                         | %    | No                            | %    |
| <b>Under 5 deaths by month, No., %</b>           |                            |      |                               |      |
| January  | 115                        | 8.8  | 41                            | 10.4 |
| February   | 120                        | 9.2  | 42                            | 10.6 |
| March  | 116                        | 8.9  | 50                            | 12.6 |
| April  | 102                        | 7.8  | 29                            | 7.3  |
| May  | 120                        | 9.2  | 36                            | 9.1  |
| June   | 99                         | 7.6  | 35                            | 8.8  |
| July   | 116                        | 8.9  | 31                            | 7.8  |
| August   | 116                        | 8.9  | 28                            | 7.1  |
| September  | 95                         | 7.3  | 24                            | 6.1  |
| October  | 112                        | 8.6  | 30                            | 7.6  |
| November   | 87                         | 6.7  | 26                            | 6.6  |
| December   | 105                        | 8.1  | 23                            | 5.8  |
| Missing  | 0                          | 0    | 1                             | 0.2  |
| <b>Age of Death by Age Group (Month), No., %</b> |                            |      |                               |      |
| 0 – 11   | 795                        | 61   | 195                           | 49.2 |
| 12 – 23  | 225                        | 17.3 | 98                            | 24.7 |
| 24 – 35  | 135                        | 10.4 | 44                            | 11.1 |
| 36 – 47  | 70                         | 5.4  | 31                            | 7.8  |
| 48 – <60   | 66                         | 5.1  | 23                            | 5.8  |
| Missing  | 12                         | 0.8  | 5                             | 1.4  |
| <b>Gender, No., %</b>                            |                            |      |                               |      |
| Male   | 733                        | 56.3 | 220                           | 55.6 |
| Female   | 569                        | 43.7 | 175                           | 44.2 |
| Missing  | 1                          | 0    | 1                             | 0.2  |
| <b>Ethnicity, No., %</b>                         |                            |      |                               |      |
| Malay  | 600                        | 46   | 199                           | 50.3 |
| Chinese  | 130                        | 10   | 18                            | 4.5  |
| Indian   | 61                         | 4.7  | 15                            | 3.8  |
| Orang Asli                                       | 60                         | 4.6  | 87                            | 22   |
| Bumiputra Sabah                                  | 157                        | 12   | 32                            | 8.1  |
| Bumiputra Sarawak                                | 87                         | 6.7  | 35                            | 8.8  |
| Other Malaysian                                  | 39                         | 3    | 3                             | 0.8  |
| Non Citizen                                      | 163                        | 12.5 | 7                             | 1.8  |
| Others   | 0                          | 0    | 0                             | 0    |
| Missing  | 6                          | 0.5  | 0                             | -0.1 |
| <b>Non Citizen, No., %</b>                       |                            |      |                               |      |
| Indonesian                                       | 61                         | 37.4 | 4                             | 57.1 |
| Filipino   | 89                         | 54.6 | 1                             | 14.3 |
| Others   | 7                          | 4.3  | 2                             | 28.6 |
| Not Available                                    | 6                          | 3.7  | 0                             | 0    |
| <b>Cases reported by State , No., %</b>          |                            |      |                               |      |
| Johor  | 103                        | 7.9  | 18                            | 4.5  |
| Kedah  | 72                         | 5.5  | 29                            | 7.3  |
| Kelantan   | 78                         | 6    | 66                            | 16.7 |
| Melaka   | 30                         | 2.3  | 7                             | 1.8  |
| Negeri Sembilan                                  | 47                         | 3.6  | 13                            | 3.3  |
| Pahang   | 80                         | 6.1  | 53                            | 13.4 |
| Perak  | 82                         | 6.3  | 37                            | 9.3  |
| Perlis   | 5                          | 0.4  | 5                             | 1.3  |
| Pulau Pinang                                     | 60                         | 4.6  | 9                             | 2.3  |
| Sabah  | 342                        | 26.2 | 36                            | 9.1  |

