



Institute for
Health Metrics
and Evaluation

Incorporating uncertainty in Health Risk Assessments

Greg Freedman

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Importance of uncertainty

- Though we wish to present a concrete recommendation many of the inputs into a health risk assessment have large degrees of uncertainty
- We can lose the trust of the public if we do not accurately portray the uncertainty in our analyses

Multiple sources of uncertainty in HRAs for outdoor air pollution

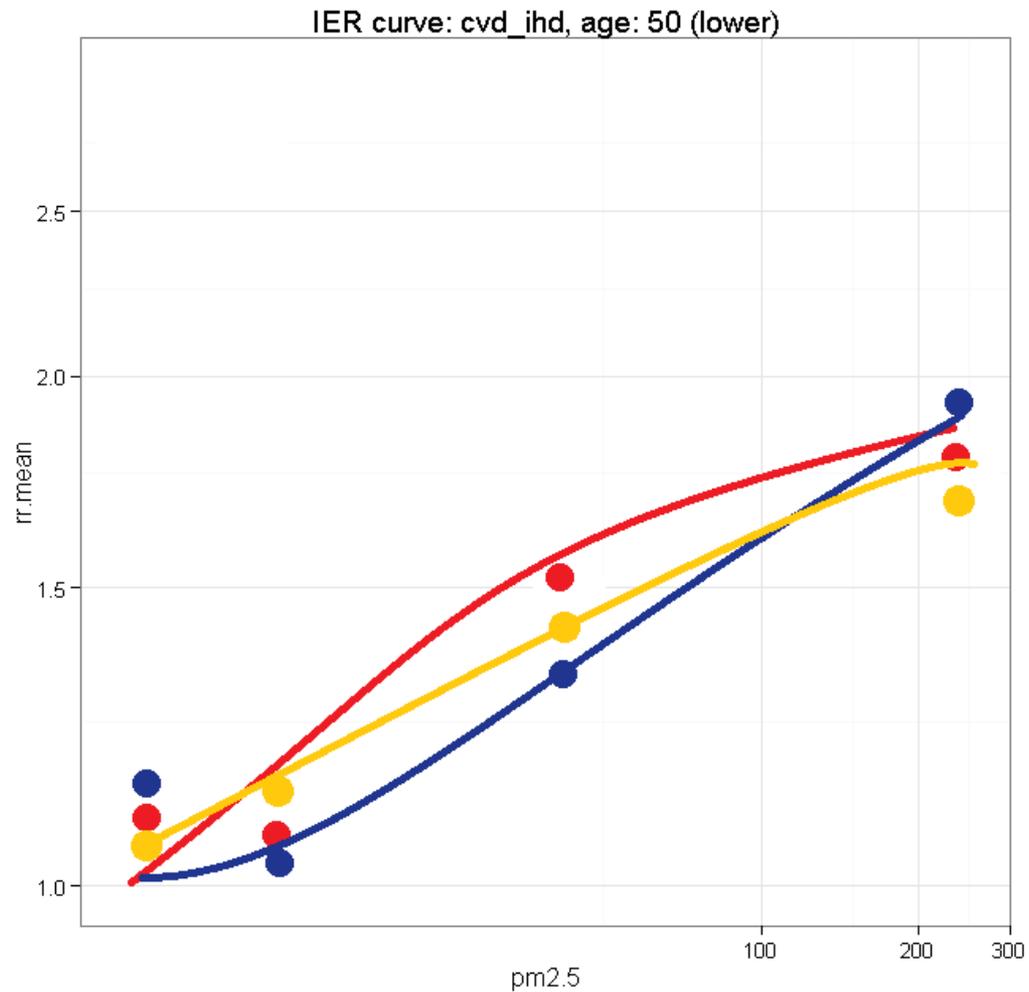
- Quantifiable
 - Exposure estimation
 - Dose-response curve
 - Counterfactual level of exposure
 - Disease burden

- Unquantifiable
 - Causal pathway
 - “Unknown unknowns”

