

Why we think we know what we know, and why that matters

The curious case of salt

Sandro Galea





Justin Wolfers

@JustinWolfers



Following

If you think economics is a mess, read the medicos trying to figure out if we're eating too much salt, or too little.

[nytimes.com/2013/05/15/hea...](https://www.nytimes.com/2013/05/15/health/medicos-trying-to-figure-out-if-we-re-eating-too-much-salt-or-too-little.html)



Reply



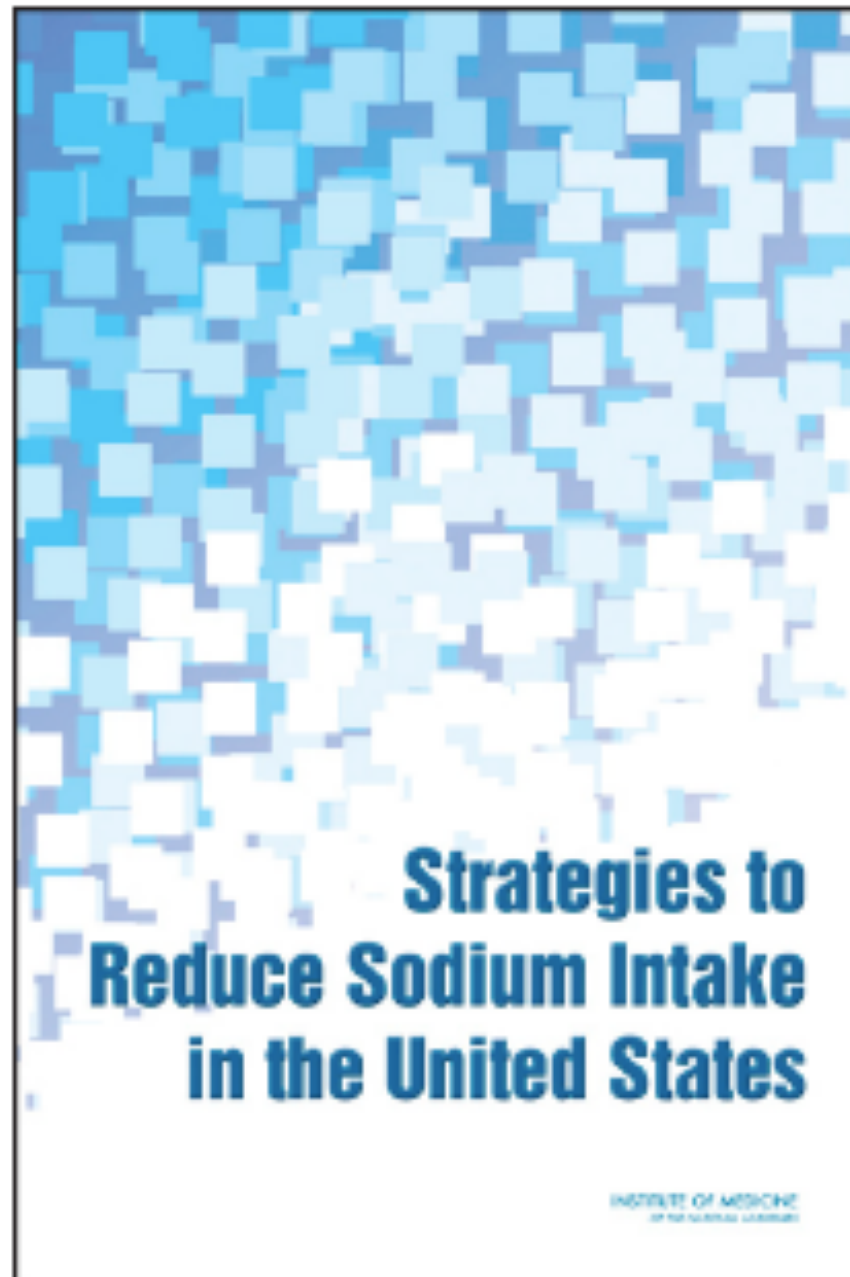
Retweet

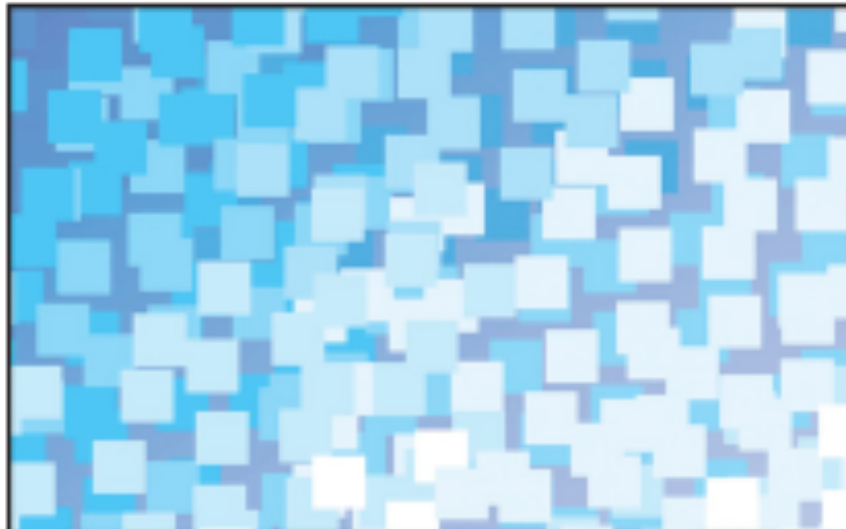


Favorite

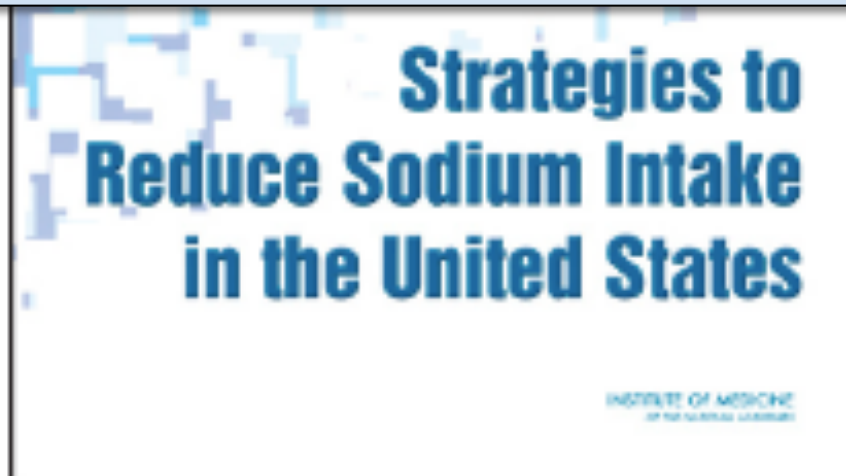


More





For 40 years we have known about the relationship between sodium and the development of hypertension and other life threatening diseases.



We Can Reduce Dietary Sodium, Save Money, and Save Lives

Most Americans consume far more salt than is healthy; the average sodium intake has increased over the past 30 years from already high levels to more than double the recommended amount (1, 2). Excess sodium consumption increases blood pressure (3); each 20-mm Hg increase in systolic blood pressure above 115 mm Hg doubles the risk for heart attack and stroke (4), which are the first and third leading causes of death in the United States, respectively (5). These effects of increased blood pressure on heart attack and stroke begin to occur at blood pressures that are well below levels at which drug treatment of hypertension is recommended currently (6).