|   | Hospital Death<br>N = 1303 |          | Non Hospital Death<br>N = 396 |          |
|---|----------------------------|----------|-------------------------------|----------|
| Sarawak                                       | 146                        | 11.2     | 61                            | 15.4     |
| Selangor                                      | 96                         | 7.4      | 9                             | 2.3      |
| Terengganu                                    | 40                         | 3.1      | 23                            | 5.8      |
| Wilayah Persekutuan                           | 122                        | 9.4      | 30                            | 7.5      |
| <b>District of Residence by State, No., %</b> | <b>No</b>                  | <b>%</b> | <b>No</b>                     | <b>%</b> |
| Johor   | 112                        | 100.0    | 18                            | 100.0    |
| • Batu Pahat                                  | 12                         | 10.7     | 1                             | 5.6      |
| • Johor Bahru                                 | 62                         | 55.4     | 0                             | 0.00     |
| • Kluang                                      | 7                          | 6.3      | 1                             | 5.6      |
| • Kota Tinggi                                 | 6                          | 5.4      | 0                             | 0.00     |
| • Mersing                                     | 2                          | 1.8      | 0                             | 0.00     |
| • Muar  | 13                         | 11.6     | 3                             | 16.7     |
| • Pontian                                     | 3                          | 2.7      | 5                             | 27.8     |
| • Segamat                                     | 7                          | 6.3      | 8                             | 44.4     |
| Kedah   | 77                         | 100.0    | 29                            | 100.0    |
| • Baling                                      | 8                          | 10.4     | 3                             | 10.3     |
| • Bandar Baharu                               | 0                          | 0.0      | 2                             | 6.9      |
| • Kota Setar                                  | 21                         | 27.3     | 2                             | 6.9      |
| • Kuala Muda                                  | 16                         | 20.8     | 2                             | 6.9      |
| • Kubang Pasu                                 | 5                          | 6.5      | 5                             | 17.2     |
| • Kulim                                       | 13                         | 16.9     | 5                             | 17.2     |
| • Langkawi                                    | 2                          | 2.6      | 1                             | 3.5      |
| • Padang Terap                                | 1                          | 1.3      | 3                             | 10.3     |
| • Pendang                                     | 4                          | 5.2      | 3                             | 10.3     |
| • Sik   | 2                          | 2.6      | 2                             | 6.9      |
| • Yan   | 5                          | 6.5      | 1                             | 3.5      |
| Kelantan                                      | 81                         | 100.0    | 66                            | 100.0    |
| • Bachok                                      | 2                          | 2.5      | 4                             | 6.1      |
| • Gua Musang                                  | 13                         | 16.1     | 40                            | 60.6     |
| • Jeli  | 1                          | 1.2      | 1                             | 1.5      |
| • Kota Bharu                                  | 39                         | 48.2     | 8                             | 12.1     |
| • Kuala Krai                                  | 3                          | 3.7      | 4                             | 6.1      |
| • Machang                                     | 5                          | 6.2      | 1                             | 1.5      |
| • Pasir Mas                                   | 4                          | 5.0      | 1                             | 1.5      |
| • Pasir Puteh                                 | 2                          | 2.5      | 7                             | 10.6     |
| • Tanah Merah                                 | 8                          | 9.9      | 0                             | 0.00     |
| • Tumpat                                      | 4                          | 5.0      | 0                             | 0.00     |
| Melaka  | 33                         | 100.0    | 6                             | 100.0    |
| • Alor Gajah                                  | 3                          | 9.1      | 1                             | 16.7     |
| • Jasin                                       | 8                          | 24.2     | 1                             | 16.7     |
| • Melaka Tengah                               | 22                         | 66.7     | 4                             | 66.7     |
| Negeri Sembilan                               | 47                         | 100.0    | 14                            | 100.0    |
| • Jelebu                                      | 2                          | 4.3      | 2                             | 14.3     |
| • Jempol                                      | 2                          | 4.3      | 0                             | 0.0      |
| • Kuala Pilah                                 | 10                         | 21.3     | 3                             | 21.4     |
| • Port Dickson                                | 2                          | 4.3      | 2                             | 14.3     |
| • Rembau                                      | 1                          | 2.1      | 2                             | 14.3     |
| • Seremban                                    | 24                         | 51.1     | 3                             | 21.4     |

