APPENDIX AVAILABLE ON REQUEST

Research Report 157, Public Health and Air Pollution in Asia (PAPA): Coordinated Studies of Short-Term Exposure to Air Pollution and Daily Mortality in Two Indian Cities

Part 1. Short-Term Effects of Air Pollution on Mortality:
   Results from a Time-Series Analysis in Chennai, India
Kalpana Balakrishnan et al.

Part 2. Time-Series Study on Air Pollution and Mortality in Delhi
Uma Rajarathnam et al.

Appendix I. Mortality Data Registration System in Delhi (Part 2)

Note: Appendices Available on the Web appear in a different order than in the original Investigators’ Report. HEI has not changed these documents. Appendices were relettered as follows:

   Appendix C was originally Appendix I
   Appendix D was originally Appendix II
   Appendix E was originally Appendix III
   Appendix F was originally Annexure 2
   Appendix G was originally Annexure 3 (Figure 1)
   Appendix H was originally Appendix IV
   Appendix I was originally Appendix V
   Appendix J was originally Appendix VII

Note: Appendices F & G are for Part 1; Appendices H–J are for Part 2.

Correspondence for Part 1 may be addressed to Dr. Kalpana Balakrishnan, Professor and Head, Department of Environmental Health Engineering, Sri Ramachandra University, Porur, Chennai 600 116, India. kalpanasrmc@vsnl.com. Correspondence for Part 2 may be addressed to Dr. Uma Rajarathnam, Enzen Global Solutions, 90, Madiwala, Hosur Road, Bangalore 560 068, India. uma.r@enzenglobal.com.

The PAPA Program was initiated by the Health Effects Institute in part to support the Clean Air Initiative for Asian Cities (CAI-Asia), a partnership of the Asian Development Bank and the World Bank to inform regional decisions about improving air quality in Asia. Additional funding was obtained from the William and Flora Hewlett Foundation. The contents of this document have not been reviewed by private party institutions, including those that support the Health Effects Institute; therefore, it may not reflect the views or policies of these parties, and no endorsement by them should be inferred.

This document was reviewed by the HEI Health Review Committee but did not undergo the HEI scientific editing and production process.

© 2011 Health Effects Institute, 101 Federal Street, Suite 500, Boston, MA 02110-1817
Appendix V: Mortality Data Registration system in Delhi

In Delhi, three Local Bodies viz. Municipal Corporation of Delhi (MCD), New Delhi Municipal Council (NDMC) and Delhi Cantonment Board are carrying out the registration of births & deaths. The Directorate of Economics & Statistics, Govt. of National Capital Territory of Delhi (NCT of Delhi), being the office of the Chief Registrar, Births & Deaths, co-ordinates the work related to the registration of Births & Deaths. The figure 1 shows line of hierarchy of officials entrusted with the responsibilities of the registration in NCT of Delhi.

Figure 1. Death registration system in Delhi
Following chart shows line of hierarchy of officials entrusted with the responsibilities of the registration in NCT of Delhi:-

The registration of deaths in Delhi is done by three local bodies viz MCD (188 centres), NDMC (10 centres) and Delhi Cantonment Board (1 centre). About 85 000 deaths per year are registered in Delhi. In which about 67 000 deaths per year were recorded in MCD and about 17 000 deaths per year were recorded in NDMC area. Cantonment area is under the Indian Army and death records from cantonment area, which is less than 2 % of total deaths, are not available.

As per Delhi Registration of Births & Deaths Rules, 1999 (w.e.f 1.1.2000), all births, still births and deaths within 21 days of the occurrence are to be reported to the Registrar /Sub-Registrar of the concerned local area. For Institutional deaths i.e. deaths in hospitals/health centers/maternity homes/nursing homes, other similar institutions or in jail or in hostels etc., it is the responsibility of the in charge of the institution to report death to the Registrar (B&D) in their respective area within the prescribed time limit. If death occur at home, it is the responsibility of the head of the household (the head being the person who is so recognized by the Household) to report the death and if he is not present in the house the nearest relative of the head present in the house and in the absence of any such person, the oldest adult person present in the house to report the occurrence of any death. About 55% of reported deaths are institutional deaths and about 45% are reported by the members of household.

At present the scheme of Medical Certification of Cause of Death (MCCD) in Delhi has been confined to the institutional deaths occurred in the hospitals/nursing homes and other private institutions. The domiciliary deaths have not been brought under the ambit of MCCD due to
various reasons such as lack of awareness among the citizens and also due to non-availability of adequate infrastructure of medical facility.