Worldwide, cardiovascular disease is the leading cause of death among people aged 60 years or older and second among those aged 15 to 59 years; half or more of all strokes and heart attacks are attributable to high blood pressure (7). In the United States, approximately 100 000 deaths each year have been attributed to excess sodium intake (8). Because about one third of U.S. adults have hypertension and another 28% have levels above the desirable range (9), and because sodium consumption contributes to the increase in blood pressure observed with increasing age (9), reductions in salt intake will lead to substantial population-wide improvements in health.

Clinical care and health education require considerable individual attention and effort to help one person at a time through medical treatment or to adopt healthy behaviors. Policy interventions that change the environment to make

savings of \$18 billion in direct health care costs (15). Still-larger decreases in sodium intake than were examined in this study would probably result in even larger health improvements and cost savings and would be more cost-effective than using medications to lower blood pressure in people with hypertension (13).

After tobacco control, the most cost-effective intervention to control chronic diseases might be reduction of sodium intake. But because more than three fourths of Americans' sodium intake comes from processed foods and restaurant meals (16), it is very difficult for individuals to limit their consumption to healthy levels. As a result, sodium reduction will rely on action by the food industry (14, 17).

Sodium reduction initiatives involving the food industry in other countries have been successful. In 2003, the United Kingdom introduced a voluntary strategy to decrease the sodium content of processed and packaged food, which has resulted in reductions of 20% to 30% in most processed food sold in stores (14). New sodium reduction targets in the United Kingdom are being established and are expected to lead to a total 40% reduction in population sodium intake by 2012 (14). Japan and Finland have also implemented effective salt reduction programs; Ireland, Australia, and Canada have recently begun similar initiatives; and many other countries have committed to reducing sodium intake at the population level (14).

Although substantial changes in food production will

We Can Reduce Dietary Sodium, Save Money, and Save Lives

Most Americans consume far more salt than is healthy; the average sodium intake has increased over the past 30 years from already high levels to more than double the recommended amount (1, 2). Excess sodium consumption increases blood pressure (3); each 20-mm Hg increase in systolic blood pressure above 115 mm Hg doubles the

savings of \$18 billion in direct health care costs (15). Still-larger decreases in sodium intake than were examined in this study would probably result in even larger health improvements and cost savings and would be more cost-effective than using medications to lower blood pressure in people with hypertension (13).

After tobacco control the most cost effective intervention to control chronic disease might be reduction of sodium intake.

and heart attacks are attributable to high blood pressure (7). In the United States, approximately 100 000 deaths each year have been attributed to excess sodium intake (8). Because about one third of U.S. adults have hypertension and another 28% have levels above the desirable range (9), and because sodium consumption contributes to the increase in blood pressure observed with increasing age (9), reductions in salt intake will lead to substantial population-wide improvements in health.

Clinical care and health education require considerable individual attention and effort to help one person at a time through medical treatment or to adopt healthy behaviors. Policy interventions that change the environment to make

ity in other countries have been successful. In 2003, the United Kingdom introduced a voluntary strategy to decrease the sodium content of processed and packaged food, which has resulted in reductions of 20% to 30% in most processed food sold in stores (14). New sodium reduction targets in the United Kingdom are being established and are expected to lead to a total 40% reduction in population sodium intake by 2012 (14). Japan and Finland have also implemented effective salt reduction programs; Ireland, Australia, and Canada have recently begun similar initiatives; and many other countries have committed to reducing sodium intake at the population level (14).

Although substantial changes in food production will

REDUCING POPULATION SALT INTAKE

The sodium phantom

Niels Graudal *senior consultant*¹, Gesche Jürgens *MD*²

BMJ

¹Department of Rheumatology, Copenhagen University Hospital, Rigshospitalet, DK-2100 Copenhagen, Denmark; ²Department of Clinical Pharmacology, Bispebjerg University Hospital, Copenhagen

REDUCING POPULATION SALT INTAKE

The sodium phantom

Niels Graudal *senior consultant*¹, Gesche Jürgens *MD*²

¹Department
Pharmacolog

BMJ

of Clinical

It is surprising that many countries have uncritically adopted sodium reduction, which probably is the largest delusion in the history of preventive medicine.

Effects of low sodium diet versus high sodium diet on blood pressure, renin, aldosterone, catecholamines, cholesterol, and triglyceride (Review)

Graudal NA, Hubeck-Graudal T, Jurgens G



This is a reprint of a Cochrane review, prepared and maintained by The Cochrane Collaboration and published in *The Cochrane Library* 2011, Issue 11

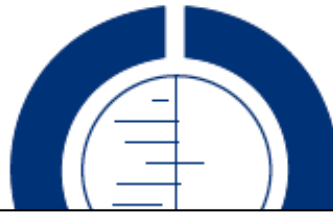
<http://www.thecochranelibrary.com>



Effects of low sodium diet versus high sodium diet on blood pressure, renin, aldosterone, catecholamines, cholesterol, and triglyceride (Review)
Copyright © 2011 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Effects of low sodium diet versus high sodium diet on blood pressure, renin, aldosterone, catecholamines, cholesterol, and triglyceride (Review)

Graudal NA, Hubeck-Graudal T, Jurgens G



We are commonly advised to cut down on salt...[but] we do not know if low salt diets improve or worsen health outcomes.

This is a reprint of a Cochrane review, prepared and maintained by The Cochrane Collaboration and published in *The Cochrane Library* 2011, Issue 11

<http://www.thecochranelibrary.com>



Effects of low sodium diet versus high sodium diet on blood pressure, renin, aldosterone, catecholamines, cholesterol, and triglyceride (Review)
Copyright © 2011 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

Reduced Dietary Salt for the Prevention of Cardiovascular Disease: A Meta-Analysis of Randomized Controlled Trials (Cochrane Review)

Rod S. Taylor¹, Kate E. Ashton², Tiffany Moxham³, Lee Hooper⁴ and Shah Ebrahim⁵

BACKGROUND

Although meta-analyses of randomized controlled trials (RCTs) of salt reduction report a reduction in the level of blood pressure (BP), the effect of reduced dietary salt on cardiovascular disease (CVD) events remains unclear.

METHODS

We searched for RCTs with follow-up of at least 6 months that compared dietary salt reduction (restricted salt dietary intervention or advice to reduce salt intake) to control/no intervention in adults, and reported mortality or CVD morbidity data. Outcomes were pooled at end of trial or longest follow-up point.

RESULTS

Seven studies were identified, three in normotensives, two in hypertensives, one in a mixed population of normo- and hypertensives and one in heart failure. Salt reduction was associated with reductions in urinary salt excretion of between 27 and 39 mmol/24 h and reductions in systolic BP between 1 and 4 mm Hg. Relative risks (RRs) for all-cause mortality in normotensives (longest follow-up—RR: 0.90, 95% confidence interval (CI): 0.58–1.40, 79 deaths) and hypertensives (longest follow-up RR 0.96, 0.83–1.11, 565 deaths) showed no strong evidence of any effect of salt reduction CVD morbidity in people with normal BP (longest follow-up: RR 0.71, 0.42–1.20, 200 events) and raised BP at baseline (end of trial: RR 0.84, 0.57–1.23, 93 events) also showed no strong evidence of benefit. Salt restriction increased the risk of all-cause mortality in those with heart failure (end of trial RR 2.59, 1.04–6.44, 21 deaths). We found no information on participant's health-related quality of life.

CONCLUSIONS

Despite collating more event data than previous systematic reviews of RCTs (665 deaths in some 6,250 participants) there is still insufficient power to exclude clinically important effects of reduced dietary salt on mortality or CVD morbidity. Our estimates of benefits from dietary salt restriction are consistent with the predicted small effects on clinical events attributable to the small BP reduction achieved.

