## FULBRIGHT LECTURE SERIES

# Air Quality Where You Are:
# *The Paradox of a Livable City*

**Thursday, May 3, 2018**
**3:00-5:00 p.m.**

**Hotel Tibet**
**Lazimpat, Kathmandu**
**Nepal**

AMERICAN EMBASSY

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# State of Scientific Evidence on Health Burden from Air Pollution in Nepal

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# Estimated Annual Average $PM_{2.5}$

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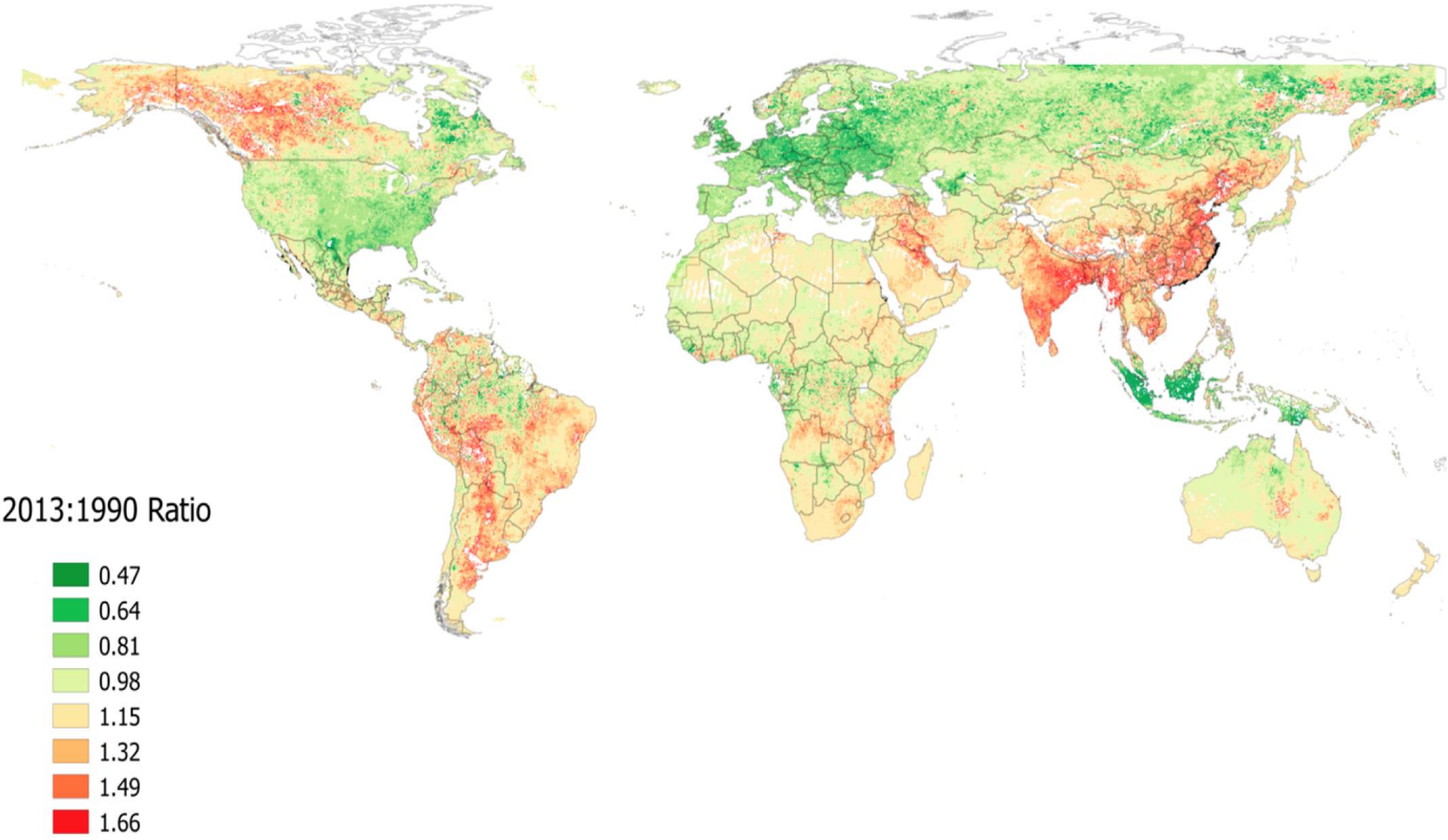

# Air Pollution: Single Largest Environmental Health Risk

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- Air Pollution is the **single largest environmental health risk** ( WHO 2012).