Figure 2 and 3 depicts the death registration and data collection system in Delhi. Available data from NDMC for the entire study period is not in the electronic form. Hard copy of the death registration form has 2 parts (Personal information for legal part; information for statistical analysis). For the present study, information on the statistical part of the death certificate was made available. Field assistants were employed to screen the statistical information recorded in the death certificate and entered into the “VITAL” database (created in visual fox pro software) maintained by NDMC. After data entry, records were transferred into MS Excel database and brought to TERI. So far we have collected mortality data for the period of 2004 from NDMC; for other 2 years data collection is in progress.

Since 2004, MCD has introduced the online death registration system. In which the all hospital deaths could be registered online. And domiciliary deaths were entered into the online system through respective MCD local centers. Complied mortality data for the year 2004 in electronic form were collected from MCD. The data has been crosschecked from the online database available for public.
Figure 2: Mortality data flow for NDMC region

Death at home

Unreported
Most of the deaths are reported and only in few cases it is not.

Death at hospital in NDMC

Reported to NDMC Subregistrar offices (10 offices) Death is reported in Form no 2 which has two sections – Legal and statistical

Registrar, Death and Birth Registration Center, NDMC Mandir Marg

Teri
Point of data collection. TERI has access for mortality data at this point

Additional chief registrar, NDMC Palika Bhavan

Chief Registrar, Directorate of Economics and Statistics, Delhi Government

Annual report on vital statistics
Figure 3: Mortality data flow for MCD region

Death at home

Death at hospital in MCD

MCD Hospitals

Unreported
Most of the deaths are reported and only in few cases it is not.

Reported to Sub-registrar office (188 offices)
Death is reported in Form no 2 which has two sections – Legal and statistical

Registrar and Statistical officer (10)

Asst. Chief Registrar (Officer in charge vital statistics) MCD

Teri
Point of data collection

Additional Chief Registrar (Municipal Health officer)

Chief Registrar, Directorate of Economics and Statistics, Delhi Government

Annual report on vital statistics
Standard operating procedure for collection of Mortality data at NDMC office

**Aim:** To collect the statistical information of all deaths registered in the NDMC region in electronic format

**Procedure**

Assistants with minimum education qualification of under graduation with basic knowledge on computers were recruited for the mortality data collection from NDMC office. They were trained by the assistant registrar of death, NDMC and his team members on the “VITAL data base” (visual fox pro database used at NDMC office for registration). Software for VITAL database is loaded in selected system at birth and death registration office at NDMC and field assistants entered the data in those systems maintained at NDMC office premise.

**Task done by NDMC staff**

Assign registration no and code in hard copy of the death registration record (form no 2). Code no were assigned according to the hospital or zonal registration office.

Domiciliary deaths registered at seven registration centers were coded with single-digit code (starting from 1 to 7) and institutional deaths at eight hospitals were coded with three digits (three digit code starting from 101 to 108).

Detach the legal information part of form 2 and file separately (generally according to the code no)

Generally each file has record of approximately 200 forms.

Make bunch statistical information and keep separately.
Our observation:

As the legal information is important for NDMC, filing and maintenance of legal part is done systematically and access to information in legal part restricted.

However statistical information part is detached from the form 2 is made into bunches and stacked separately. No particular order was maintained for storing the statistical records. Statistical Part of death records were further processed by the directorate of economics and statistics at Delhi Government for publishing the Annual vital statistics report.

Tasks of staff hired by TERI

Enter all information provided in the statistical part) of form no 2 in the VITAL database.

After entering all the information, the file is saved in Vital database. The database files are also MS-EXCEL compatible and can be opened as EXCEL files.

After data entry, reports are compiled by NDMC staff and the give the electronic copy of death data reports (MS-EXCEL file) to TERI.
Procedure for registering deaths

1. When death events happen in any institution such as hospital, jail, hostel, lodging, or in a public transport or in any home for women, these events are called institutional. When these events take place in your home or in a building that cannot be called an institution, then these events are called non-institutional or domiciliary.

