Reassessing the health impacts of trade and investment agreements: a systematic review of quantitative studies, 2016–20

Article  (Accepted Version)

Barlow, Pepita, Sanap, Rujuta, Garde, Amandine, Winters, L Alan, Mabhala, Mzwandile A and Thow, Anne-Marie (2022) Reassessing the health impacts of trade and investment agreements: a systematic review of quantitative studies, 2016–20. The Lancet Planetary Health, 6 (5). E431-E438. ISSN 2542-5196

This version is available from Sussex Research Online: http://sro.sussex.ac.uk/id/eprint/105200/

This document is made available in accordance with publisher policies and may differ from the published version or from the version of record. If you wish to cite this item you are advised to consult the publisher's version. Please see the URL above for details on accessing the published version.

Copyright and reuse:
Sussex Research Online is a digital repository of the research output of the University.

Copyright and all moral rights to the version of the paper presented here belong to the individual author(s) and/or other copyright owners. To the extent reasonable and practicable, the material made available in SRO has been checked for eligibility before being made available.

Copies of full text items generally can be reproduced, displayed or performed and given to third parties in any format or medium for personal research or study, educational, or not-for-profit purposes without prior permission or charge, provided that the authors, title and full bibliographic details are credited, a hyperlink and/or URL is given for the original metadata page and the content is not changed in any way.

http://sro.sussex.ac.uk
Re-assessing the health impacts of trade and investment agreements: a systematic review of quantitative studies, 2016-2020

Pepita Barlow¹, Rujuta Sanap², Amandine Garde³, L Alan Winters⁴, Mzwandile A Mabhala⁵, Anne-Marie Thow⁶

1 – DPhil. Department of Health Policy, London School of Economics and Political Science, Houghton Street, London, WC2A 2AE, United Kingdom
2 – MSc. Department of Health Policy, London School of Economics and Political Science, Houghton Street, London, WC2A 2AE, United Kingdom
3 – Full Professor. School of Law and Social Justice, University of Liverpool, Chatham Street, Liverpool L69 7ZR, United Kingdom
4 – Full Professor. Department of Economics, University of Sussex Business School, BRIGHTON BN1 9SL, United Kingdom.
5 – University of Chester, Parkgate Road, Chester CH1 4BJ, United Kingdom
6 – Menzies Centre for Health Policy, School of Public Health, Edward Ford Building, A27 Fisher Rd, University of Sydney NSW 2006, Australia

Corresponding author

Pepita Barlow, p.barlow@lse.ac.uk

Word count

2, 979 words (word limit: 3,000 words in main text)
Summary

Background

In order to ensure a high level of health protection, governments must ensure that health and trade policy objectives are aligned. In this article, we conduct a systematic review of the health impacts of Trade and Investment Agreements (TIAs) in order to provide a timely overview of the evidence in this field.

Methods

We systematically reviewed studies evaluating the health impacts of TIAs published between 19th January 2016 and 10th July 2020. Studies were included if they were quantitative empirical studies evaluating the impact of TIAs or a trade/investment policy on a health determinant or outcome. We performed a narrative synthesis, evaluated methodological quality, and analysed co-citation patterns.

Findings

Among 28,066 articles identified by our search, 21 met our review criteria. Methodologically strong studies showed that TIAs and trade policy reforms corresponded to reduced child mortality, deteriorating worker health, rising sugar, tobacco, and alcohol supplies, and rising rates of suicides and drug poisoning among those heavily exposed to tariff reductions on imports within TIAs. However, these associations varied across country contexts and according to individual socio-economic characteristics. TIAs also associated with increases in the supply, imports, and sales of ultra-processed foods, SSBs, and sugars.

Interpretation

TIAs have diverse impacts on health and health-determinants and these effects vary significantly across contexts and socio-economic groups. Governments seeking to negotiate healthy trade policies
should take these updated findings into account to ensure that opportunities for health improvement are leveraged and harms are avoided.

