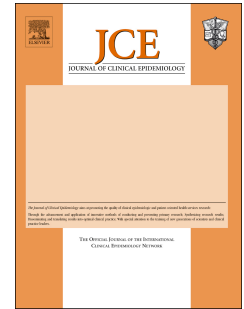


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[Title page]

Cochrane systematic reviews of interventions for risk factors correlate weakly with global risk factor burden: A cross-sectional study

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WORD COUNT

Main text word count = 2995 (excluding table and figure titles)

Tables = 3 (GBD intro, main descriptive results, main correlation findings)

Figures = 2 (DALYS per SR bar chart; residuals per risk factor bar chart)

[Abstract]**Background**

Systematic reviews (SRs) are important for healthcare decision makers requiring evidence for interventions that target modifiable risk factors to prevent disease. We investigated whether Cochrane SR output correlated with risk factor burden as assessed by the Global Burden of Disease Study 2015.

Methods

We screened and extracted data from Cochrane reviews and protocols published since January 2011 investigating modifiable risk factors as outcomes. We calculated Spearman's rank correlation between the number of occasions a risk factor was a SR outcome and that risk factor's global disease burden in DALYs. We also calculated standardised Pearson residuals of the variance between the observed and expected frequency of a risk factor featured as an outcome.

Results

We obtained 400 unique SRs and 174 unique protocols from 6392 Cochrane publications. Risk factors were an outcome a total of 965 times. The number of SR outcomes and DALYs per risk factor shared a weak-positive correlation ($r=0.45$) for all risk factors, but was high ($r=0.83$) for metabolic risks, similar for behavioural risks ($r=0.46$), and weak negative for occupational and environmental risks ($r=-0.40$). Standardised Pearson residuals for 'high total cholesterol', 'low bone mineral density', 'alcohol and drug use', and 'child and maternal malnutrition' inferred a higher than expected frequency of outcomes, and for 'air pollution', 'dietary risk', and 'unsafe water, sanitation, and handwashing', fewer than expected.

Conclusions

Our study investigated whether Cochrane risk factor SRs align with global risk factor burden, demonstrating a weak positive correlation. Interventions modifying air pollution and dietary risks were sparsely studied, given disease burden.

HIGHLIGHTS

What is already known about this subject:

- Systematic reviews are important tools to inform healthcare and policy decisions, and there is moderate correlation between systematic review output and the burden of disease assessed using disability-adjusted life years (DALYs)
- Limited data published in 2005 suggested there was a mismatch in the evidence examining specific risk factors for diseases and their burden in DALYs, particularly for child and maternal malnutrition, occupational, and environmental risks

What this study adds:

- Whilst there is a positive correlation between global burden and the number of systematic review outcomes for modifiable risk factors, some risk factors are "over-studied" and others "under-studied"
- Air pollution in particular but also dietary risks and 'unsafe water, sanitation & hand-washing' risk factors featured as outcomes in fewer than expected systematic reviews, given their risk factor burden
- When prioritising research, reviewers should consider global burden as a measure of need for research

[Main text]

BACKGROUND

Using explicit and systematic methods, systematic reviews (SRs) provide healthcare providers, consumers, researchers, and policy makers the means to make unbiased, evidence-informed decisions in a timely fashion¹⁻³. Most commonly, SRs are used to assess the benefits and harms of an intervention⁴. Controlled trials (CTs), particularly where interventions are randomly assigned in randomised controlled trials (RCTs), represent the gold standard method for answering this type of question⁴, but other types of primary evidence, such as observational research, may also be considered. SRs published by the Cochrane Collaboration account for around 27% of all SRs of interventions, and are conducted to a rigorous standard using a compulsory approach which minimises bias, leading to more complete reporting than other SRs⁴; for these reasons their findings have been highly influential on health policy decision making around the globe^{4 5}.

Early intervention against a disease risk factor (defined as an 'attribute, characteristic or exposure of an individual that increases the likelihood of developing a disease or injury'⁶), rather than simply treating diseases once they have occurred, is a tenet of public health practice. The Global Burden of Disease (GBD) study 2015 provided a comprehensive account of the contribution of individual diseases and injuries to the global burden of ill health, measured using the disability-adjusted life year (DALY) metric, the sum of years lived with disability (YLD) and years of life lost (YLL) to premature death⁷. GBD also provided an assessment of the contribution of 79 potentially modifiable risk factors for these diseases and injuries to the global DALY burden in 195 countries⁸.