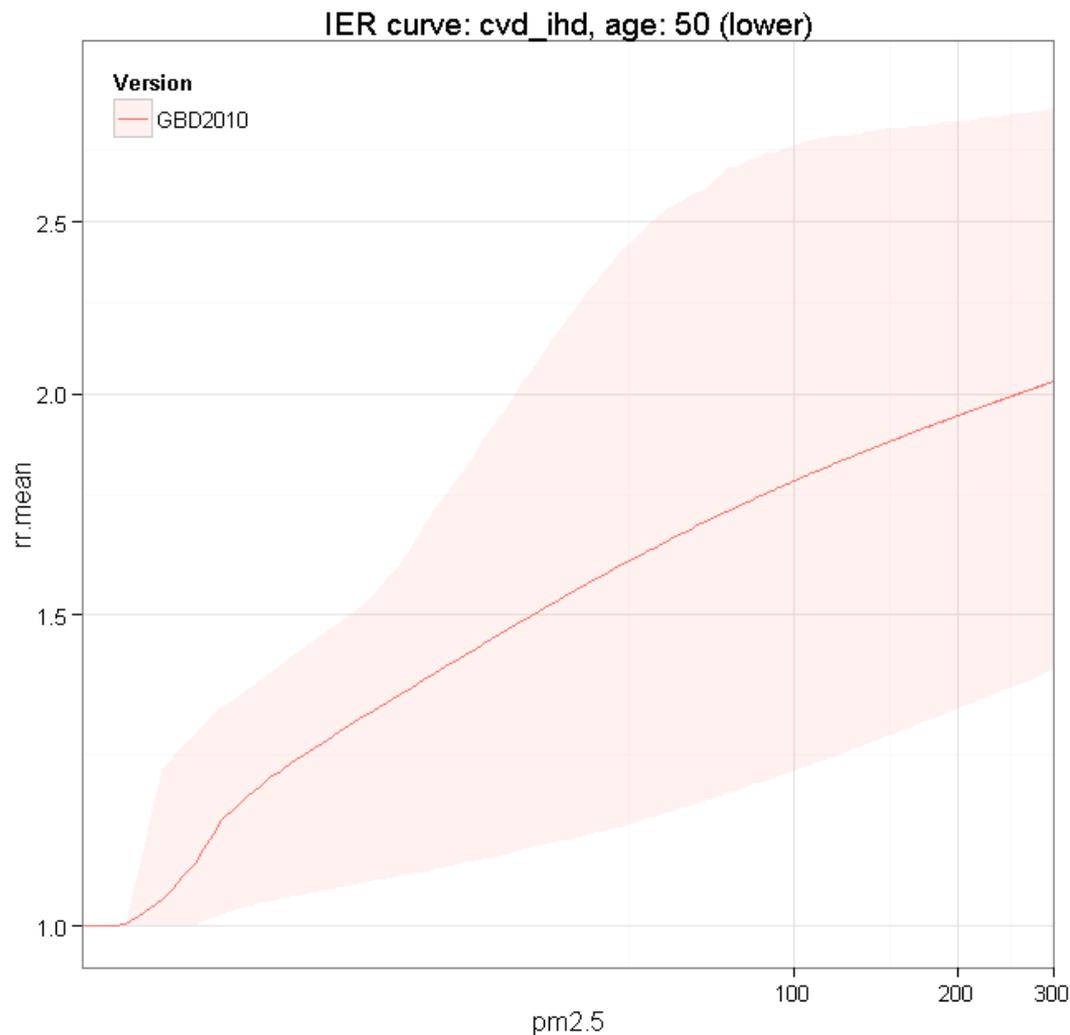
Overview of simulation methods

- Simulation methods use random draws of all unknown parameters to create estimates of interest
- Given a large enough number of simulations, we can approximate the true distribution of our estimates