- In 2016, of the top 30 cities in the world with the poorest air quality, **17 are in South Asia** ( WHO 2016).

- Air pollution exposure is **second most important risk factor** for health in South Asia contributing to between 13% and 21.7% of all deaths and about 58 millions DALYS in 2015.

# Human Health Impact of Air Pollution in Nepal

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- In Nepal, **household air pollution is ranked 2nd and particulate matter ranked 3rd** leading risk factor in terms of DALYs in 2015 (GDB 2015).

- Based on Environmental Performance Index 2018, **Nepal's (180th) air quality has been reported worse than other countries** in the region like Pakistan (176th), China (177th), India (178th) and Bangladesh (179th).

# Deaths Attributable to Ambient $PM_{2.5}$ in South Asia

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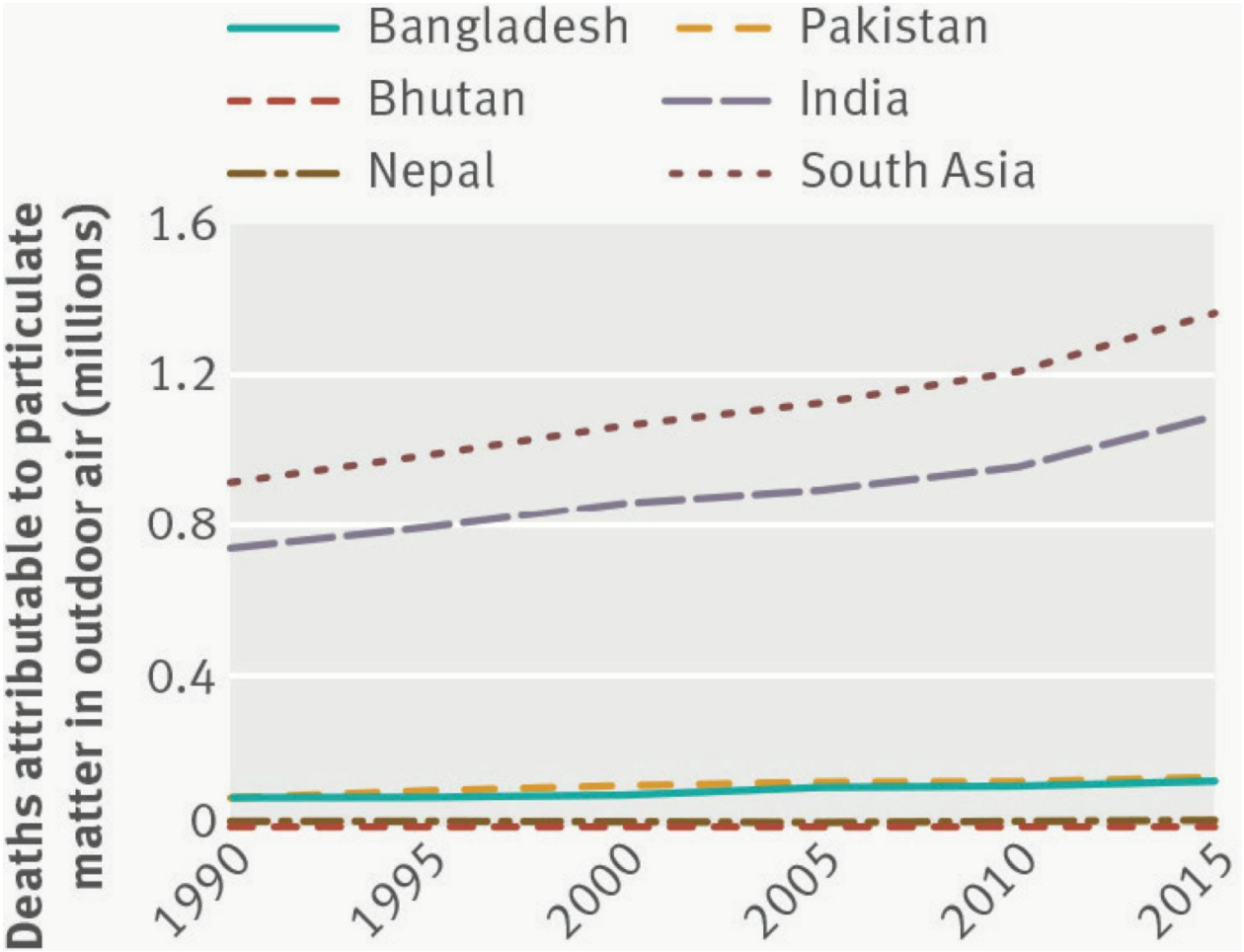
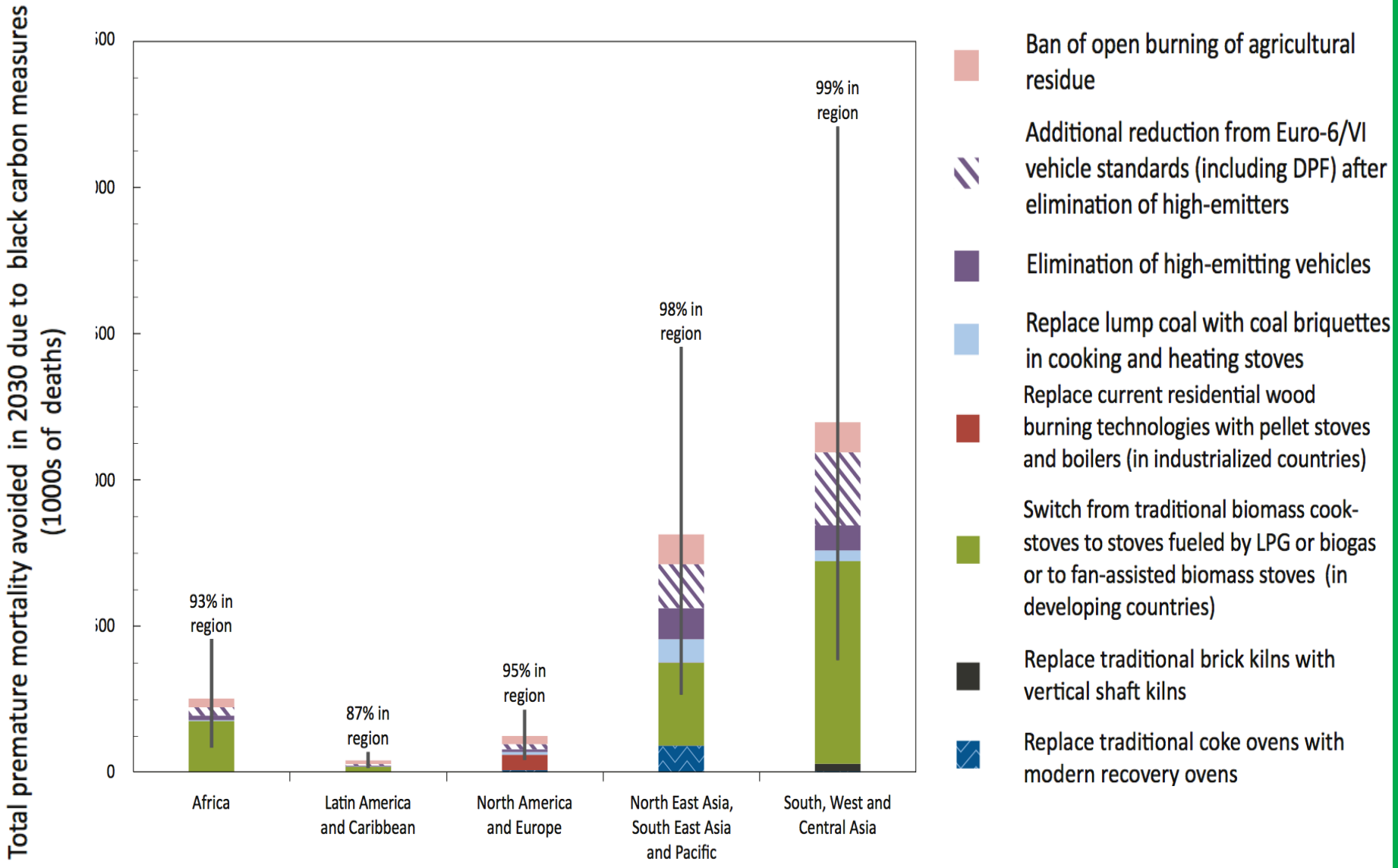