Burden of disease has been compared to research output, in order to prioritise research⁹. Given the role of systematic reviews in aiding policy-making, using disease burden to prioritise review production to match population needs is one sensible approach and enables identification of common diseases that have hitherto received relatively little resource (so called 'neglected' diseases, or in this case, 'neglected risk factors')⁹.

A 2005 mapping exercise of Cochrane and other SR output against important risk factors found important mismatches in SR evidence against burden, particularly for child and maternal malnutrition, occupational, and environmental risks^{10 11}. *Disease* burden, quantified by the GBD study, has been correlated with volume of output using a sample of reviews from the Cochrane Database of Systematic Reviews (CDSR)¹², finding a statistically significant, positive correlation ($r=0.68$) between the number of DALYs attributed to a disease, and the number of Cochrane systematic reviews¹² of interventions to treat it. This study looked at the relationship with the burden of disease only and did not examine the relationship with risk factors. To our knowledge, there has been no published research examining the relationship between SRs of risk factor interventions and estimates of their respective global burden.

We aimed to determine the correlation between the number of Cochrane SRs of interventions targeting risk factors, and the global burden for those risk factors, according to GBD 2015, and to collect descriptive data on key SR characteristics, which may help to explain any relationships observed.

METHODS

Systematic review and primary research sample

We identified all Cochrane SRs of interventions to modify risk factors described by the GBD, using the GBD definitions. The GBD study grouped risk factors into hierarchical levels 1 to 4 (from ‘all risk factors’ at level 1, down to the 67 in level 4 – see supplementary table 1), with greater detail of individual risk factors at each lower level. Correlations between GBD burden and number of SRs were analysed at level 2, which describes the burden associated with 17 risk factors or risk factor clusters (see table below). We chose this level as it provided a meaningful level of granularity but also sufficient data for appropriate analysis.

>>insert Table 1. Global Burden of Disease 2015 risk factors in hierarchy levels 1 and 2, with the highest associated global DALY burden in 2015 (level two risk factors are given in this order)⁸ <<

Table 1: GBD level 2 risk factors and the level 1 risk factors that contain them

Identifying reviews

We used a wildcard (*) search term and applied the Cochrane SR filter to search the Cochrane Repository of Studies (CRS), a continuously-updated online repository of all systematic reviews in the Cochrane Library, for all reviews published within the last 5.5 years (January 1st 2011 to July 1st 2016). We chose this time period to focus our resources because previous research has shown this to be the median ‘life expectancy’ of SRs, after which they require updating to maintain relevance to health policy decision making¹³.

Eligibility criteria

We included completed Cochrane SRs or protocols of SRs of interventions, including overview reviews, to modify risk factors identified by GBD 2015 as a primary or secondary outcome of the SR. Reviews of interventions that utilised an apparent risk factor reduction strategy solely as a treatment for a condition were excluded, e.g. physical activity to treat depression, unless they either also sought to assess modification of the risk factor as a primary or secondary outcome, or targeted another risk factor included in GBD definitions e.g. physical activity to modify systolic hypertension. We also included reviews of interventions that directly facilitated risk factor modification e.g. mobile phone messaging to improve adherence to anti-hypertensives. For updated reviews, only the latest version of the review was included. Plans for future Cochrane reviews must first be published as peer reviewed protocols, before progressing to publication as full systematic reviews; we included protocols (herein, Cochrane SRs and protocols are collectively referred to as ‘publications’) but present our findings disaggregated by publication type, in order to give an indication of how the alignment of Cochrane SRs with risk factors may change as protocols reach the full review stage. Publications that had been withdrawn from the Cochrane Library (for any reason) were excluded, as were duplicates.

Data collection and analysis

Two review authors (DR and JC) independently screened all the publication citations and abstracts using *Covidence*® (Cochrane Collaboration) for potential inclusion. The full reports of potentially

eligible publications were then assessed independently by at least two authors (JC and DR or EP) for final inclusion.

We extracted data on items relating to publication level descriptors and GBD risk factor(s) addressed. We identified differences in data extraction between authors both by manual inspection and using an automated function in *Excel* (Microsoft), and resolved any differences in data extraction through discussion or, if necessary, by consulting a third author. GBD risk factor burden, quantified using DALYs, was extracted from the published GBD 2015 report⁸.