|                          | Hospital Death<br>N = 1303 |        | Non Hospital Death<br>N = 396 |        |
|--------------------------|----------------------------|--------|-------------------------------|--------|
| • Tampin                 | 6                          | 12.8   | 2                             | 14.3   |
| Pahang                   | 96                         | 100.0  | 52                            | 100.0  |
| • Bentong                | 4                          | 4.2    | 4                             | 7.7    |
| • Bera                   | 1                          | 1.0    | 3                             | 5.8    |
| • Cameron Highlands      | 3                          | 3.1    | 10                            | 19.2   |
| • Jerantut               | 9                          | 9.4    | 6                             | 11.5   |
| • Kuala Lipis            | 7                          | 7.3    | 9                             | 17.3   |
| • Kuantan                | 24                         | 25.0   | 7                             | 13.5   |
| • Maran                  | 3                          | 3.3    | 2                             | 3.9    |
| • Pekan                  | 8                          | 8.3    | 4                             | 7.7    |
| • Raub                   | 7                          | 7.3    | 3                             | 5.8    |
| • Rompin                 | 6                          | 6.2    | 3                             | 5.8    |
| • Temerloh               | 23                         | 25.0   | 1                             | 1.9    |
| Perak                    | 76                         | 100.0  | 37                            | 100.0  |
| • Batang Padang          | 9                          | 11.8   | 8                             | 21.6   |
| • Hilir Perak            | 9                          | 11.8   | 1                             | 2.7    |
| • Hulu Perak             | 7                          | 9.2    | 12                            | 32.4   |
| • Kerian                 | 3                          | 4.0    | 0                             | 0.0    |
| • Kinta                  | 21                         | 27.6   | 11                            | 29.7   |
| • Kuala Kangsar          | 9                          | 11.8   | 0                             | 0.0    |
| • Larut, Matang & Selama | 7                          | 9.2    | 0                             | 0.0    |
| • Manjung                | 9                          | 11.8   | 5                             | 13.5   |
| • Perak Tengah           | 1                          | 1.3    | 0                             | 0.0    |
| • Missing                | 1                          | 1.3    | 0                             | 0.0    |
| Perlis                   | 7                          | 100.0  | 5                             | 100.0  |
| • Kangar                 | 7                          | 100.0  | 5                             | 100.0  |
| Pulau Pinang             | 58                         | 100.0  | 9                             | 100.0  |
| • Barat Laut             | 6                          | 10.3   | 0                             | 0.0    |
| • Pulau Pinang           | 1                          | 1.7    | 0                             | 0.0    |
| • Seberang Perai Selatan | 3                          | 5.2    | 0                             | 0.0    |
| • Seberang Perai Tengah  | 18                         | 31.0   | 2                             | 22.2   |
| • Seberang Perai Utara   | 18                         | 31.0   | 7                             | 77.8   |
| • Timur Laut             | 10                         | 17.3   | 0                             | 0.0    |
| • Missing                | 2                          | 3.5    | 0                             | 0.0    |
| Sabah                    | 343                        | 100.00 | 36                            | 100.00 |
| • Beaufort               | 1                          | 0.29   | 0                             | 0.0    |
| • Beluran                | 7                          | 2.04   | 3                             | 8.3    |
| • Keningau               | 17                         | 4.96   | 6                             | 16.7   |
| • Kinabatangan           | 2                          | 0.58   | 0                             | 0.0    |
| • Kota Belud             | 7                          | 2.0    | 9                             | 25.0   |
| • Kota Kinabalu          | 56                         | 16.3   | 2                             | 5.6    |
| • Kota Marudu            | 15                         | 4.4    | 4                             | 11.1   |
| • Kuala Penyu            | 2                          | 0.6    | 0                             | 0.0    |
| • Kudat                  | 14                         | 4.1    | 0                             | 0.0    |
| • Kunak                  | 8                          | 2.3    | 0                             | 0.0    |