Krishna et a. 2017. Tackling the health burden of air pollution in South Asia. BMJ 2017;359:j5209 | do 10.1136/bmj.j5209




UNEP 2011. Near-term Climate Protection and Clean Air Benefits: Actions for Controlling Short-Lived Climate Forcers, United Nations Environment Programme (UNEP), Nairobi, Kenya, 78pp

# Health Impact of Air Pollution

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eye irritation asthma
emergency room visit coronary
atherosclerosis hospital
admission chronic respiratory
diseases cardiovascular
diseases lung cancer
ischaemic heart disease death
acute myocardial infraction
low birth weight congestive
heart failure still birth

# Air Pollution and Health Impact in Nepal

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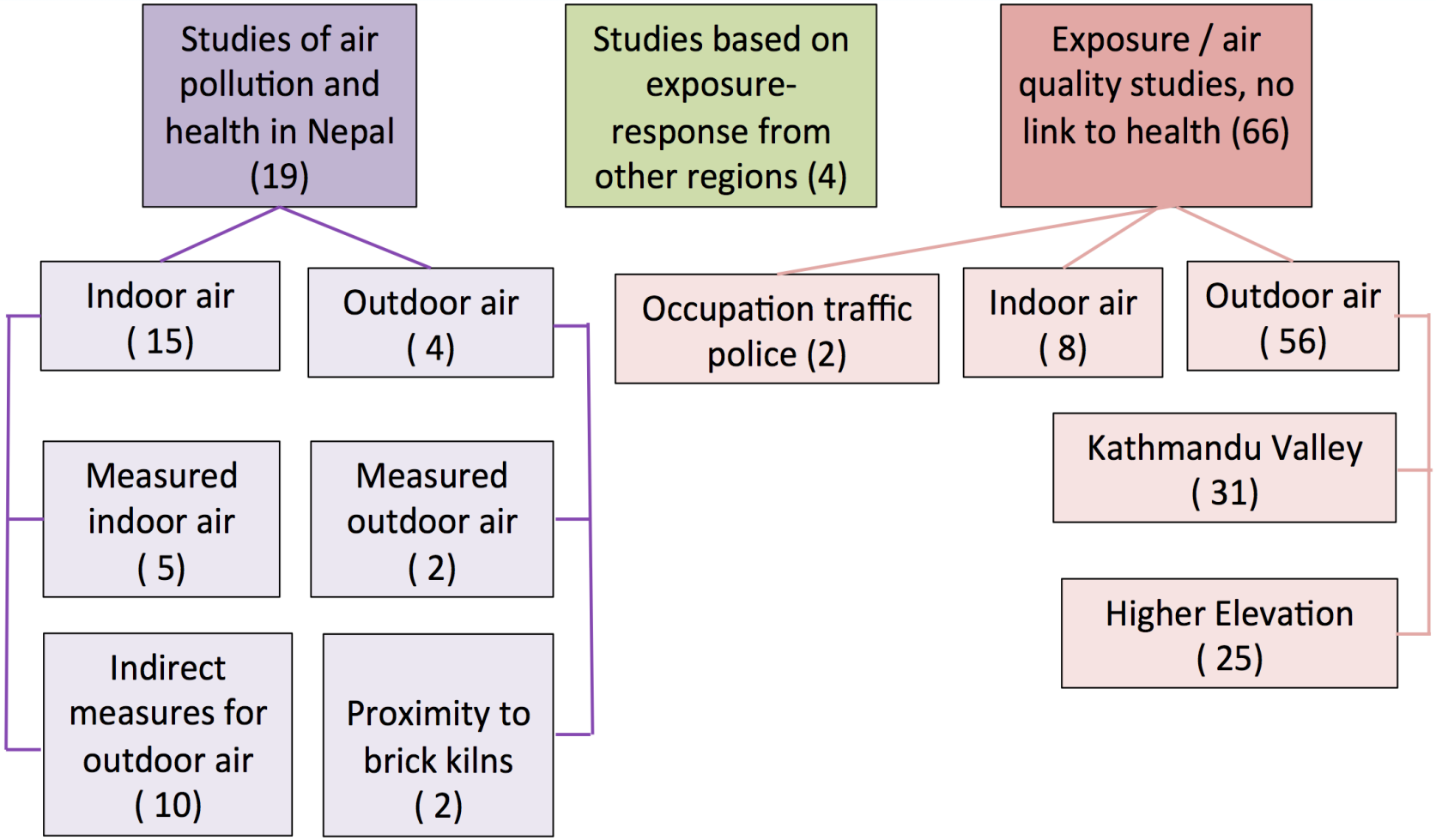