Simulation methods in practice

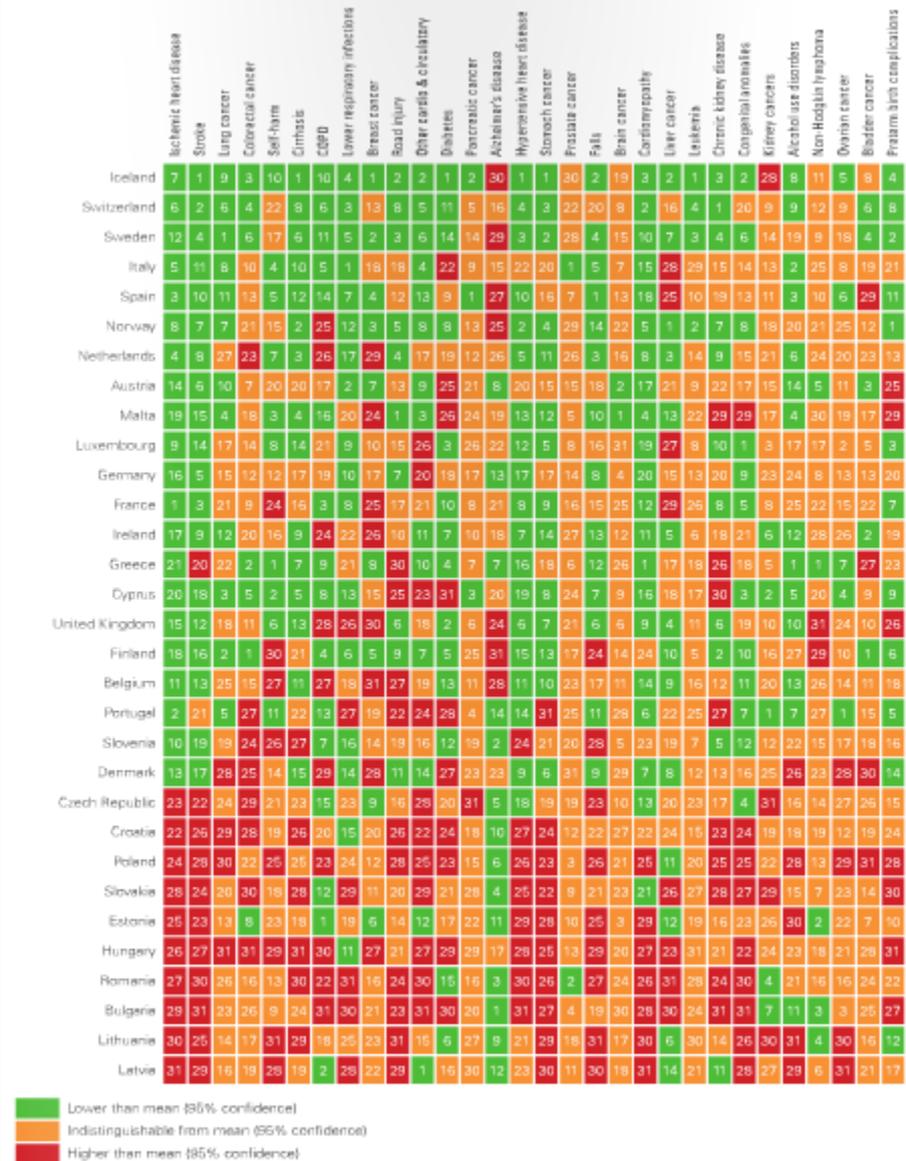


Final uncertainty (after 1000 draws)



Cross country comparisons in the GBD

Figure 11: Leading causes of years of life lost, EU and EFTA countries relative to region average, 2010



Note: Countries are ordered from top to bottom in order of (least to greatest) all-cause age-standardized YLLs.