|                    | Hospital Death<br>N = 1303 |              | Non Hospital Death<br>N = 396 |               |
|--------------------|----------------------------|--------------|-------------------------------|---------------|
| • Lahad Datu       | 53                         | 15.5         | 0                             | 0.0           |
| • Papar            | 8                          | 2.3          | 0                             | 0.0           |
| • Penampang        | 1                          | 0.3          | 0                             | 0.0           |
| • Ranau            | 7                          | 2.0          | 4                             | 11.1          |
| • Sandakan         | 57                         | 16.6         | 0                             | 0.0           |
| • Semporna         | 41                         | 12.0         | 0                             | 0.0           |
| • Sipitang         | 3                          | 0.9          | 0                             | 0.0           |
| • Tambunan         | 1                          | 0.3          | 2                             | 5.6           |
| • Tawau            | 35                         | 10.2         | 0                             | 0.0           |
| • Tenom            | 4                          | 1.2          | 0                             | 0.0           |
| • Tuaran           | 4                          | 1.2          | 6                             | 16.7          |
| <b>Sarawak</b>     | <b>152</b>                 | <b>100.0</b> | <b>61</b>                     | <b>100.00</b> |
| • Betong           | 2                          | 1.3          | 1                             | 1.6           |
| • Bintulu          | 25                         | 16.5         | 0                             | 0.0           |
| • Dalat            | 1                          | 0.7          | 0                             | 0.0           |
| • Daro             | 3                          | 2.0          | 0                             | 0.0           |
| • Kapit            | 9                          | 5.9          | 5                             | 8.2           |
| • Kuching          | 40                         | 26.3         | 9                             | 14.8          |
| • Limbang          | 5                          | 3.3          | 2                             | 3.3           |
| • Miri             | 23                         | 15.1         | 1                             | 1.6           |
| • Mukah            | 3                          | 2.0          | 2                             | 3.3           |
| • Samarahan        | 3                          | 2.0          | 13                            | 21.3          |
| • Saratok          | 2                          | 1.3          | 4                             | 6.6           |
| • Sarikei          | 4                          | 2.6          | 3                             | 4.9           |
| • Serian           | 4                          | 2.6          | 1                             | 1.6           |
| • Sibu             | 24                         | 15.8         | 7                             | 11.5          |
| • Simunjan         | 1                          | 0.7          | 4                             | 6.6           |
| • Sri Aman         | 3                          | 2.0          | 9                             | 14.8          |
| <b>Selangor</b>    | <b>131</b>                 | <b>100.0</b> | <b>29</b>                     | <b>100.0</b>  |
| • Gombak           | 14                         | 10.7         | 2                             | 6.9           |
| • Hulu Langat      | 19                         | 14.5         | 2                             | 6.9           |
| • Hulu Selangor    | 4                          | 3.1          | 4                             | 13.8          |
| • Klang            | 26                         | 19.9         | 1                             | 3.5           |
| • Kuala Langat     | 10                         | 7.6          | 0                             | 0.0           |
| • Kuala Selangor   | 12                         | 9.2          | 1                             | 3.5           |
| • Petaling         | 36                         | 27.5         | 17                            | 58.6          |
| • Sabak Bernam     | 6                          | 4.6          | 0                             | 0.0           |
| • Sepang           | 3                          | 2.3          | 2                             | 6.9           |
| • Missing          | 1                          | 0.8          | 0                             | 0.0           |
| <b>Terengganu</b>  | <b>45</b>                  | <b>100.0</b> | <b>23</b>                     | <b>100.00</b> |
| • Besut            | 3                          | 6.7          | 1                             | 4.4           |
| • Dungun           | 4                          | 8.9          | 5                             | 21.7          |
| • Hulu Terengganu  | 7                          | 15.6         | 3                             | 13.0          |
| • Kemaman          | 12                         | 26.7         | 2                             | 8.7           |
| • Kuala Terengganu | 13                         | 28.9         | 2                             | 8.7           |
| • Marang           | 2                          | 4.4          | 6                             | 26.1          |
| • Setiu            | 4                          | 8.9          | 4                             | 17.4          |