Gurung and Bell. 2013.The State of Scientific Evidence on Air Pollution and Human Health in Nepal. Environmental Research 124.54 – 64.

# Need for Exposure Assessment

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- Differences in source characteristics
- Built structure, topography, and landuse
- Weather
- Lifestyle and culture

# Daily $PM_{2.5}$ Exposure for Traffic Police in Kathmandu Valley, Nepal

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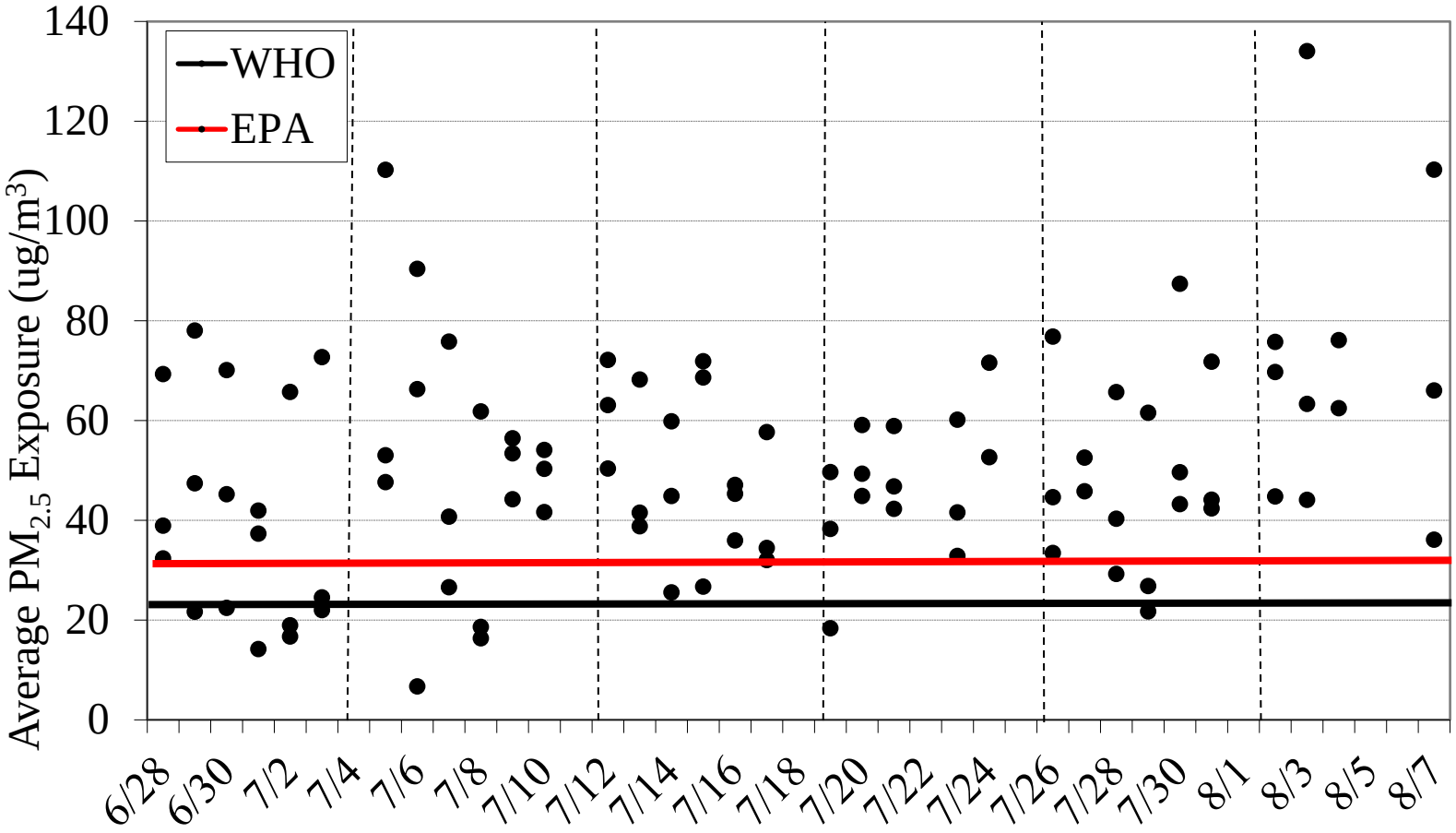