Analyses were performed using *STATA* version 11 software (StataCorp). Data were summarised as frequency and percentage for categorical data, and as median and interquartile range (IQR) for continuous or count data. We described characteristics of all included publications. We then described the characteristics, on a GBD risk factor level, of interventions assessed by publications, including the absolute number of publications investigating interventions for each risk factor as an outcome. Each risk factor included as an outcome in a publication was only counted once, but each publication could assess more than one risk factor, therefore the sum of publications investigating interventions for each risk factor could be greater than the total number of publications. We also describe the number of DALYs (in millions) per SR, and quantity of evidence from RCTs and other types of primary evidence. For risk factor level analyses, we analysed both SRs and protocols together and all SRs and protocols separately. Overviews of systematic reviews were excluded from descriptive analyses of number of included primary studies per risk factor.

Spearman's rank correlation was used to assess the strength of association between the count of Cochrane SRs assessing a GBD risk factor as the dependent variable, against the number of DALYs for that risk factor in 2015 as the independent variable, for all risk factors in the level 2 hierarchy, and for the three risk factor groupings of the GBD level 1 hierarchy. To assess whether risk factors had greater or fewer Cochrane SRs addressing them than expected, given the number of DALYs, we first calculated the Pearson residual for each level 2 risk factor¹⁴. We then divided the Pearson residuals by their standard error to calculate the standardised Pearson residual (SPR), which results in a distribution closer to the Gaussian so that values can be interpreted similarly to a Z score¹⁴. We adopted a conservative interpretation that SPRs exceeding +3 confirmed the presence of significantly greater publications than expected, and -3 as significantly fewer¹⁴.

RESULTS

Description of research sample


Our search-term identified 6396 citations yielding 574 publications (9% of the 6392 total citations returned after automated de-duplication) for data extraction, of which 400 (70%) were SRs and 174 (30%) protocols (see PRISMA flow diagram in appendix).

Of the 400 SRs, 1 was an overview of systematic reviews; 386 reviews (97%) were updates of previously conducted reviews. Of the 174 protocols, 3 were for overview systematic reviews; 11 (6%) of protocols were for updates of previously conducted reviews.

Corresponding authors of SRs or protocols listed addresses in 47 countries, most frequently the UK (28%), followed by Australia (13%), Canada, the United States and Italy (5-8%). Corresponding author addresses were from other high income countries in a further 20% of publications, and from low and middle income countries in only 19%. Systematic reviews included a total of 6800 primary studies, with a median of 9 primary studies per SR (interquartile range 3-19). The majority (93%) of reviews included RCTs as the highest level of evidence obtained, and 7% included only uncontrolled intervention or observational studies.

Given more than one GBD risk factor could be assessed as an outcome of interest in each publication, risk factors were an outcome a total of 637 times in the 400 SRs (see table 2), and 965 times in the 574 SRs or protocols. A limited selection of risk factors were outcomes of interest in overview reviews: tobacco smoking was the only risk factor to feature in a published overview of systematic reviews; child and maternal health was the outcome of interest in one protocol, high BMI in two protocols, high systolic BP one protocol, physical activity one protocol, and high fasting plasma glucose one protocol.

For all other systematic reviews, 'Air pollution' was an outcome in the fewest Cochrane SRs (1 SR), whereas 'child and maternal malnutrition' was the most frequently assessed outcome (96); the median was 22 Cochrane SRs per risk factor. 'Air pollution' had the highest number of DALYs per systematic review (167.29 million), and 'low bone mineral density' the fewest (0.52) (see figure 1). 'Tobacco smoke' reviews included the most primary studies (1552, of which 1415 were RCTs), and 'Air pollution' the fewest (0). When considered as a percentage of the total number of primary studies per risk factor, 89% of primary studies were RCTs, with the lowest percentage seen for 'environmental risks' (37%) and 'occupational risks' (53%), and the highest for dietary risks (99%). Fourteen percent of all reviews were 'empty', i.e. did not locate any primary studies meeting their inclusion criteria. The only systematic review addressing air pollution was an empty review, and high fasting plasma glucose had the second highest percentage of empty reviews (29%).

167.29 

>> insert Figure 1. Number of DALYs (millions) per Cochrane systematic review, for each GBD risk factor (n=637 systematic review outcomes). Note bar for 'air pollution' cut below actual value (167.29million DALYs) to better display values for other risk factors. <<

GBD – Global Burden of Disease

* Excludes single published overview of systematic reviews

^a Excludes missing data on 1/637 (0.16%) of SRs from which number of randomised primary research studies could not be ascertained

>> insert Table 2. Risk Factor level descriptive statistics extracted from included Cochrane publications (n=400 Cochrane SRs and 174 Protocols)<<

Correlation between number of systematic reviews and global risk factor burden

Formal analysis of correlation between the frequency with which a risk factor was assessed as an SR outcome, and DALYs per risk factor revealed a weak-positive correlation ($r=0.45$) (table 3), and for the number of all publication outcomes a moderate positive correlation ($r=0.55$). Number of SR outcomes and publication outcomes correlated most strongly for metabolic risk factors, then behavioural risks; a weak negative correlation was observed for environmental and occupational risks. This latter negative correlation was largely due to the influence of 'air pollution', as the correlation became moderate positive ($r=0.50$ for SRs) on its exclusion.