Keywords: blood pressure; cardiovascular disease; diet; hypertension; meta-analysis; salt; sodium; systematic review

This article is based on a Cochrane Review published in the *Cochrane Database of Systematic Reviews* (CDSR) YYYY, Issue X, DOI: 10.1002/14651858.CD00xxxx (see www.thecochranelibrary.com for information). Cochrane Reviews are regularly updated as new evidence emerges and in response to feedback, and the CDSR should be consulted for the most recent version of the review.

A more detailed review has been published and will be updated in the *Cochrane Database of Systematic Reviews* [Taylor RS, Ashton KE, Moxham T, Hooper L, Ebrahim S. Reduced dietary salt for the prevention Of cardiovascular disease. *Cochrane Database of Systematic Reviews* (CDSR) 2011, Issue X, DOI: 10.1002/14651858.CD00xxxx (see www.thecochranelibrary.com for information). This is a version of a Cochrane review, which is available in The Cochrane Library. Cochrane systematic reviews are regularly updated to include new research, and in response to feedback from readers. The results of a Cochrane review can be interpreted differently, depending on people's perspectives and circumstances. Please consider the conclusions presented carefully. They are the opinions of review authors, and are not necessarily shared by The Cochrane Collaboration.

American Journal of Hypertension, advance online publication 6 July 2011; doi:10.1038/ajh.2011.115

High dietary intake of salt has been identified as an important risk factor for cardiovascular disease (CVD). The current public health recommendations in most developed countries are to reduce salt intake by about half, i.e., from ~10 to 5 g/day.^{1–4} However, the evidence for the reduction of CVD morbidity and mortality as the result of reduced salt intake remains controversial.⁵

A number of observational studies support the link between salt intake and CVD. A meta-analysis of 13 prospective studies including 177,000 participants reported a high salt intake was associated with a greater risk of stroke (RR, 1.23, 95% confidence interval (CI): 1.06–1.43).⁶ However, there was no association between salt intake and all CVD events, and total mortality was not reported. Furthermore, the interpretation of this observational evidence base is complicated by the heterogeneity in estimating sodium intake (diet or urinary salt excretion), types of participants (healthy, hypertensive, obese, and nonobese), different end points, and definition of outcomes across studies.⁵

¹Peninsula College of Medicine and Dentistry, University of Exeter, Exeter, UK; ²Clinical Trials and Evaluation Unit, University of Bristol, Bristol, UK; ³Wimberly Library, Florida Atlantic University, Boca Raton, Florida, USA; ⁴Norwich Medical School, University of East Anglia, Norwich, UK; ⁵Faculty of Epidemiology and Population Health, London School of Hygiene and Tropical Medicine, London, UK. Correspondence: Rod S. Taylor (rod.taylor@pms.ac.uk)

Received 1 May 2011; first decision 9 May 2011; accepted 9 May 2011.

© 2011 American Journal of Hypertension, Ltd.

Reduced Dietary Salt for the Prevention of Cardiovascular Disease: A Meta-Analysis of Randomized Controlled Trials (Cochrane Review)

Rod S. Taylor¹, Kate E. Ashton², Tiffany Moxham³, Lee Hooper⁴ and Shah Ebrahim⁵

BACKGROUND

Although meta-analyses of randomized controlled trials (RCTs) of salt reduction report a reduction in the level of blood pressure (BP), the effect of reduced dietary salt on cardiovascular disease (CVD) events remains unclear.

METHODS

We searched for RCTs with follow-up of at least 6 months that compared dietary salt reduction (restricted salt dietary intervention or advice to reduce salt intake) to control/no intervention in adults, and reported mortality or CVD morbidity data. Outcomes were pooled at end of trial or longest follow-up point.

CONCLUSIONS

Despite collating more event data than previous systematic reviews of RCTs (665 deaths in some 6,250 participants) there is still insufficient power to exclude clinically important effects of reduced dietary salt on mortality or CVD morbidity. Our estimates of benefits from dietary salt restriction are consistent with the predicted small effects on clinical events attributable to the small BP reduction achieved.

Keywords: blood pressure; cardiovascular disease; diet; hypertension; meta-analysis; salt; sodium; systematic review

This article is based on a Cochrane Review published in the *Cochrane Database of Systematic Reviews* (2008, Issue 4). DOI: 10.1002/14651958.CD006666

We found no strong evidence that salt reduction reduced all-cause mortality or CVD morbidity in normotensives or hypertensives.

0.57–1.23, 93 events) also showed no strong evidence of benefit.

Salt restriction increased the risk of all-cause mortality in those with heart failure (end of trial RR 2.59, 1.04–6.44, 21 deaths). We found no information on participant's health-related quality of life.

American Journal of Hypertension, advance online publication 6 July 2011; doi:10.1038/ajh.2011.115

High dietary intake of salt has been identified as an important risk factor for cardiovascular disease (CVD). The current public health recommendations in most developed countries are to reduce salt intake by about half, i.e., from ~10 to 5 g/day.^{1–4} However, the evidence for the reduction of CVD morbidity and mortality as the result of reduced salt intake remains controversial.⁵

A number of observational studies support the link between salt intake and CVD. A meta-analysis of 13 prospective studies including 177,000 participants reported a high salt intake was associated with a greater risk of stroke (RR, 1.23, 95% confidence interval (CI): 1.06–1.43).⁶ However, there was no association between salt intake and all CVD events, and total mortality was not reported. Furthermore, the interpretation of this observational evidence base is complicated by the heterogeneity in estimating sodium intake (diet or urinary salt excretion), types of participants (healthy, hypertensive, obese, and nonobese), different end points, and definition of outcomes across studies.⁵

¹Peninsula College of Medicine and Dentistry, University of Exeter, Exeter, UK; ²Clinical Trials and Evaluation Unit, University of Bristol, Bristol, UK; ³Wimberly Library, Florida Atlantic University, Boca Raton, Florida, USA; ⁴Norwich Medical School, University of East Anglia, Norwich, UK; ⁵Faculty of Epidemiology and Population Health, London School of Hygiene and Tropical Medicine, London, UK. Correspondence: Rod S. Taylor (rod.taylor@pms.ac.uk)

Received 1 May 2011; first decision 9 May 2011; accepted 9 May 2011.

© 2011 American Journal of Hypertension, Ltd.

SODIUM INTAKE IN POPULATIONS

ASSESSMENT OF EVIDENCE



INSTITUTE OF MEDICINE
OF THE NATIONAL ACADEMIES

SODIUM INTAKE IN POPULATIONS

ASSESSMENT OF EVIDENCE

The committee determined that evidence from studies on direct health outcomes is inconsistent and insufficient to conclude that lowering sodium intakes below 2,300 mg per day either increases or decreases risk of CVD outcomes (including stroke and CVD mortality) or all cause mortality in the general U.S. population.