Cross country comparisons in the CRD

Figure 11: Leading causes of years of life lost, EU and EFTA countries relative to region average, 2010

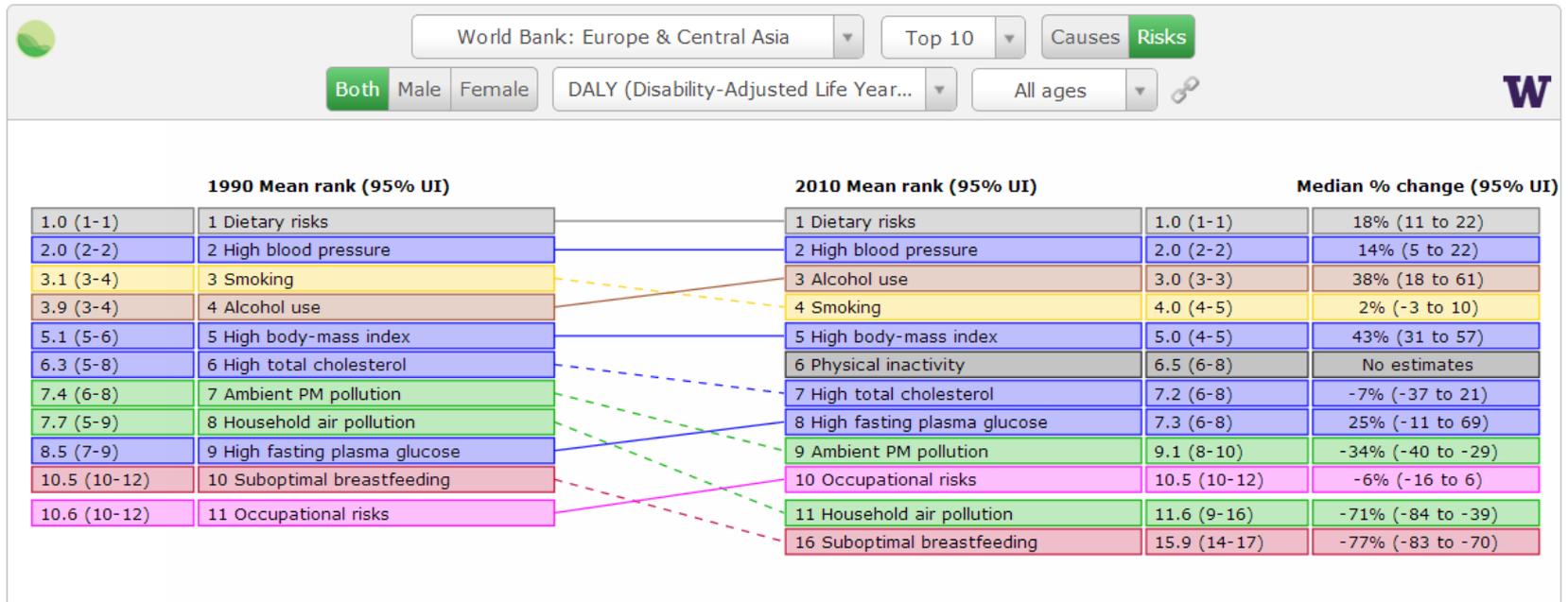
	Ischemic heart disease	Stroke	Lung cancer	Colorectal cancer	Self-harm	Cirrhosis	COVID	Lower respiratory infections	Breast cancer	Road injury	Other cardio & circulatory	Diabetes	Pancreatic cancer	Alzheimer's disease	Stomach cancer	Prostate cancer	PML	Brain cancer	Cardiomyopathy	Liver cancer	Leukemia	Chronic kidney disease	Congenital anomalies	Kidney cancers	Alcohol use disorders	Non-Hodgkin lymphoma	Ovarian cancer	Bladder cancer	Fraternal twin complications	
Iceland	7	1	9	3	10	1	10	4	1	2	2	1	2	30	1	30	2	19	2	1	3	2	28	8	11	5	8	4		
Switzerland	6	2	6	4	22	8	6	3	13	8	5	11	5	16	3	22	20	8	2	4	1	20	9	9	12	9	6	8		
Sweden	12	4	1	5	17	9	11	5	4	3	5	14	18	29	3	28	4	15	10	7	5	4	6	14	19	9	18	4	2	
Italy	5	11	8	10	4	10	5	1	18	18	4	22	9	15	22	10	1	5	7	15	28	29	11	14	13	2	25	8	19	21
Spain	3	10	11	13	5	12	14	7	4	12	13	9	1	27	10	13	7	1	13	18	25	10	19	11	3	10	6	29	11	
Norway	8	7	7	21	15	2	25	12	3	9	6	8	13	25	2	4	9	14	22	5	1	2	7	8	20	21	25	12	1	
Netherlands	4	8	27	23	7	3	26	17	29	4	17	19	12	26	5	11	2	3	16	8	3	14	9	15	21	4	24	20	23	13