|  | Hospital Death<br>N = 1303 |          | Non Hospital Death<br>N = 396 |          |
|--|----------------------------|----------|-------------------------------|----------|
| Wilayah Persekutuan (Kuala Lumpur)                     | 39                         | 100.0    | 10                            | 0.0      |
| • Kuala Lumpur   | 39                         | 100.0    | 10                            | 0.0      |
| Wilayah Persekutuan (Labuan)                           | 1                          | 100.0    | 0                             | 0.0      |
| <b>Place of Hospital Death, No., %</b>                 | <b>No</b>                  | <b>%</b> | <b>No</b>                     | <b>%</b> |
| PICU   | 324                        | 24.9     | 0                             | 0.0      |
| PHDW   | 165                        | 12.7     | 0                             | 0.0      |
| Main ICU   | 101                        | 7.8      | 0                             | 0.0      |
| A & E  | 85                         | 6.5      | 0                             | 0.0      |
| Paed Medical Ward                                      | 390                        | 29.9     | 0                             | 0.0      |
| Paed Surgical Ward                                     | 41                         | 3.1      | 0                             | 0.0      |
| NICU   | 187                        | 14.4     | 0                             | 0.0      |
| Other ICU  | 4                          | 0.3      | 0                             | 0.0      |
| Others   | 2                          | 0.2      | 0                             | 0.0      |
| Missing  | 4                          | 0.2      | 0                             | 0.0      |
| <b>Highest Level Care Received, No., %</b>             | <b>No</b>                  | <b>%</b> | <b>No</b>                     | <b>%</b> |
| PICU   | 346                        | 26.6     | 0                             | 0        |
| PHDW   | 168                        | 12.9     | 0                             | 0        |
| Main ICU   | 104                        | 8        | 0                             | 0        |
| A & E  | 80                         | 6.1      | 0                             | 0        |
| Paed Medical Ward                                      | 369                        | 28.3     | 0                             | 0        |
| Paed Surgical Ward                                     | 41                         | 3.1      | 0                             | 0        |
| NICU   | 188                        | 14.4     | 0                             | 0        |
| Other ICU  | 4                          | 0.3      | 0                             | 0        |
| Others   | 0                          | 0        | 0                             | 0        |
| Missing  | 3                          | 0.3      | 396                           | 100      |
| <b>Highest Level of Person Managing, No., %</b>        | <b>No</b>                  | <b>%</b> | <b>No</b>                     | <b>%</b> |
| HO   | 2                          | 0.2      | 0                             | 0        |
| MO   | 278                        | 21.3     | 0                             | 0        |
| Specialist   | 380                        | 29.2     | 0                             | 0        |
| Consultant   | 636                        | 48.8     | 0                             | 0        |
| Others   | 0                          | 0        | 0                             | 0        |
| Missing  | 7                          | 0.5      | 396                           | 100      |
| <b>Place of Non-Hospital Death, No., %</b>             | <b>No</b>                  | <b>%</b> | <b>No</b>                     | <b>%</b> |
| Home   | 0                          | 0        | 266                           | 67.2     |
| Clinic   | 0                          | 0        | 17                            | 4.3      |
| On the way to hospital                                 | 0                          | 0        | 62                            | 15.7     |
| On the way to clinic                                   | 0                          | 0        | 9                             | 2.3      |
| On the way home from hospital/clinic                   | 0                          | 0        | 5                             | 1.3      |
| Site of accident                                       | 0                          | 0        | 6                             | 1.5      |
| Pond, river, etc.                                      | 0                          | 0        | 12                            | 3        |
| Place of care  | 0                          | 0        | 6                             | 1.5      |
| Others   | 0                          | 0        | 9                             | 2.3      |
| Missing  | 1303                       | 100      | 4                             | 0.9      |
| <b>Person Certifying of Non-Hospital Death, No., %</b> | <b>No</b>                  | <b>%</b> | <b>No</b>                     | <b>%</b> |
| Medical  | 0                          | 0        | 160                           | 40.4     |
| Non-Medical  | 0                          | 0        | 204                           | 51.5     |
| Missing  | 1303                       | 100      | 32                            | 8.1      |

