REPEATED SHORT TERM PEAKS OF PM$_{10}$ EXPOSURE HAVE A GREATER EFFECT ON MORTALITY: A NEW APPROACH TO TIME SERIES STUDIES

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BACKGROUND

- Air pollution is the presence of harmful gaseous and particulate substances above the ‘normal’ level.
- It is a major environmental risk to health (3.7 million premature deaths in 2012).$^1$
- Health risk from pollution is often reported as percentages.
- Thus, a 1% increase in mortality risk per 10 units increase in pollution compares two days, say with 2 and 12 units; the days need not be sequential.
- But a change from 2 to 12 could follow different patterns—
  - increase by 2 units each day for 5 days
  - all in one go over 1 day, etc (Figure 1).

![Figure 1: Hypothetical pollution exposure patterns](image)

- Conventional studies on health effects of air pollution do not take into account such variation in exposure patterns.

AIM

- To assess the impact of short term patterns in pollution exposure on mortality risk estimates associated with air pollution.

METHODS

- Data on daily particulate matter pollution (PM$_{10}$), mortality and weather were obtained from London (2000-2005).
- The daily PM$_{10}$ data were used to define exposure patterns on each day by counting number of:
  1. Positive changes in PM$_{10}$ over successive days (delta)
  2. PM$_{10}$ peaks
  3. Delta peaks
  each for the week just before the mortality day.

![Figure 2: Peaks for PM$_{10}$ and delta metrics](image)

- Regression models (Poisson GAMs) were used to study the association between PM$_{10}$ and mortality taking into account exposure patterns.
- Models adjusted for time trends, seasonality, day of the week and temperature effects.

RESULTS

- Excess risk (ER) in mortality was generally higher for larger number of positive deltas, PM$_{10}$ and delta peaks (Figure 3).

![Figure 3: ER estimates in PM$_{10}$ related mortality stratified by exposure patterns](image)

- The association was similar for cardiovascular and respiratory mortality.
- These were well above the conventional estimate which ignored exposure patterns.

DISCUSSION

- The results have major implications on
  (A) estimation of public health risk
  (B) control in relation to air pollution
- For (A), results indicated higher risks for weeks with larger number of peaks— current approach underestimates risk.
- For (B), study showed that excess risk in mortality could be reduced by minimizing the number peaks in air pollution.
- This could be done for example through short term policy interventions.

CONCLUSION

- Epidemiologic studies should take into account patterns of exposure in addition to exposure concentration and the time period of exposure.
- Further investigations focusing on mechanistic implications are highly needed as well as replication in multiple locations.

REFERENCES

1. http://www.who.int/mediacentre/factsheets

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