	Ischemic heart disease	Stroke	Lung cancer	Colorectal cancer	Self-harm	Cirrhosis	COVID	Lower respiratory infections	Breast cancer	Road injury	Other cardio & circulatory	Diabetes	Pancreatic cancer	Alzheimer's disease
Iceland	7	1	9	3	10	1	10	4	1	2	2	1	2	30
Switzerland	6	2	6	4	22	8	6	3	13	8	5	11	5	16

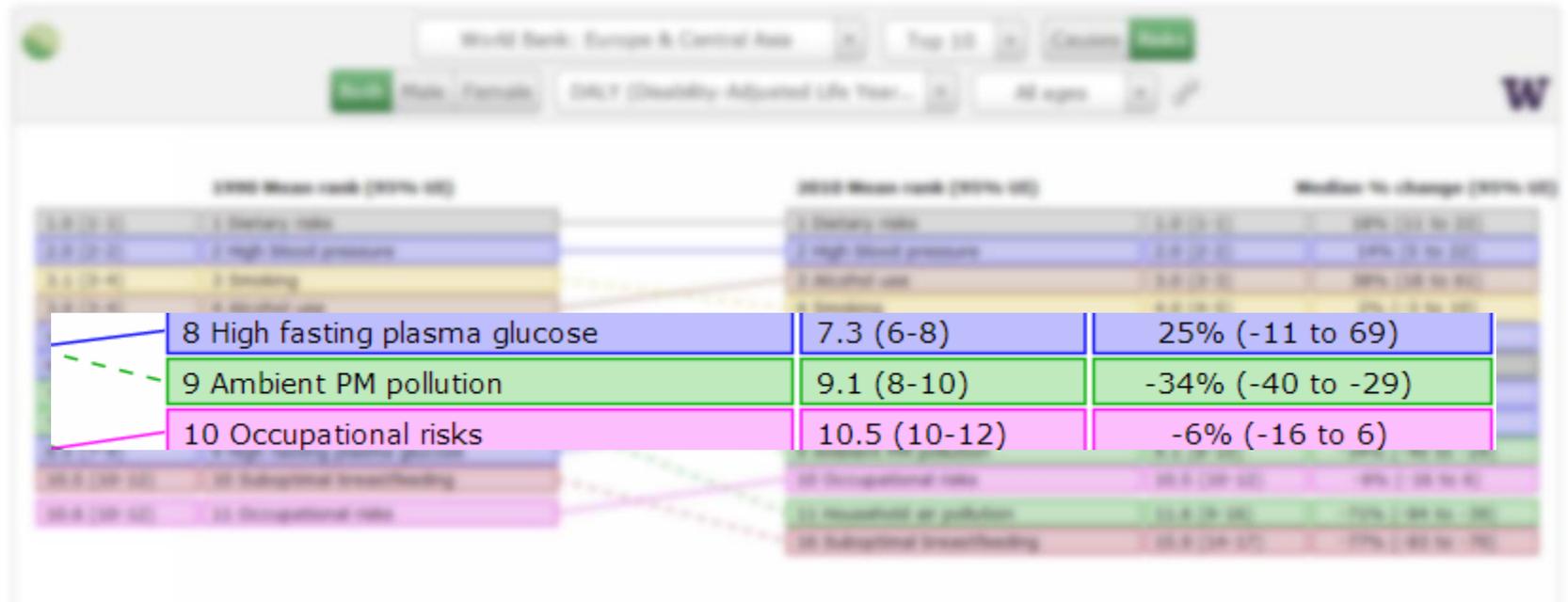
Higher than mean (85% confidence)

Note: Countries are ordered from top to bottom in order of (least to greatest) all-cause age-standardized YLLs.