|   | Hospital Death<br>N = 1303 |          | Non Hospital Death<br>N = 396 |          |
|---|----------------------------|----------|-------------------------------|----------|
| <b>Medical Person Certifying of Non-Hospital Death, No., %</b>                              | <b>No</b>                  | <b>%</b> | <b>No</b>                     | <b>%</b> |
| Doctor  | 0                          | 0        | 115                           | 71.9     |
| Medical Assistant   | 0                          | 0        | 18                            | 11.3     |
| Others  | 0                          | 0        | 8                             | 5        |
| Missing   | 0                          | 100      | 19                            | 11.8     |
| <b>Non Medical Person Certifying of Non-Hospital Death, No., %</b>                          | <b>No</b>                  | <b>%</b> | <b>No</b>                     | <b>%</b> |
| Police  | 0                          | 0        | 91                            | 44.6     |
| Family  | 0                          | 0        | 33                            | 16.2     |
| Jabatan Orang Asli  | 0                          | 0        | 40                            | 19.6     |
| Imam/Ketua Kampung/Tuai Rumah   | 0                          | 0        | 8                             | 3.9      |
| Others  | 0                          | 0        | 0                             | 0        |
| Missing   | 0                          | 100      | 32                            | 15.7     |
| <b>Symptom(s) of Current Illness Leading to Death, No., %*</b>                              | <b>No</b>                  | <b>%</b> | <b>No</b>                     | <b>%</b> |
| Not applicable  | 111                        | 8.5      | 80                            | 20.2     |
| Fever   | 703                        | 54       | 172                           | 43.4     |
| Cough   | 440                        | 33.8     | 85                            | 21.5     |
| Difficult breathing   | 578                        | 44.4     | 88                            | 22.2     |
| Diarrhoea   | 207                        | 15.9     | 63                            | 15.9     |
| Convulsion  | 236                        | 18.1     | 27                            | 6.8      |
| Lethargy  | 368                        | 28.2     | 46                            | 11.6     |
| Unconsciousness   | 152                        | 11.7     | 20                            | 5.1      |
| Not able to drink/feed  | 357                        | 27.4     | 59                            | 14.9     |
| Others  | 456                        | 35       | 112                           | 28.3     |
| <b>Pre-Admission Treatment(s) Received for the Current Illness Leading to Death, No., %</b> | <b>No</b>                  | <b>%</b> | <b>No</b>                     | <b>%</b> |
| Yes   | 830                        | 63.7     | 163                           | 41.2     |
| No  | 279                        | 21.4     | 147                           | 37.1     |
| Not applicable  | 180                        | 13.8     | 73                            | 18.4     |
| Missing   | 14                         | 1.1      | 13                            | 3.3      |
| <b>Place(s) of Treatment, No., % *</b>  | <b>No</b>                  | <b>%</b> | <b>No</b>                     | <b>%</b> |
| Hospital  | 594                        | 71.6     | 93                            | 57.1     |
| Clinic  | 292                        | 35.2     | 105                           | 64.4     |
| Unknown   | 16                         | 1.9      | 1                             | 0.6      |
| <b>Type(s) of Hospital Treatment, No., % *</b>  | <b>No</b>                  | <b>%</b> | <b>No</b>                     | <b>%</b> |
| Government  | 527                        | 88.7     | 77                            | 82.8     |
| University  | 21                         | 3.5      | 8                             | 8.6      |
| Private   | 52                         | 8.8      | 14                            | 15.1     |
| Others  | 13                         | 2.2      | 2                             | 2.2      |
| <b>Type(s) of Clinic Treatment, No., % *</b>  | <b>No</b>                  | <b>%</b> | <b>No</b>                     | <b>%</b> |
| Government  | 136                        | 46.6     | 73                            | 69.5     |
| University  | 2                          | 0.7      | 1                             | 1        |
| Private   | 164                        | 56.2     | 38                            | 36.2     |
| Others  | 9                          | 3.1      | 8                             | 7.6      |
| <b>Reason(s) of Not Receiving Pre-Admission Treatment(s), No., % *</b>                      | <b>No</b>                  | <b>%</b> | <b>No</b>                     | <b>%</b> |
| Self-medication   | 28                         | 10       | 32                            | 21.8     |
| Traditional/complementary treatment   | 24                         | 8.6      | 47                            | 32       |
| No transport  | 19                         | 6.8      | 54                            | 36.7     |
| Unaware child is seriously ill  | 122                        | 43.7     | 48                            | 32.7     |