2. The procedure for registering institutional and non-institutional events is different. In case of institutional events it is the primary responsibility of the head of the institution to inform MCD about the event that has taken place in it. He does that in a form that has been prescribed under the law. These forms are freely available in all hospitals and are supplied free of cost by MCD. Alternatively the form can also be collected from any zonal office free of cost. The form (form no 2) has two sections. One portion of the form deals with legal information. The other portion is about statistical information. Both the portions of the form have to be filled to get the death certificate.

3. For reporting non-institutional events, the law authorizes the head of the family or the nearest relative to inform the event to the municipal office. They need to fill in the form and submit it to the nearest registration centre. MCD has set up a number of registration centres – including eleven crematoriums managed by MCD - in the whole of Delhi.
Online Registration of Death events

Beginning of year 2004, MCD has introduced the Online Institutional Registration (OLIR) scheme to register birth and death.

1. Deaths events can be registered in different ways.
   a. By the Institutions empanelled under Online Institutional Registration (OLIR) scheme through logging in to MCD's Website [www.mcdonline.gov.in](http://www.mcdonline.gov.in)
   b. At registration centers
   c. Downloading the forms from [www.mcdonline.gov.in](http://www.mcdonline.gov.in)

Purpose of the Scheme

1. To help hospitals to send the information at quickest possible time
2. To help out -station patient / relatives in getting the certificate in time without overstaying or repeated visits to Delhi for collecting the same.
3. To help hospitals to maintain their own data base
4. To help citizen to submit online application and to collect certificate through courier or from the nearest CSB

Type of hospitals covered

1. All Hospitals and Nursing Homes registered with Govt. of Delhi.
2. Preferably the Hospital must have computers.
Procedure of Empanelment

1. The Hospital has to apply to the DHO of the Zone, in which the institution is located

2. There is a prescribed application form, which can be collected from the office of the DHO or BHI located at Town Hall.

3. Fill the form and authorized signatures and submit it to the DHO along with the prescribed fees.

4. MCD will issue User’s I.D. and Password to the authorized person from the empanelled Institution.

5. The personnel will also be trained by MCD at the concerned zone

Methodology

1. The empanelled hospital will installed One computer in the hospital for this purpose

2. Hospitals will be issued a User’s I.D. and Password to login to the MCD Web site.

3. A screen with different hyperlinks will be seen on the screen. These hyperlink are

   I. Birth Registration
   II. Death Registration
   III. Still Birth Registration
   IV. Birth Record Search
   V. Death Record Search
   VI. Still Birth Record Search

4. For registration, open the click on the concerned hyperlink. Fill the application form. Red Stars are compulsory field and click submits.
5. On submission a unique referral number will be generated along with registration Number.
   - Take out a print. This has got two portions. The upper potion composes Legal information and statistical information. The bottom portion is called Acknowledgement.
   - The authorized signatory is supposed to sign both the portion. The Acknowledgement portion has to be given to the patient / relatives. The other portion has to be sent to MCD Zonal Office.
   - On submission of the Acknowledgement Slip at the CSB, Certificates will be issued to the citizen immediately.
   - A search facility has been given for the institutions to search the records up-loaded by them.

A Record should not be entered more than once into the website. If it happens, then it is the responsibility of the hospital to inform MCD in detail about the genuine record, so that the duplicate can be deleted.

**Role of the Hospital**

1. The Hospital has to recommend the name of M.S. / One Official who will be the contact person and will be given the password.
2. Install the hardware.
3. Nominate staff for training

2. The Institution shall display a signboard informing this facility to the patients and relatives at the prominent places.
**Other Related Terms and Conditions**

1. That the tenure of the present agreement is for a specific period of one year. On expiry of the said period of one year, the tenure of the present agreement may be extended by mutual consent of both the parties on payment of renewal fees.

2. That the Institution shall display a signboard informing this facility to the patients and relatives at the prominent places.

3. That this agreement can be terminated at any time after the initial period of six months by giving a one month notice in advance to either side.

4. That any dispute arising out of the terms and conditions of the said agreement shall be referred to the arbitrator and the decision of the arbitrator shall be final and binding upon the parties concerned.

5. **Correction:** Once data is entered, the hospital will not be allowed to correct any mistakes. In that condition the hospital will follow the normal practice.

6. Even the data entry is being done into the MCD database; the hard copies have to be submitted to the office as usual in the stipulated period.