Cross risk comparisons in the GBD



Cross risk comparisons in the GBD



Advice for presenting uncertainty

- A single number will likely be the first thing that decision makers want to see
- A desire to show decision makers what we're certain about
- Classification of scientific knowledge (drawing from IARC classification system)
- For researchers, need to be transparent about methods and assumptions to show uncertainty that could not be calculate

Interactive visualizations allow more information-dense graphics

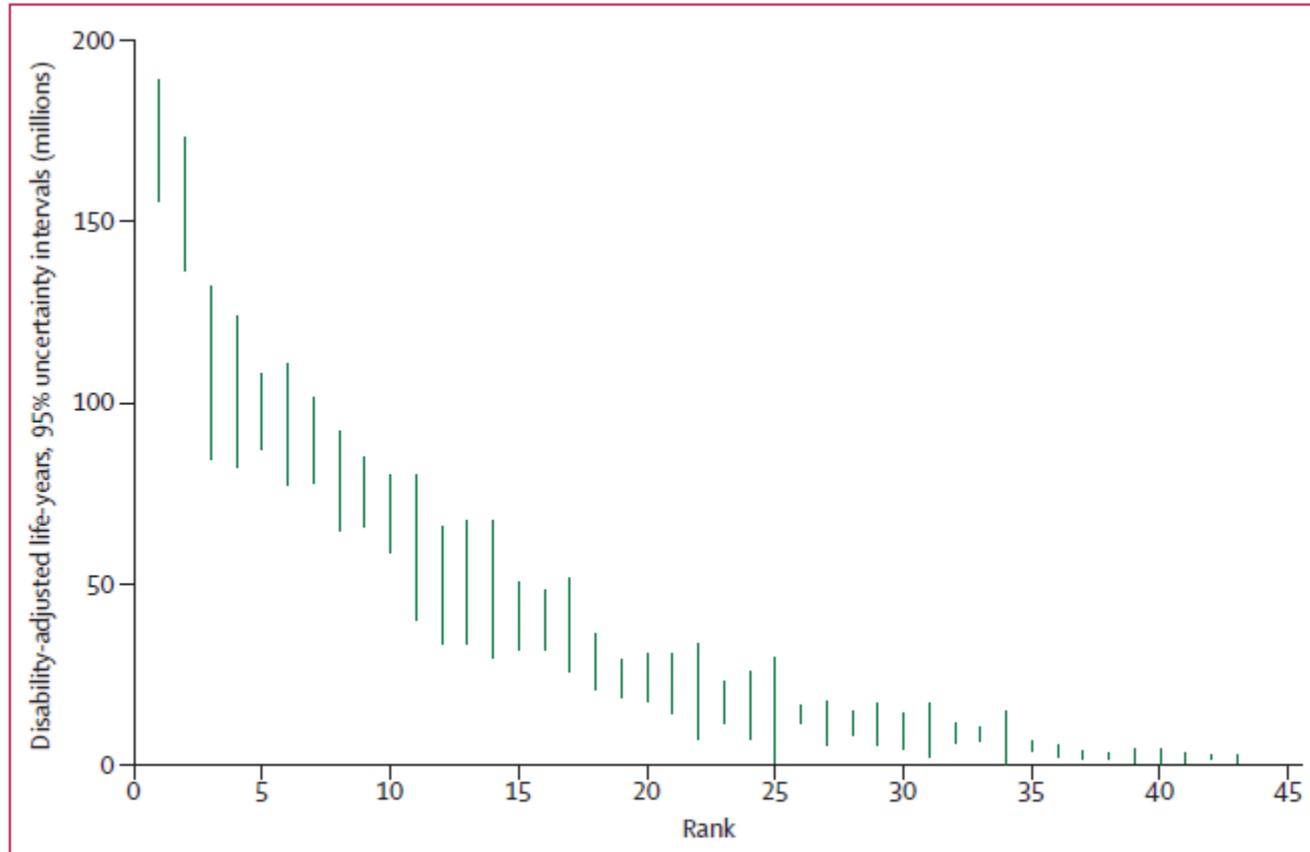
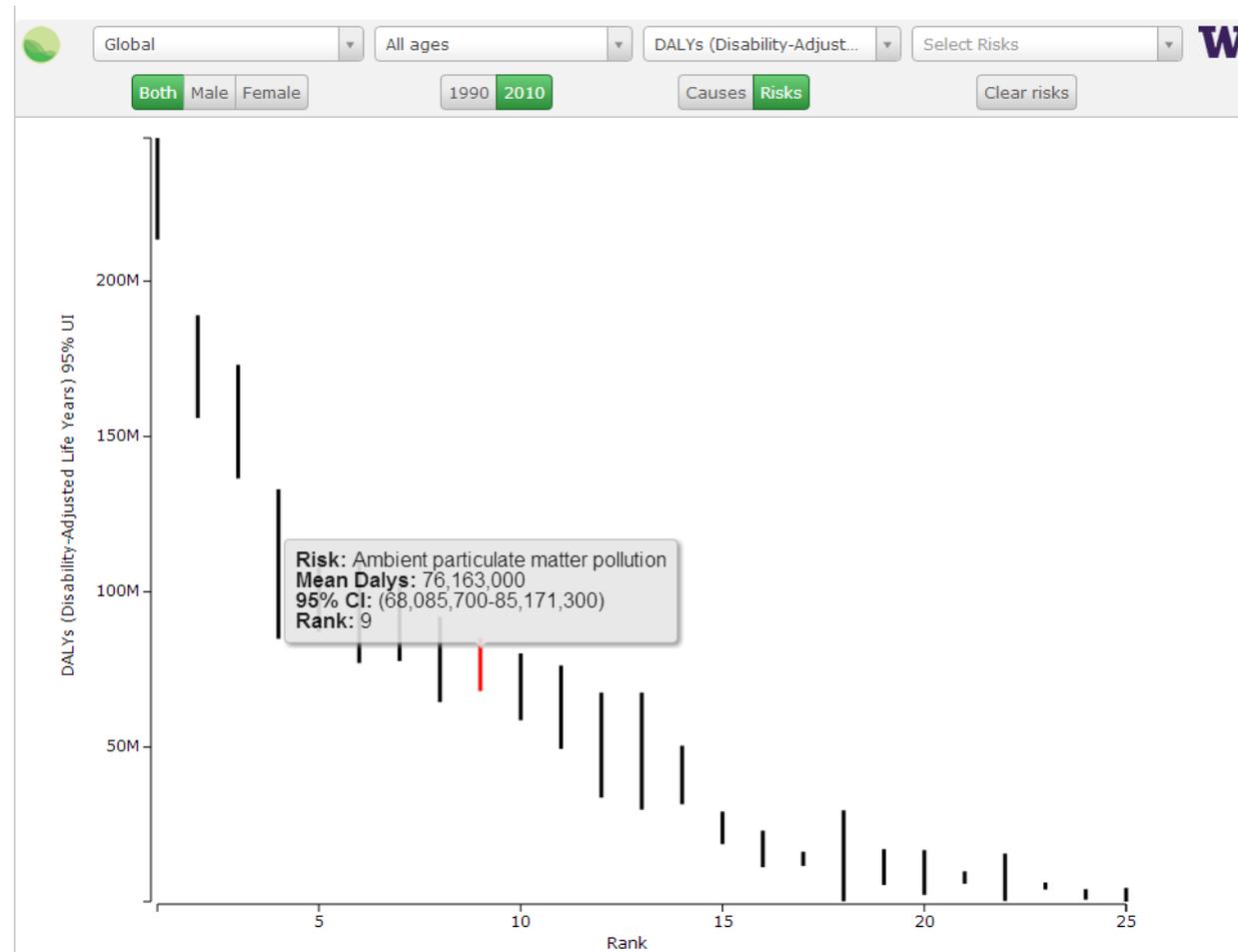