*SR – Systematic Review; *based on Global Burden of Disease 2015 level 1 hierarchy; †'outcomes' refers to occasions when a risk factor was assessed as an outcome in a systematic review/protocol; ‡'publication' refers to both systematic reviews and protocols*

>> insert Table 3. Spearman's r for the correlation between risk factors on the first level of the GBD risk factor hierarchy and number of systematic review outcomes (n=637), and number of publication outcomes (n=965) <<

The SPRs for 'High total cholesterol' (6.09), 'low bone mineral density' (7.49), 'Child and maternal malnutrition' (4.34), and 'alcohol and drug use' (3.03), were all greater than 3, inferring a higher than expected number of SR addressing this outcome (see figure 2). SPRs were lower than -3 for 'air pollution' (-7.11), 'dietary risk' (-7.83), and 'unsafe water, sanitation, and hand-washing' (-4.48) risk factors, demonstrating fewer than expected SR.

>> insert Figure 2. Bar chart of the standardised Pearson residual value for published Cochrane systematic reviews, on a GBD 2015 risk factor level. Upper and lower control limits (dashed lines) are equivalent to +3 and -3 residuals, respectively (n=637 review outcomes). <<

For all publications, the SPRs for 'High total cholesterol' (5.14), 'low bone mineral density' (7.75), 'low physical activity' (4.15), and 'Child and maternal malnutrition' (3.83) were all greater than 3, inferring a higher than expected number of publication outcomes (data not shown). SPRs were lower than -3 for 'air pollution' (-7.24), 'dietary risk' (-7.52), and 'unsafe water, sanitation, and hand-washing' (-4.60) risk factors, which had fewer than the expected number of publication outcomes.

DISCUSSION

To our knowledge, this is the first study to investigate whether the number of Cochrane SRs of interventions for *all* GBD level 2 modifiable risk factors aligns with the global risk factor burden. Analysis of the relationship between risk factor burden and corresponding number of reviews demonstrated a weak positive correlation overall. However, the burden of metabolic risk factors correlated highly with review output, although behavioural risks correlated weakly, and a negative correlation was observed for occupational and environmental risk factors. 'Air pollution' in particular but also 'dietary risks', and 'unsafe water, sanitation and hand-washing' risk factors featured as outcomes in fewer than expected systematic reviews, given their risk factor burden, and 'High total cholesterol', 'low bone mineral density', 'child and maternal malnutrition', and 'alcohol and drug use' in more than expected reviews. We cannot conclude definitively from our findings that particular risk factors are 'under-' or 'over-studied' but large mismatches between burden and output increase our confidence that some risk factors are wastefully over-studied, or worryingly 'neglected', with the complete absence of review evidence for air pollution being the most alarming example. Also of note, of the 574 relevant reviews or protocols identified, the corresponding author was from a low or middle income country in only 19% of reviews.

Our research has several important strengths. We selected included publications from all published Cochrane SRs rather than a sample, and used a rigorous inclusion process, minimising selection bias and obviating the need for inferential statistics (with associated error margins) to generalise across Cochrane reviews and compare between the risk factor sub-groups. We took steps to prevent potential misclassification of publications by using objective criteria and multiple authors to classify the risk factor studied, and we have correlated review numbers against the most recent and comprehensive estimate of global risk factor burden⁸.

Although we have only assessed publications in a single database, Cochrane SRs represent a very significant share of the total SRs published⁴, particularly for interventions, and they play an influential role in shaping global health policy. Because of resource constraints we were unable to examine all databases of systematic reviews globally. However there is evidence that Cochrane reviews do not differ in content or focus to other major collections of reviews of interventions⁴. We tested alignment against DALYs, which are not the only measure of risk factor burden available but as DALYs account for morbidity as well as mortality, we believe they are more reflective of actual health needs and societal impact than using incidence, prevalence, or mortality measures alone. We did not adjust for potential confounders such as low volume of primary research that may also

explain relative differences in SR publication rates. However, a Cochrane principle is to prioritise review production based on the needs of ‘consumers’ (patients, clinicians, and policymakers), and not based on likely yield. Indeed, ‘empty’ reviews are considered to be an important finding in themselves, illustrating important gaps in primary research and there is no available evidence to suggest that the availability of studies is a motivating factor for authors when undertaking reviews. Indeed, in this study we found that 14% of risk factor reviews were ‘empty’.