Gurung and Bell. 2012. Exposure to airborne particulate matter in Kathmandu Valley, Nepal. Journal of Exposure Science and Environmental Epidemiology. 22(3). 235-242

# Predicted $NO_2$ five urban VDCs in Kathmandu Valley, Nepal.

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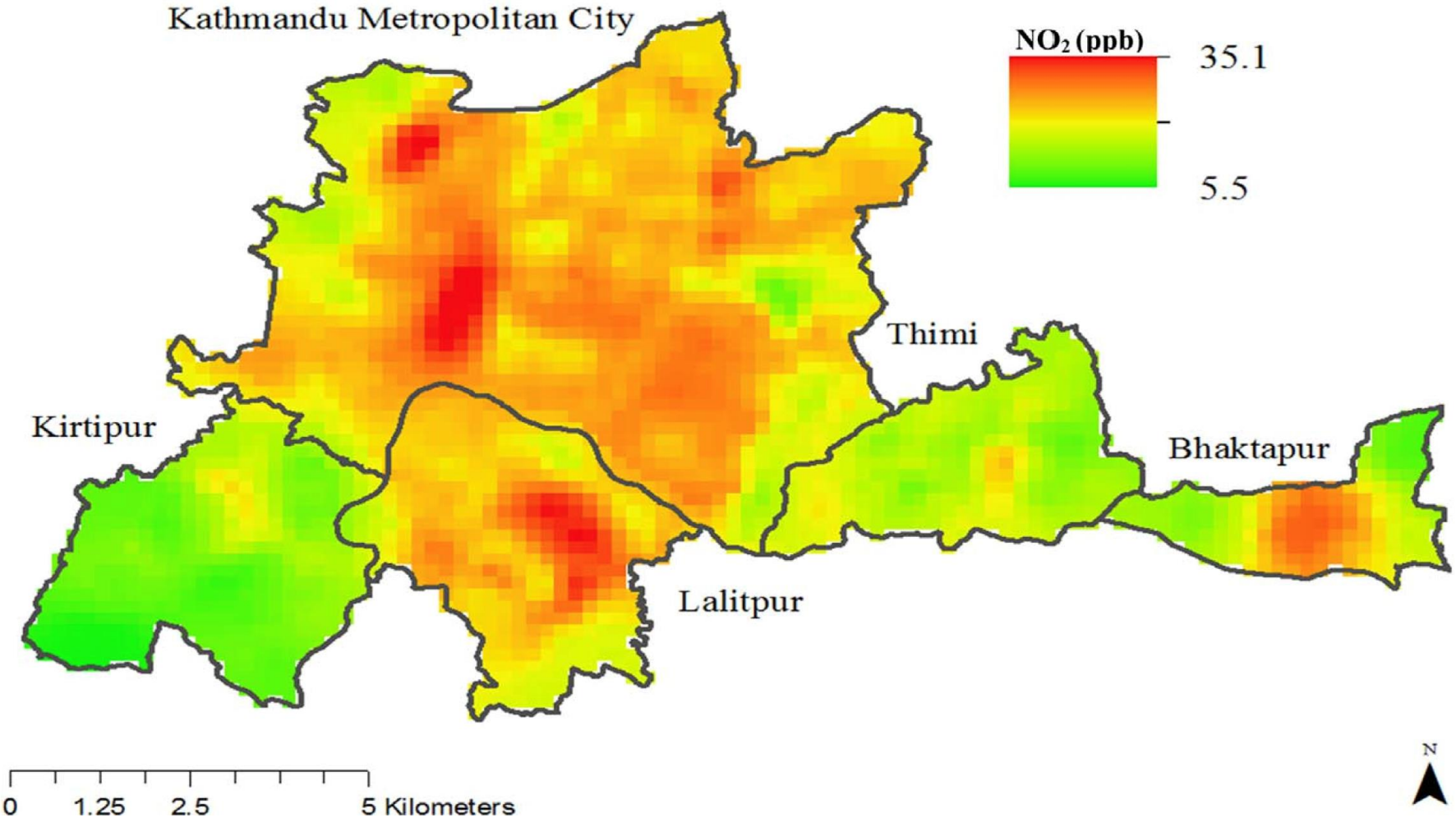