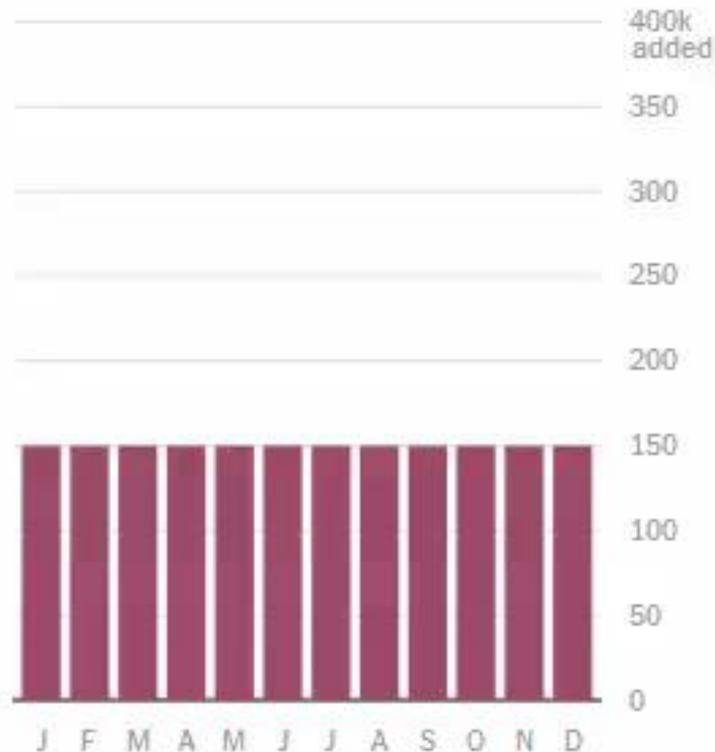
Figure 4: 95% uncertainty intervals for risk factors ranked by global attributable disability-adjusted life-years, 2010

Interactive visualizations allow more information-dense graphics



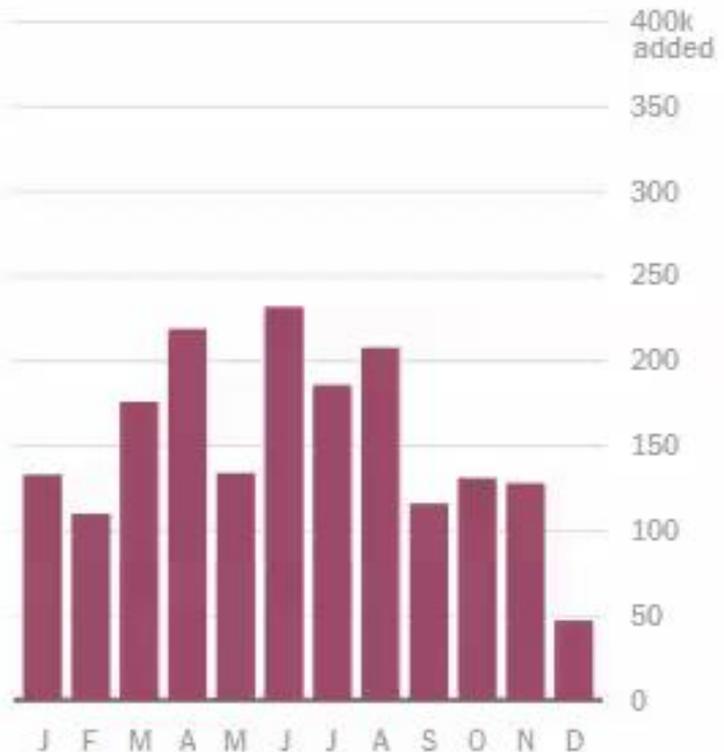
Animation can also be used to convey information

If job growth **were actually steady** over the last 12 months...



...the jobs report **could look like this:**

Pause



Source: <http://www.nytimes.com/2014/05/02/upshot/how-not-to-be-misled-by-the-jobs-report.html>