|  | Hospital Death<br>N = 1303 |          | Non Hospital Death<br>N = 396 |          |
|--|----------------------------|----------|-------------------------------|----------|
| Others   | 51                         | 18.3     | 23                            | 15.6     |
| <b>Co-Morbid Condition, No., %</b>                     | <b>No</b>                  | <b>%</b> | <b>No</b>                     | <b>%</b> |
| No   | 834                        | 64       | 153                           | 38.6     |
| Yes  | 438                        | 33.6     | 217                           | 54.8     |
| Not applicable   | 2                          | 0.2      | 10                            | 2.5      |
| Missing  | 29                         | 2.2      | 16                            | 4.1      |
| <b>Type(s) of Co-Morbid Condition, No., % *</b>        | <b>No</b>                  | <b>%</b> | <b>No</b>                     | <b>%</b> |
| Cerebral Palsy   | 40                         | 4.8      | 19                            | 12.4     |
| Chronic Lung Disease                                   | 64                         | 7.7      | 6                             | 3.9      |
| Malnutrition   | 155                        | 18.6     | 40                            | 26.1     |
| Congenital Anomaly                                     | 266                        | 31.9     | 40                            | 26.1     |
| Cardiac Disease  | 188                        | 22.5     | 26                            | 17       |
| Malignancy   | 41                         | 4.9      | 0                             | 0        |
| Condition from perinatal period                        | 110                        | 13.2     | 21                            | 13.7     |
| Immunodeficiency                                       | 26                         | 3.1      | 3                             | 2        |
| Others   | 255                        | 30.6     | 47                            | 30.7     |
| <b>ICD Classification of Cause(s) of Death, No., %</b> | <b>No</b>                  | <b>%</b> | <b>No</b>                     | <b>%</b> |
| Infection & parasitic disease                          | 253                        | 19.4     | 67                            | 16.9     |
| Neoplasm   | 61                         | 4.7      | 2                             | 0.5      |
| Disease of blood & immune system                       | 23                         | 1.8      | 1                             | 0.3      |
| Endocrine, nutritional, metabolic                      | 108                        | 8.3      | 8                             | 2        |
| CNS  | 126                        | 9.7      | 14                            | 3.5      |
| Circulatory system                                     | 36                         | 2.8      | 2                             | 0.5      |
| Respiratory  | 149                        | 11.4     | 72                            | 18.2     |
| Gastro-intestinal                                      | 23                         | 1.8      | 12                            | 3        |
| Genitourinary tract                                    | 6                          | 0.5      | 1                             | 0.3      |
| Conditions from perinatal period                       | 61                         | 4.7      | 15                            | 3.8      |
| Congenital malformation                                | 366                        | 28.1     | 60                            | 15.2     |
| Injuries & external causes                             | 68                         | 5.2      | 60                            | 15.2     |
| Symptoms, signs & abnormal findings, NEC               | 7                          | 0.5      | 57                            | 14.4     |
| Others   | 16                         | 1.2      | 25                            | 6.3      |
| <b>Is Death Preventable, No., %</b>                    | <b>No</b>                  | <b>%</b> | <b>No</b>                     | <b>%</b> |
| No   | 496                        | 38.1     | 251                           | 63.4     |
| Yes  | 769                        | 59       | 118                           | 29.8     |
| Not Sure   | 0                          | 0        | 4                             | 1        |
| Missing  | 38                         | 2.9      | 23                            | 5.8      |
| <b>Reason(s) of Preventable Death, No., % *</b>        | <b>No</b>                  | <b>%</b> | <b>No</b>                     | <b>%</b> |
| Patient & family factor                                | 272                        | 54.8     | 161                           | 64.1     |
| Peripheral/referral centre                             | 57                         | 11.5     | 13                            | 5.2      |
| Transport problem                                      | 27                         | 5.4      | 66                            | 26.3     |
| Department/treatment problem                           | 126                        | 25.4     | 22                            | 8.8      |
| Others   | 10                         | 2        | 21                            | 8.4      |