INSTITUTE OF MEDICINE
OF THE NATIONAL ACADEMIES

Controversial Salt Report Peppered with Uncertainty

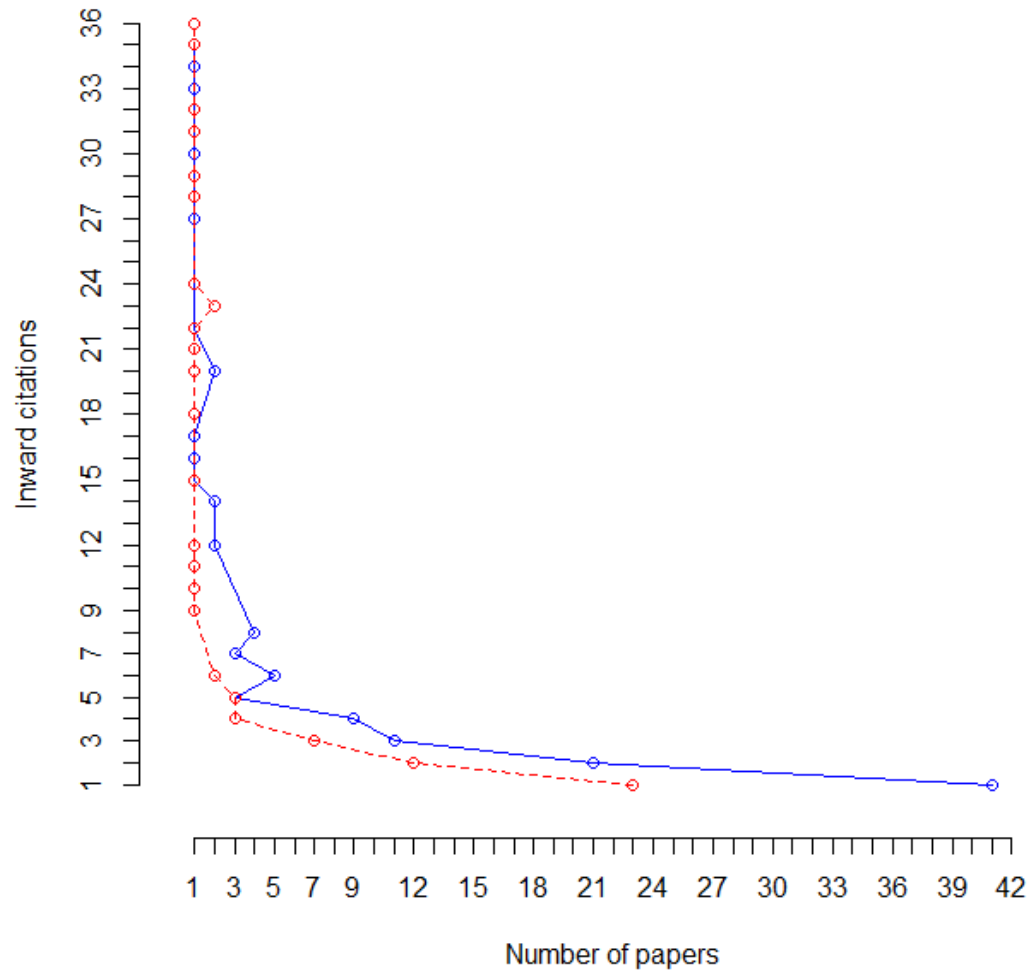
A RECENT INSTITUTE OF MEDICINE (IOM) assessment (*1*) provoked controversy by concluding that there is a lack of evidence for health benefits of reducing sodium intake to the very low levels recommended by some authoritative groups (“Report reignites battle over low-salt diets,” K. Kupferschmidt, *News & Analysis*, 24 May, p. 908). The IOM

mentary by three members of the IOM salt committee likewise stressed that the Dietary Guidelines for Americans (DGA), IOM, AHA, and the World Health Organization (WHO) were “congruent” in the belief that excess sodium intake should be reduced (*6*).

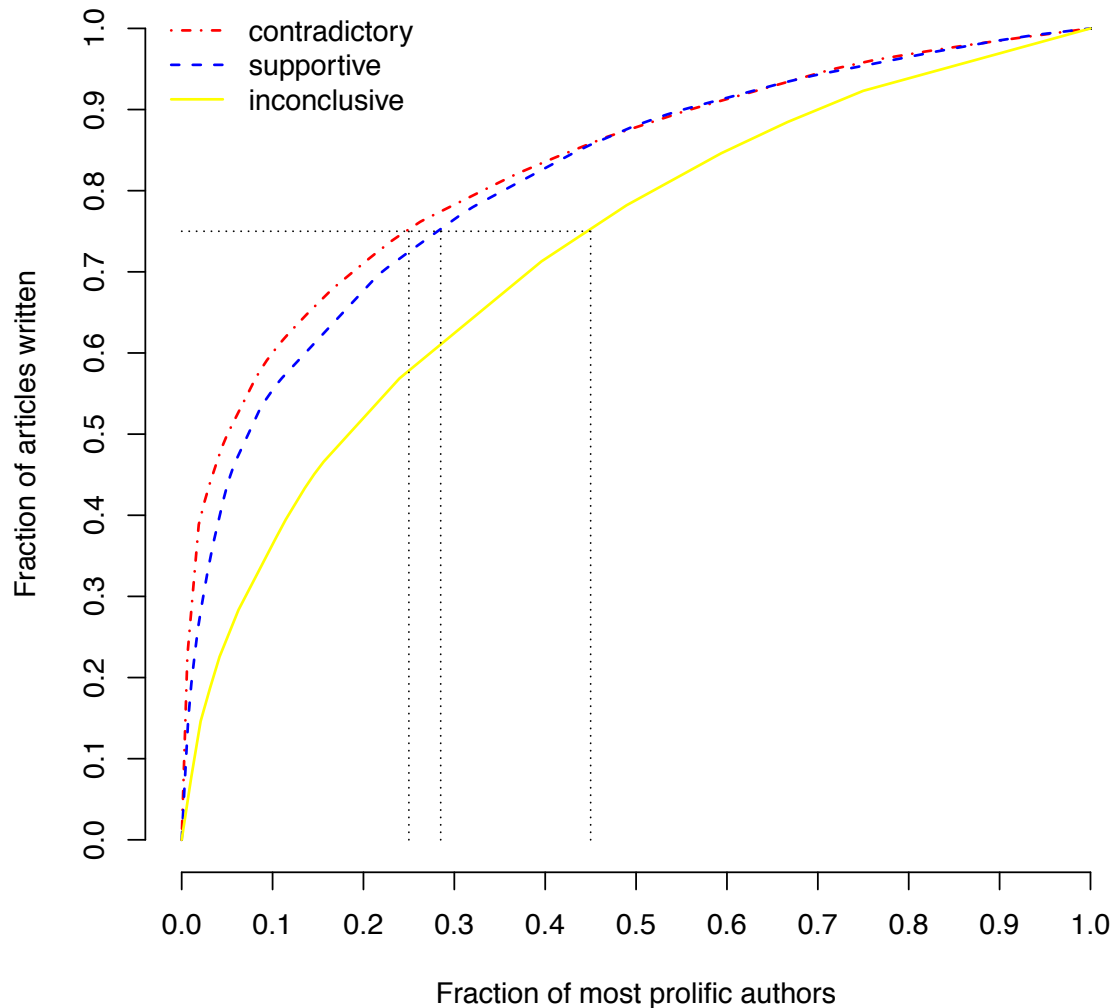
Other key players essentially ignored the IOM study. The New York City Health Department, which leads a coalition of health organizations in a partnership with industry to reduce sodium in restaurant

Why?