**Limitations in Mortality Data**

1. **Missing entries** - As the Filing and maintenance of statistical information is not done in a systematic manner; there are some chances for some missing entry.
2. **Misclassification/coding in cause of Death:** Certification of cause of death is limited to institutional deaths. In many of the certified cases, all information for proper coding is not provided the form. Data entry operators also make mistakes in reading disease name and entering proper codes in the VITAL statistics. As a result, cause of death coding may not be accurate.

3. **Multiple entries:** Few death records were entered more than once. Numbers of such cases are more in MCD records. In case of online registration system hospitals/zonal offices are entering the records through online registration system. In few cases due to some problem in the gateway or to make sure the information is submitted the information is submitted more than once. During the initial months (January, February) such entries were more and with experience the number of such entries reduced in later months.

4. **Address of deceased person:** Delhi, being capital of India with comparatively better medical facilities than neighboring states, people from neighboring areas visit Delhi hospitals for medical treatment. If death occurs in Delhi, it gets registered in Delhi. In few cases, they give address of residents who are residents of Delhi.

**Standard Operating Procedure for mortality data cleaning**

**Aim:** To develop and follow Quality assurance and Quality control (QA/QC) procedures and improve the quality of mortality data

**Objectives**
- Check death records to ensure completeness
- To check mortality data for multiple entries and remove same records entered more than once
- To correct the data entry errors by cross checking with original records

a. Procedure for Checking and cleaning death records collected from NDMC

**Verify the records for completeness**

Count total number of deaths and month wise average death records and compare with previous year records. Any abnormality should be probed further. For example about 16000 –18000 deaths per year are recorded in NDMC. If the death records for a particular year is too less (less than 10000), it indicates data incompleteness which needs to be checked.

Sort death records according to the hospital/institutional wise and check for completeness by checking average death records and cross check the numbers with Hospital wise total number of records (legal part) filed separately

**Checking for multiple entries**

On special request to NDMC, all information in death records (both legal and statistical)\(^1\) for the year 2004 were collected in electronic form (MS Excel file)

Sort these records according to date of death, name, Age & sex, and by father/husband’s name by clicking the data icon in the menu bar and selecting the sort option.

---

\(^1\) Staff hired by Teri entered the statistical information (part B); legal information (Part A) was entered by NDMC staff. On assurance of maintaining the confidentiality as per ethical guidelines, electronic file (in MS Excel) containing all information provided in the death records were shared for the study.
If any death record with all entries in selected column is matching, it indicates the chances of duplicate/multiple entry. Flag those entries.

In doubtful entries should be verified with original hard copy maintained at NDMC.

On confirmation, delete multiple entries of the same record and maintain single record.

**Cause of death coding**

The data has both name of disease and also code of the disease. Codes assigned for cause of death will be checked with ICD-10 classification.

**Double-checking**

10% of death records will be selected randomly and will be crosschecked with original records maintained at NDMC by the team member in charge of QA/QC.

**b. Procedure for checking and cleaning death records collected from MCD**

Mortality data for the year 2004 are available in the MCD website (http://www.mcdonline.gov.in).

Data received from MCD (MS Access file) are being checked with the data available on MCD website.

The steps involved in accessing the mortality data posted at MCD website

1. Register as a user by filling up online registration form. And then log on to the website.

   The log in screen appears as
2. Login to the web and the screen with different information sections such as Health, Trade, Collections will appear as follows. Choose option death record search.
3. The death record search has several fields/ criteria for search such as date of death, registration date, etc. Choose date of death starting from the first day, first month of the year 2004.

4. The search result will display all registered deaths for the entire day (For example 1/1/2004 search is displayed below, which has basic details of the record such date of death, name of the person, place of death). Click on an individual record to view complete details of the record on the pop-up window.
Verify the records for completeness

Download number of daily death counts given in the websites shown in the MCD website by following step 1-4 given. Copy and paste the records in MS Excel file. Record total number of death records per day in a MS Excel file.

Delete duplicate/multiple entries and enter the total number of daily death counts in the datasheet

Match the records in the MS access file received from MCD with the records posted in the website
Checking for multiple entries

Sort these records according to date of death, name, Age & sex, and by father/husband’s name by clicking the data icon in the menu bar and selecting the sort option.

If any death record with all entries in selected column is matching, it indicates the chances of duplicate/multiple entry

Make sure by crosschecking the data downloaded from MCD website.

On confirmation, delete multiple entries of the same record and maintain single record.

Double-checking

10% of death records will be selected randomly and will be crosschecked for all entries with original records posted at MCD website.