\* It can be more than 1 tick.



**Appendix 6:  
Population Data  
(2006)**



Under 5 population, Malaysia 2006, per thousand population.<sup>18</sup>

| <b>State</b>                     | <b>Population</b> |
|----------------------------------|-------------------|
| National                         | 3080.4            |
| Johor                            | 384.3             |
| Kedah                            | 222.4             |
| Kelantan                         | 182.5             |
| Melaka                           | 83.1              |
| Negeri Sembilan                  | 102.2             |
| Pahang                           | 160.5             |
| Perak                            | 223.4             |
| Perlis                           | 25.8              |
| Pulau Pinang                     | 141.8             |
| Sabah                            | 345.4             |
| Sarawak                          | 280.4             |
| Selangor                         | 601.6             |
| Terangganu                       | 133.0             |
| Wilayah Persekutuan Kuala Lumpur | 183.2             |
| Labuan                           | 10.7              |

Under 5 population, Malaysia 2006 by Gender

| <b>Gender</b> | <b>Population</b> |
|---------------|-------------------|
| Male          | 1,589.9           |
| Female        | 1,490.5           |

Under 5 population, Malaysia 2006 by Age

| <b>Age</b> | <b>Population</b> |
|------------|-------------------|
| 0          | 638.7             |
| 1          | 627.4             |
| 2          | 616.1             |
| 3          | 604.6             |
| 4          | 593.6             |

Under 5 population, Malaysia 2006 by Ethnicity

| <b>Ethnicity</b> | <b>Population</b> |
|------------------|-------------------|
| Malay            | 1718.6            |
| Chinese          | 524.9             |
| Indian           | 180.5             |
| Others Malaysian | 386.8             |
| Non Citizen      | 269.7             |



**Appendix 7:  
Neonatal Mortality Rates  
(2006)**



Neonatal Mortality Rates, Malaysia 2006.<sup>2</sup>

| <b>State</b>    | <b>2006 NMR</b> |
|-----------------|-----------------|
| Perlis          | 1.22            |
| Kedah           | 4.23            |
| Penang          | 2.99            |
| Perak           | 4.12            |
| Selangor        | 2.22            |
| WP Kuala Lumpur | 4.23            |
| Negeri Sembilan | 4.19            |
| Melaka          | 2.79            |
| Johor           | 4.14            |
| Pahang          | 2.60            |
| Terengganu      | 5.71            |
| Kelantan        | 2.91            |
| Sabah           | 5.18            |
| Sarawak         | 4.23            |
| Malaysia        | 3.69            |