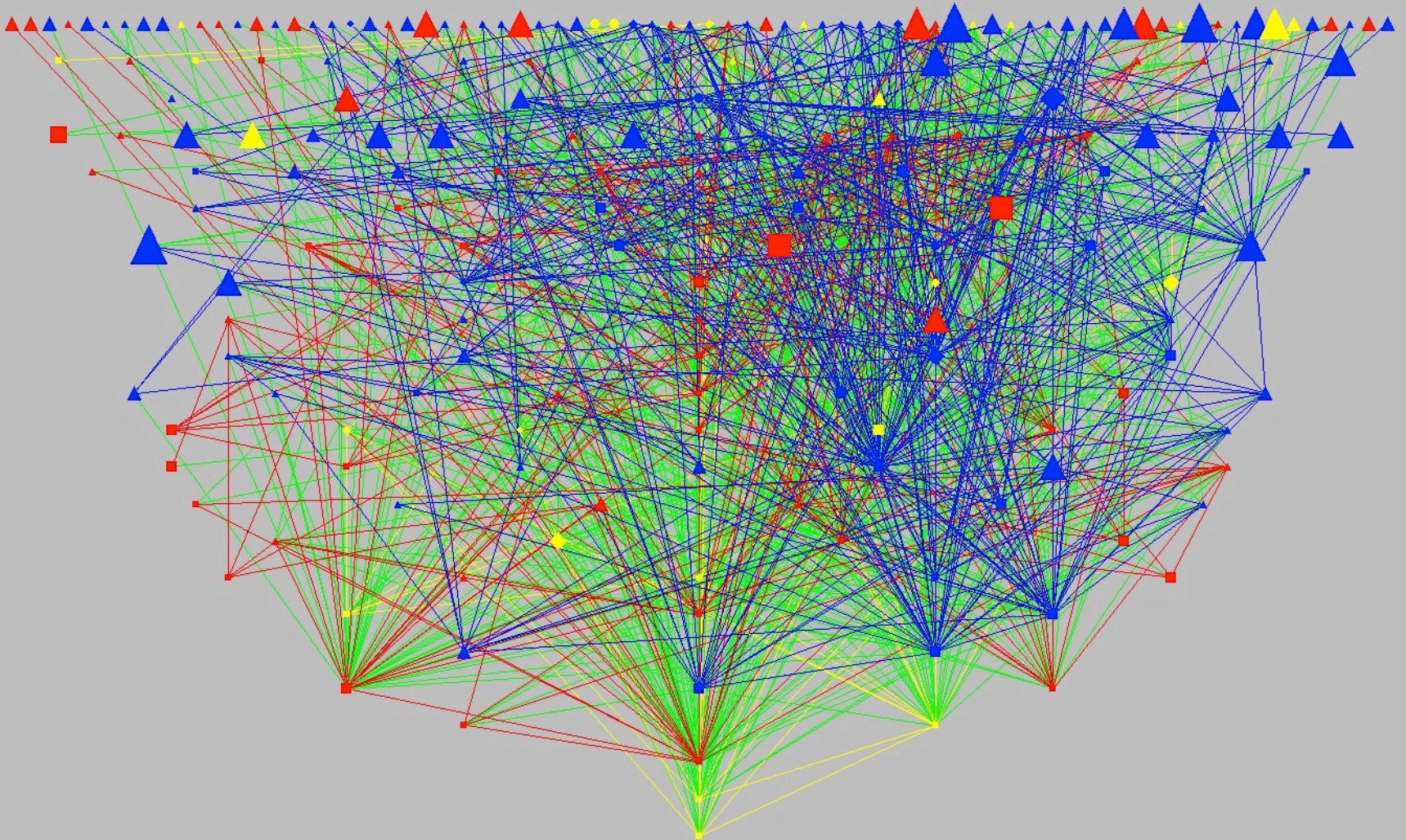
A few papers are cited quite a bit; most papers are not cited much at all



A few authors are writing most of the cited papers in each area, particularly papers that are pro/con