Other authors have examined Cochrane output to determine how it aligns with very specific areas of the GBD. A 2005 gap analysis and prioritisation exercise of Cochrane and non-Cochrane reviews of public health topics mapped public health interventions against global health risks¹⁰. Risk factors evaluated by our study that were not addressed to any great extent by the identified systematic reviews at that time (i.e. less than 3% of total number of reviews) included prevention of health risks in areas of environment, occupation, and childhood sexual abuse; child and maternal under-nutrition was also flagged as an important research gap^{10 11}. Our findings suggest that progress has been made on only some of these topics, particularly child and maternal under-nutrition.

There are a number of possible reasons for the low numbers of ‘air pollution’, sanitation, and ‘dietary risks’ reviews. It could be due to perceived difficulty caused by anticipated low numbers of RCTs on which to base a review, yet the number of reviews on the broadly similar risk factors of ‘other environmental risks’ and ‘occupational risks’ were much closer to that expected, despite identifying a relatively low percentage of RCTs as primary evidence. Our profile of SRs also showed a large majority of corresponding authors were from high income settings. Reviews on environmental risk factors may simply not be prioritised by editors and authors predominantly based in high income countries, where the diseases they cause have less impact, rather than metabolic and behavioural risk factor reviews that more closely fit the epidemic of non-communicable diseases responsible for most disease in these settings. Indeed it has long been acknowledged that ‘systematic reviews more often address health problems that are priorities in HICs, to the neglect of problems in low- and middle-income countries’¹⁵. Our work suggests that this inequity may still persist despite work to create an ‘equity lens for priority setting and agenda setting’ to enable groups to develop a more equity-oriented approach in setting the research agenda¹⁶. The dietary risks included in GBD are burdensome in all income settings however, and other reasons for their relative exclusion need to be sought.

It is important to note that many of the risk factor interventions are likely to be complex interventions; this is clearly likely to be the case for behavioural and environmental risk factors. It is challenging to design appropriate studies of complex interventions and this may have contributed to the fact that areas are ‘understudied’. RCTs, for example, were developed to examine the effectiveness of clinical interventions. This has been highlighted in the current debate on the need for a ‘complex systems approach’ in this area¹⁷. As this research area grows, employing a broad range of methods to evaluate complex interventions, so systematic reviewers will need to develop and adapt their methodology to capture these studies. Exactly how agreement is reached on what systematic reviews should be conducted is not uniform across the global collaboration - factors such as the burden of a disease/risk factor are part of a more complex process that use a wide variety of methods to identify and rank topics for reviews, ranging from online surveys and web-based question submission options to face-to-face meetings with patients and clinicians. However it is important that the methods used should at least strive to be inclusive and open^{15 16}.

Our study highlights potential global inequities in health research and the need for all researchers and influential health organisations such as Cochrane, who have a global reach and commitment as a global provider of health evidence, to consider how best to address this. In its 'Strategy for 2020', Cochrane aims to 'put its evidence at the heart of health decision-making all over the world', and acknowledges the responsibility to expand the evidence it produces in global health¹⁸. We appreciate that Cochrane has considered issues of research prioritisation in depth¹⁸ and argue that it should ensure measures of global burden of risk factors and diseases are routinely considered when prioritising relevant research, and provide the tools so that review groups and authors are not constrained to synthesising only RCT-based evidence.

COMPETING INTERESTS

The majority of the work on this paper was conducted when JC was at Cochrane UK on medical elective as part of his undergraduate studies and whilst DR was placed at Cochrane UK as part of his training rotation in public health. EP is employed on a consultancy basis by Cochrane UK.

CONTRIBUTORSHIP

DR designed the study and conducted the search along with JC. DR, JC & EP extracted the data. DR & JC conducted the analyses. All authors were involved in the draft and substantial redraft of the paper and all approved the final version.