Gurung et al. 2017. Modeling the intraurban variation in nitrogen dioxide in urban areas in Kathmandu Valley, Nepal. Environmental Research 155 (2017) 42–48

# Particulate Matter and Risk of Hospital Admission in Kathmandu Valley

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1. Effect on cardiovascular admission was higher than observed in other regions

2. Effect on respiratory admission was similar or lower than observed in other region

3. No strong evidence of effect modification by age, sex, or socioeconomic status

Gurung A, Ji-Young and Bell ML.2017. *Particulate Matter and Risk of Hospital Admission in Kathmandu Valley, Nepal: A Case Crossover Study*. American Journal of Epidemiology.186(5):573-580.

# Need for Health Impact Studies

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- Higher air pollution
- Differences in air pollution characteristics
- Variation in actual exposure pattern
- Differences in population characteristics

# Studies Needed…

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- Better characterization of exposure
- Understanding effects of chronic, long term exposure
- Integrated analysis of household and outdoor exposure to produce adverse health effects.
- Understand health effects of complex mixture.

# Conclusion

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- Better characterization of exposure to quantify **effects of specific source sectors and mitigation strategies**.
- Designing regulation and approach based on **exposure management rather than concentration management**.
- **Holistic approach** on improving air quality and human health.

# Linking Air Pollution to Health

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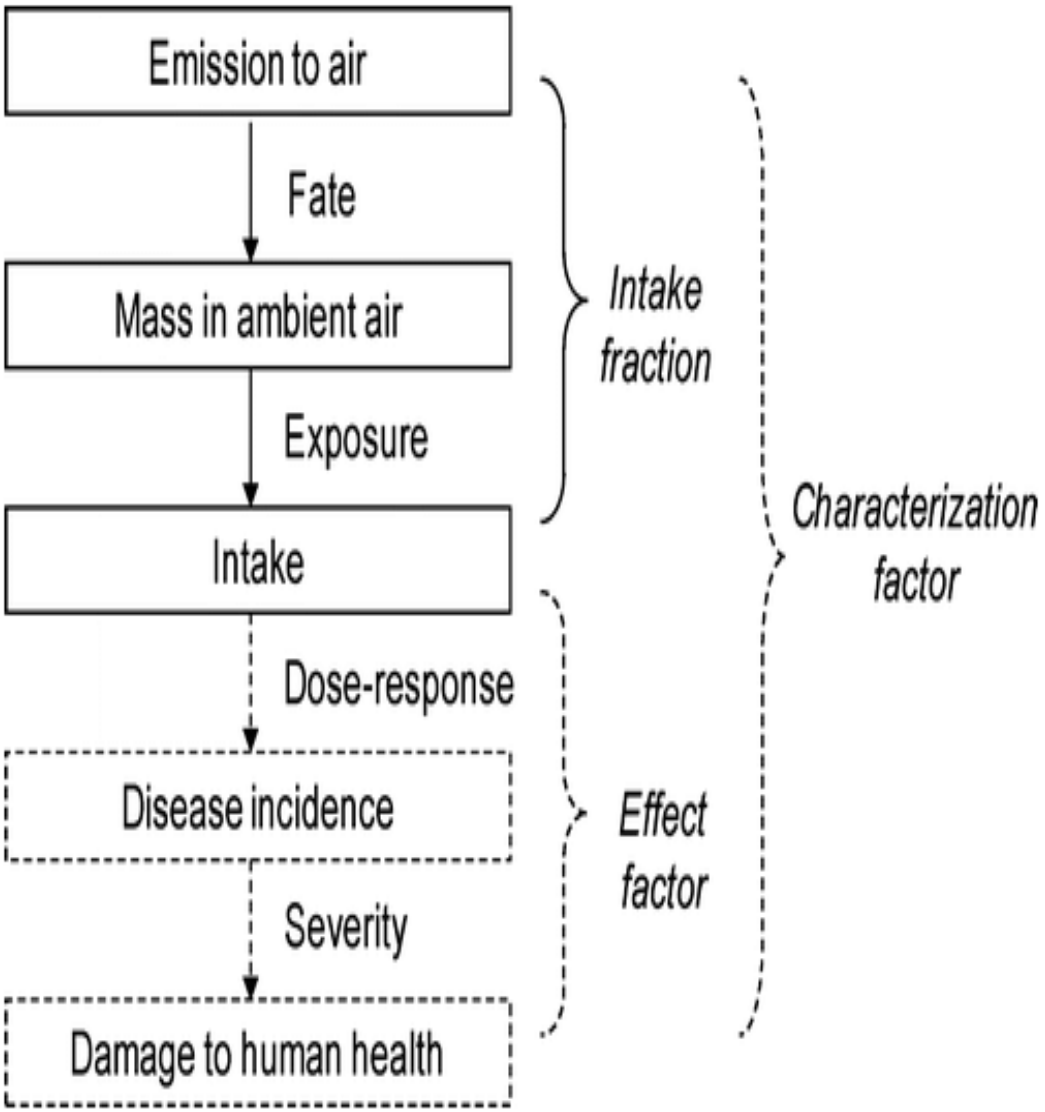