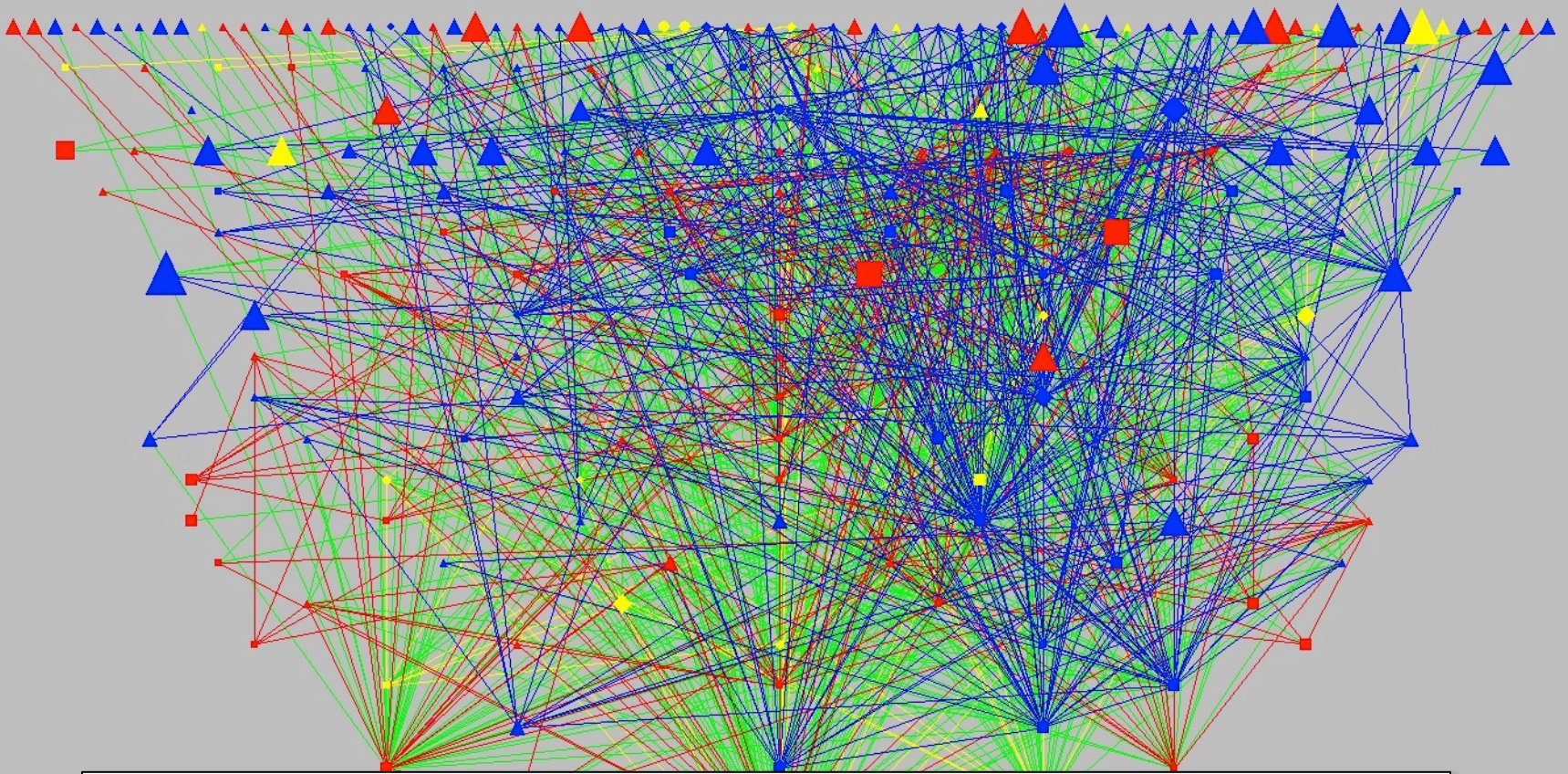


Citations between publications are highly clustered



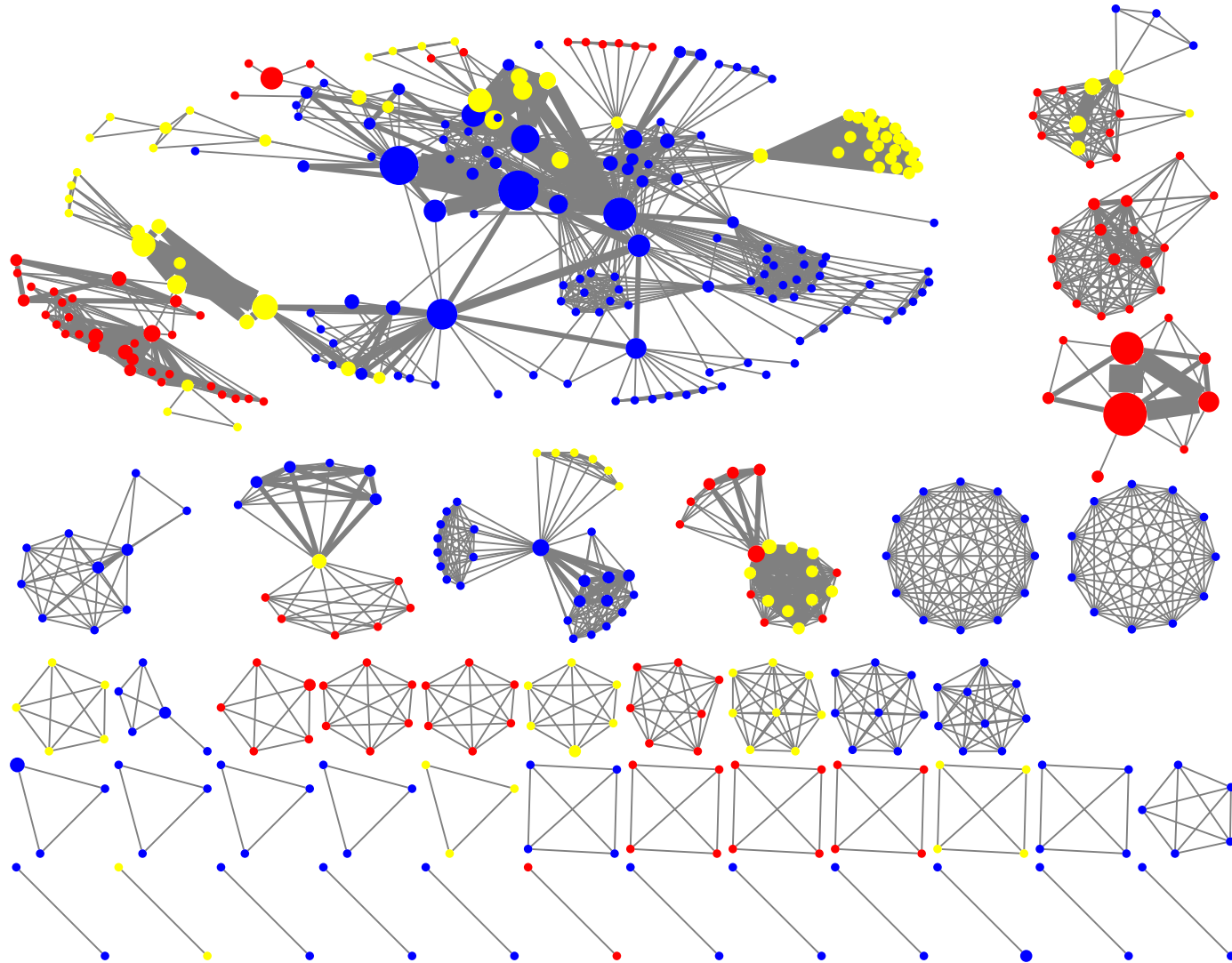
Blue is supportive of hypothesis, red is against, yellow is indeterminate; green is cross-category citation

Citations between publications are highly clustered



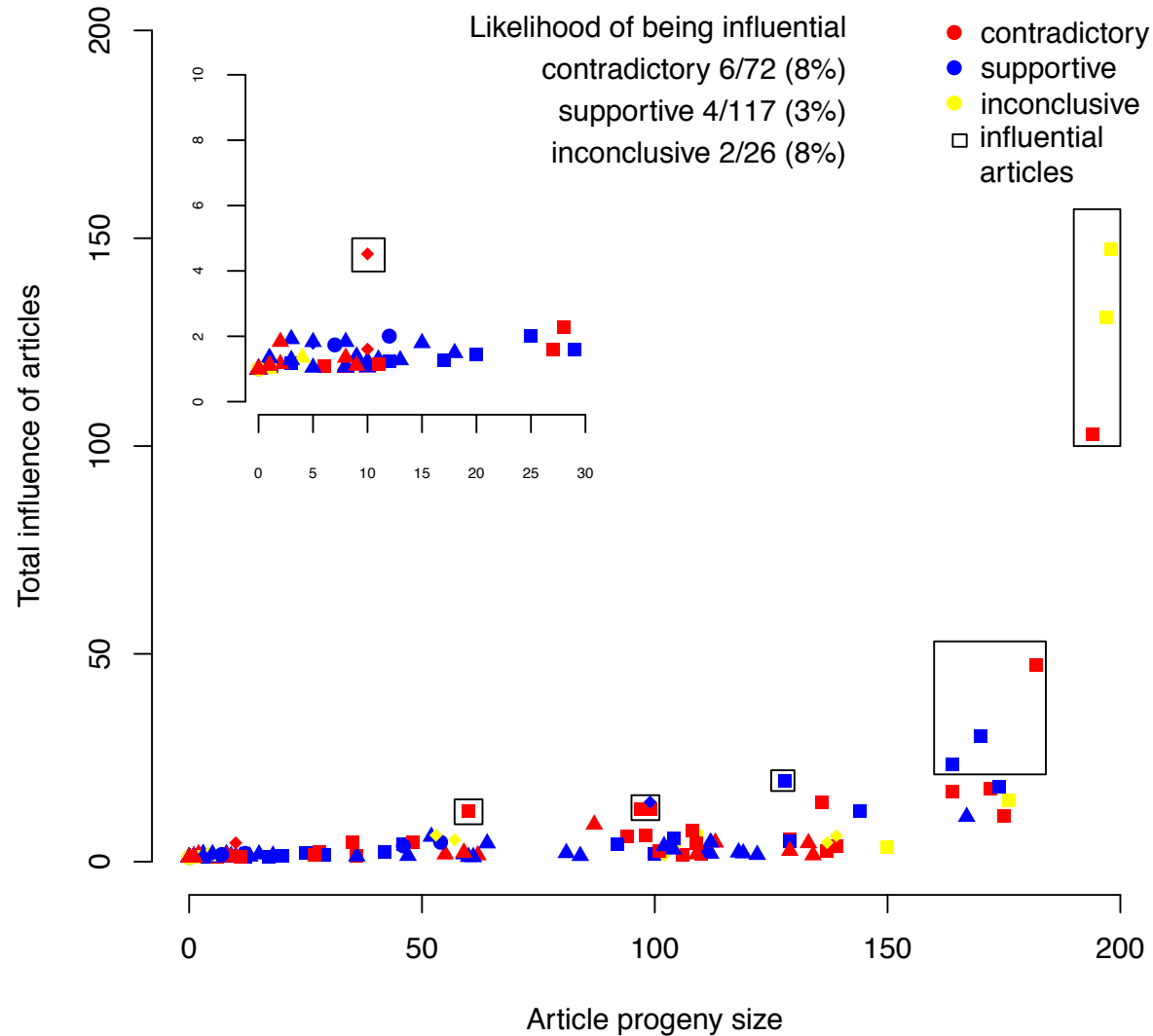
Within category homophily 1.58 (1.41-1.75), accounting for type of article, publication gap, journal impact factor