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Table 1. Global Burden of Disease 2015 risk factors in hierarchy levels 1 and 2, with the highest associated global DALY burden in 2015 (level two risk factors are given in this order)⁸

| GBD Hierarchy level 1 risk factor | GBD Hierarchy level 2 risk factor |
|-----------------------------------|---|
| Environmental and occupational | Air pollution |
| | Occupational risks |
| | Other environmental risks |
| | Unsafe water, sanitation, and handwashing |
| Metabolic | High Body Mass Index |
| | High fasting plasma glucose |
| | High systolic blood pressure |
| | High total cholesterol |
| | Low bone mineral density |
| | Low glomerular filtration rate |
| Behavioural | Alcohol and drug use |
| | Child and maternal malnutrition |
| | Dietary risk |
| | Low physical activity |
| | Sexual abuse and violence |
| | Tobacco smoke |
| | Unsafe sex |

Table 1: GBD level 2 risk factors and the level 1 risk factors that contain them

| GBD 2015 Risk Factor (level 1 in italic, level 2 in bold) | Burden in millions of DALYs (rank high to low) | Assessed in <i>n</i> systematic review outcomes (rank) | DALYs (millions) per systematic review outcome | Primary studies included in systematic reviews* | Primary incl systema (% risk primary s |
|--|--|--|--|---|--|
| <i>Environmental Risks</i> | | | | | |
| Air pollution | 167.29 (5) | 1 (17) | 167.29 | 0 | |
| Occupational risks | 63.62 (12) | 14 (12) | 4.54 | 197 | |
| Other environmental risks | 10.67 (16) | 2 (16) | 5.34 | 35 | |
| Unsafe water, sanitation and handwashing | 95.31 (9) | 6 (15) | 15.88 | 69 | |
| <i>Behavioural Risks</i> | | | | | |
| Low physical activity | 34.60 (14) | 22 (9) | 1.57 | 164 | |
| Sexual abuse and violence | 20.80 (15) | 9 (14) | 2.31 | 43 | |
| Tobacco smoke | 170.89 (4) | 69 (3) | 2.48 | 1552 | |
| Unsafe sex | 79.45 (11) | 33 (8) | 2.41 | 228 | |
| Alcohol and drug use | 111.37 (8) | 59 (6) | 1.89 | 806 | |
| Child and maternal malnutrition | 172.12 (3) | 96 (1) | 1.79 | 732 | |
| Dietary risks | 264.41 (1) | 13 (13) | 20.34 | 139 | |
| <i>Metabolic Risks</i> | | | | | |
| High BMI | 120.13 (7) | 58 (7) | 2.07 | 495 | |
| High fasting plasma glucose | 143.08 (6) | 63 (5) | 2.27 | 312 | |
| High systolic blood pressure | 211.82 (2) | 90 (2) | 2.35 | 990 | |
| High total cholesterol | 88.70 (10) | 67 (4) | 1.32 | 844 | |
| Low GFR | 54.43 (13) | 18 (10) | 3.02 | 132 | |
| Low bone mineral density | 8.81 (17) | 17 (11) | 0.52 | 65 | |
| TOTAL | 1817.49 | 637 | n/a | 6800 | |
| <i>MEDIAN (IQR)</i> | <i>83.87 (51.91-141.46)</i> | <i>22 (13-63)</i> | <i>2.35 (1.89-4.54)</i> | <i>197 (69-732)</i> | |

GBD – Global Burden of Disease

* Excludes single published overview of systematic reviews

^a Excludes missing data on 1/637 (0.16%) of SRs from which number of randomised primary research studies could not be ascertained

Table 2. Risk Factor level descriptive statistics extracted from included Cochrane publications (n=400 Cochrane SRs and 174 Protocols)

| Risk factor grouping | Spearman's <i>r</i> for SR outcomes [†] | Spearman's <i>r</i> for publication [‡] outcomes [†] |
|--|---|---|
| Environmental and occupational risks* | -0.40 | -0.40 |
| Behavioural risks* | 0.46 | 0.46 |
| Metabolic risks* | 0.83 | 0.99 |

| | | |
|---------------------------------|-------------|-------------|
| <i>All on level 2 hierarchy</i> | <i>0.45</i> | <i>0.55</i> |
|---------------------------------|-------------|-------------|

*SR – Systematic Review; *based on Global Burden of Disease 2015 level 1 hierarchy; †‘outcomes’ refers to occasions when a risk factor was assessed as an outcome in a systematic review/protocol; ‡‘publication’ refers to both systematic reviews and protocols*

Table 3. Spearman’s r for the correlation between risk factors on the first level of the GBD risk factor hierarchy and number of systematic review outcomes (n=637), and number of publication outcomes (n=965)