Samet and Krewski 1998

# Particulate Matter and Risk of Hospital Admission in Kathmandu Valley

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| | 0 | 1 | 2 | 01 | 12 | 02 |
|---|---|---|---|---|---|---|
| **Total** [c] | **1.00 (0.62,1.38 )** | 0.07 (-0.28,0.42) | 0.15 (-0.19,0.49) | **0.58 (0.17,0.99)** | 0.11 (-0.27,0.50) | **0.47 (0.04,0.90)** |
| **Respiratory** | **1.70 (0.18,3.25)** | 1.44 (0.00,2.90) | 0.99 (-0.38,2.39) | **1.68 (0.01,3.38)** | **1.60 (0.03,3.20)** | **1.84 (0.09,3.61)** |
| **Cardiovascular** | **2.29 (0.18,4.43)** | 0.03 (-1.93,2.03) | 0.22 (-1.66,2.14) | 1.29 (-0.99,3.62) | 0.05 (-2.08,2.23) | 0.88 (-1.50,3.32) |
| **Non-Accidental** | **0.75 (0.18,1.33)** | -0.37 (-0.90,0.17) | 0.16 (-0.35,0.67) | 0.14 (-0.48,0.76) | -0.09 (-0.67,0.49) | 0.22 (-0.42,0.87) |

**[a] The model adjusted for relative humidity, rainfall, and day of the week.**
**[b] Bold values represent statistically significant results.**
**[c] 'Total' admission from six hospitals (2004-2007) with known and unknown cause.**
**[d] 'Cause Specific Total' admissions from three hospitals (2004-2007) with known cause.**

Gurung A, Ji-Young and Bell ML.2017. *Particulate Matter and Risk of Hospital Admission in Kathmandu Valley, Nepal: A Case Crossover Study*. American Journal of Epidemiology.186(5):573-580.

# Collaborators and Acknowledgements

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- Brian Leaderer, Yale University
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**Impact of $PM_{10}$ on Hospital Admission**

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- Jiyoung Son, Yale University
- Participating hospitals in Nepal

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- Brian Leaderer and Tom Jankun, Yale University
- Jonathan Levy, Boston University
- Maheswar Rupakheti, Institute of Advanced Sustainability Studies
- Students volunteers, participating homes and shops

**Personal Exposure, Kathmandu Nepal**

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- Judy Sparer
- Thomas Jankun
- Bill Galdenzi
- Traffic Police, Kathmandu Nepal

**Mobile Monitoring, Nepal**

- Atmosphere Initiative Team
- Rejina Maskey, Tribhuvan University
- Josh Apte and Kyle P Messier, University of Texas
- Students from Tribhuvan University

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# Thank you

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