Substantial clustering of co-authors between publications

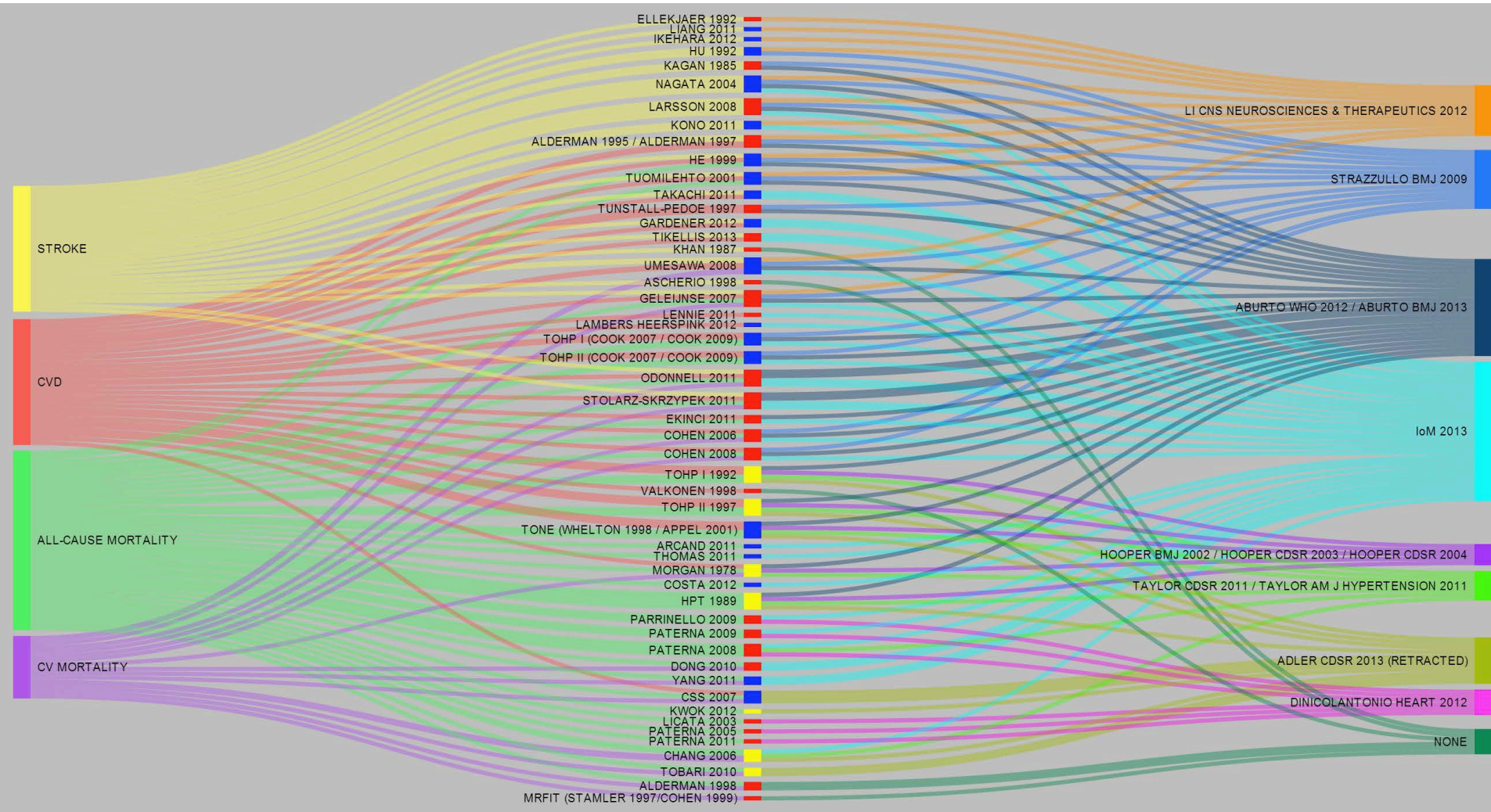


Authors with at least two articles in the field, and articles with at least two citations; density of line thickness refers to number of articles. Blue is supportive of hypothesis, red is against, black is indeterminate

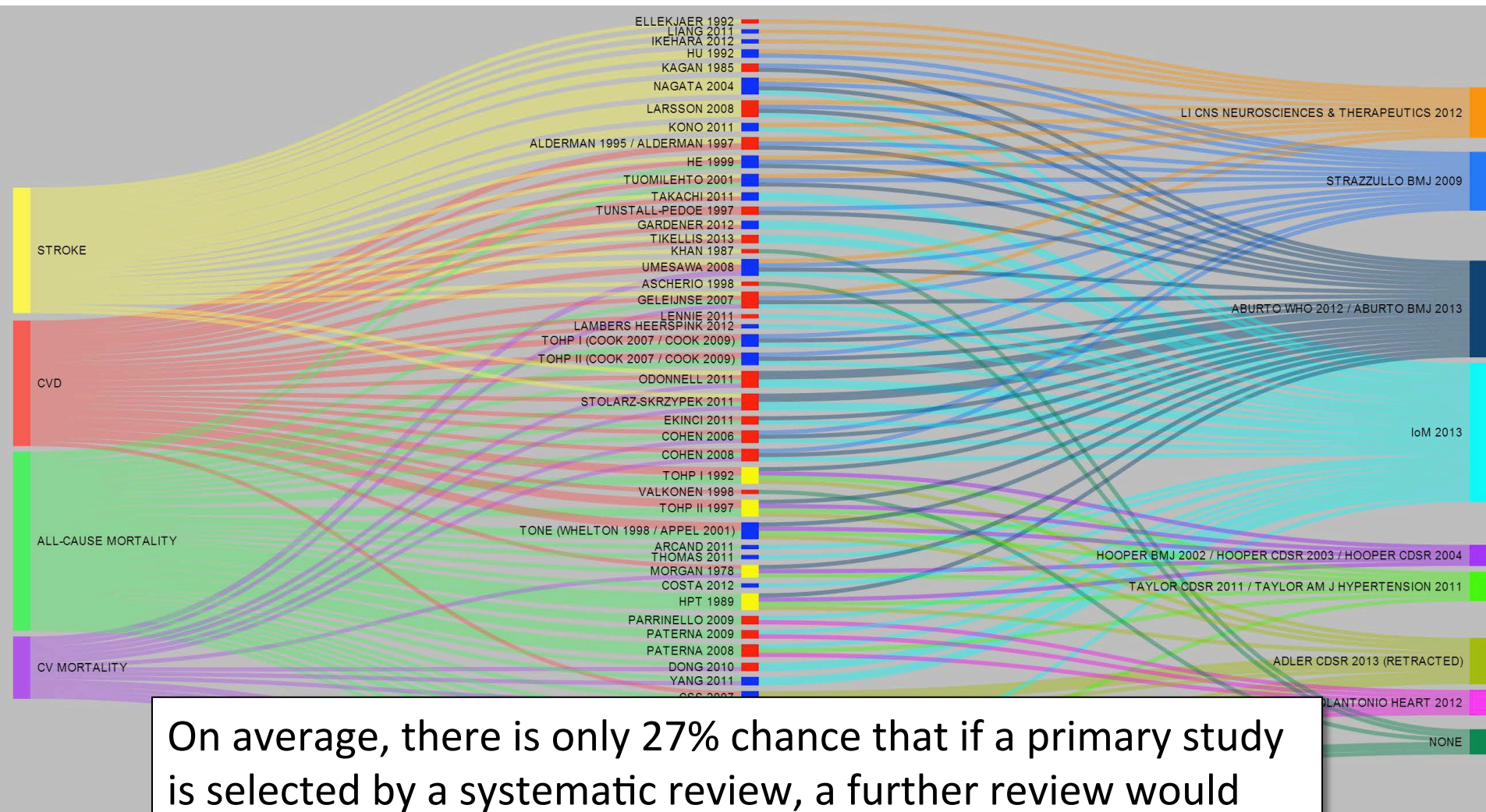
The debate has become polarized over time



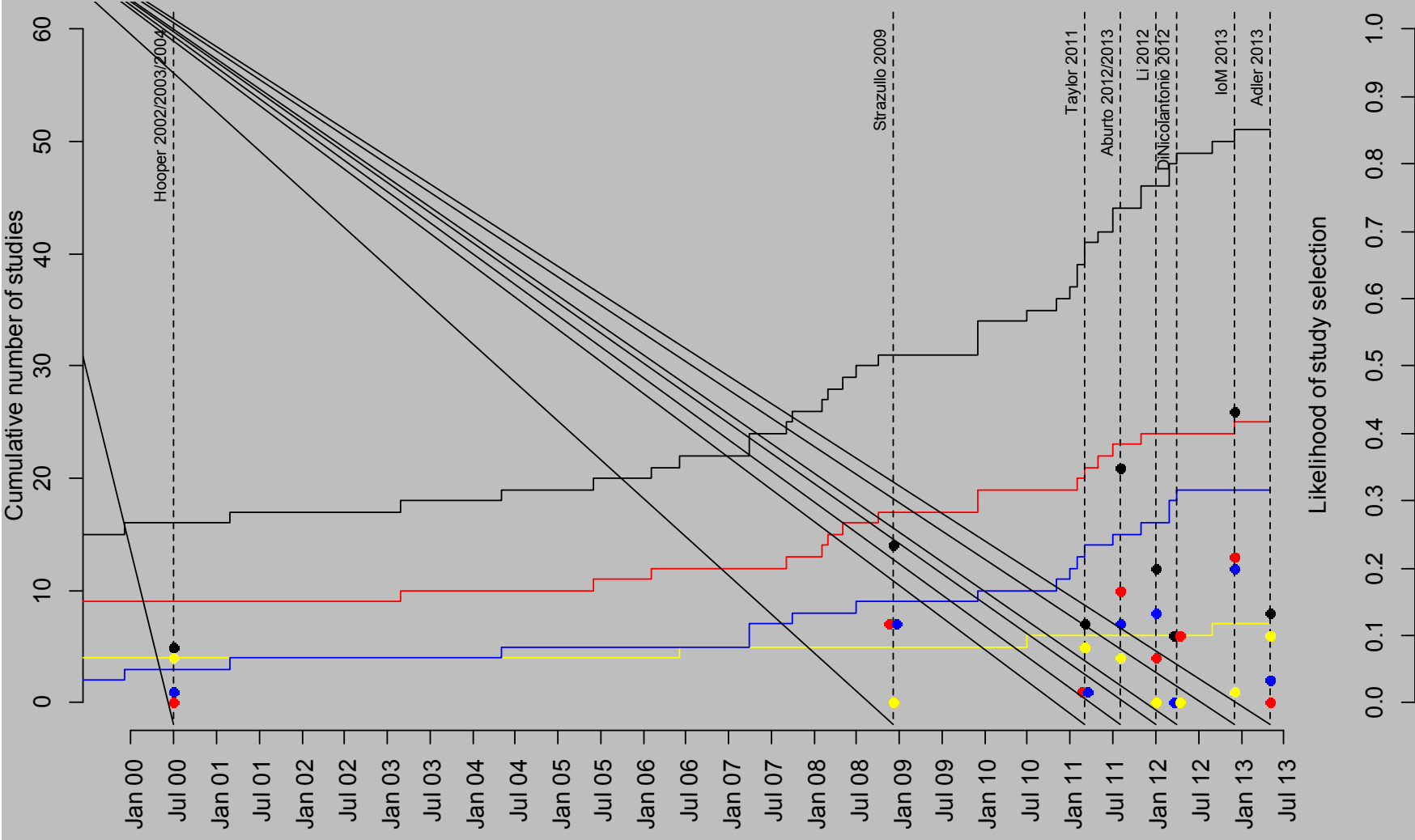
There is lack of overlap in systematic reviews



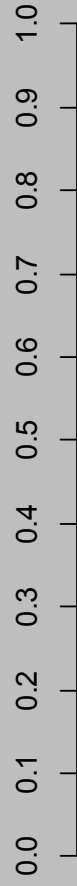
There is lack of overlap in systematic reviews



On average, there is only 27% chance that if a primary study is selected by a systematic review, a further review would also select it



Likelihood of study selection



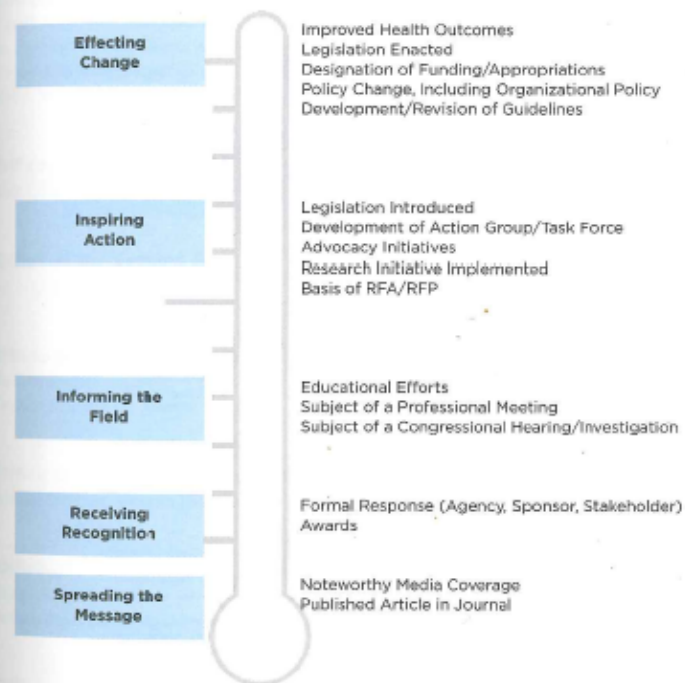
So, this strikes me all as 'easy' for the academic

“ [Our task] is not to tell people what they should do. That is a matter for societies and their individual members to decide. [Rather, our task is] to analyze the options, so that such important choices can be based on a clearer understanding of the issues ”

“ [Our task] is not to tell people what they should do. That is a matter for societies and their individual members to decide. **[Rather, our task is] to analyze the options, so that such important choices can be based on a clearer understanding of the issues** ”

**But what about the practitioner who has to do
'something'?**

Institute of Medicine Degrees of Impact



“Paternalism is the interference of a state or an individual with another person, against their will, and defended or motivated by a claim that the person interfered with will be better off or protected from harm. ”

**The key question: is the balance of evidence for
population salt reduction such that we should act?**

Key issue 1. Potential harms

“ There is now much evidence that a reduction in national salt intake would lead to lower blood pressure and some important health benefits. The change would be cheap, safe, and only mildly and temporarily painful ... we are much more likely to do good by adopting this policy than by rejecting it ”

Key issue 2. The limits of paternalism

“

A salt-free diet may give you life. I'm not sure about that, but it certainly deprives you of liberty and the pursuit of happiness ”

Slide courtesy of David Johns

Pickering G John Laragh, Fritz R. Buhler, Donald W. Seldin, eds. *Frontiers in Hypertension Research: Proceedings from International Symposium held May 19-21, 1980, in New York*. New York: Springer-Verlag, 1981, p. 68.

Ludovic Trinquart

David Johns

Ron Bayer

twitter/@sandrogalea

sgalea@columbia.edu