Funding

UK Prevention Research Partnership, Medical Research Council.
Research in Context

Evidence before this study
Ensuring the highest level of health protection requires a ‘Health in All Policies’ approach that systematically assesses the health implications of policy decisions outside of the health sector, avoids harmful health impacts, and seeks synergies across sectors. This approach is particularly important for governments seeking to ratify Trade and Investment Agreements (TIAs). TIAs set rules governing trade between signatories and can have profound short- and long-term consequences for population health and peoples’ opportunities for living healthy lives. However, in order to ensure that TIAs and health policy goals are aligned, it is first necessary to draw on up-to-date assessments of empirical evidence evaluating the health impacts of TIAs.

We searched PubMed, EMBASE, and Google Scholar for studies assessing the impact of TIAs and trade and investment policies that are common components of TIAs (e.g. tariff changes) on health determinants and outcomes. From this search we identified two previous systematic reviews, published within the last decade, which found that implementing TIAs was correlated with increases in access to unhealthy foods and in overweight/obesity, but that existing research precluded causal conclusions due to methodological limitations and inconsistencies, and that cross-disciplinary engagement was sparse. However, several papers have evaluated TIA impacts since the publication of those reviews using more rigorous methodologies, incorporating insights from other disciplines, and assessing a wider range of outcomes. There is therefore a need for an updated systematic review of evidence on the health impacts of TIAs, which we here provide

Added value of this study
This review and thematic analysis of the literature draws on recent high-quality studies to provide a timely overview of the impact of TIAs and related trade policies on a range of health outcomes and determinants. Our review identifies considerable variation in the estimated impact of TIAs on health
and health determinants across outcomes, households, and country-contexts. Methodologically strong studies in our review showed that TIAs and trade policy reforms corresponded to reduced child mortality rates, although these associations varied according to household and country characteristics. Trade agreements were also associated with deteriorating worker health and rising rates of deaths from drug poisoning suicide, and alcohol-related liver disease, or ‘deaths of despair’, in regions heavily exposed to tariff changes within TIAs. In contrast, health improvements were experienced among relatively skilled and socio-economically advantaged workers. Several studies found that signing TIAs with the USA corresponded to increases in the supply, imports, and sales of ultra-processed foods, sugar-sweetened beverages, and sugar. There was also some moderate and weak evidence suggesting associations between trade policy and additional outcomes, including changes in in food insecurity, imports of alcohol, and government health expenditure. Co-citation analysis further showed a moderately weak tendency of studies to cite studies published in journals in different disciplines.

**Implications of all the available evidence**

This review demonstrates that TIAs have diverse impacts on peoples’ opportunities for living long and healthy lives, both for better and for worse, and these effects vary significantly across contexts and socio-economic groups. TIAs, therefore, create both benefits and harms to health promotion. Our findings suggest that a ‘Health in All Policies’ approach to trade negotiations should ensure that the harms we identify are mitigated and that the health improvements we identify are realised and shared. To facilitate this, governance systems must enable medical groups and civil society to participate in trade policy scrutiny and contribute to public policy discussions on trade. While improving the evidence base is an important part of achieving healthy trade policy, action to improve the political priority and attention to health within trade policy will also be required.
Introduction

Ensuring healthy lives for all is central to global efforts to improve population health, reduce health inequalities, and accelerate progress towards the achievement of the 2030 Sustainable Development Goals (SDGs).\(^1,2\) To this effect, the World Health Organization (WHO) has called on governments to adopt a ‘Health in All Policies’ approach that considers the health implications of policy decisions outside of the health sector.\(^4\) This perspective is particularly important for governments seeking to ratify Trade and Investment Agreements (TIAs). TIAs set rules governing trade between states in order to promote cross-border trade. On 20 September 2020, 307 TIAs were in force globally.\(^5\) TIAs are a major component of globalization and are often introduced as a result of diverse political and economic factors.

TIAs are not designed to influence population health. However, the many possible impacts of TIAs on health are well-established.\(^6,7\) Potential consequences include improved child health as a result of income growth, reduced food insecurity as a result of trade in food, and increased supplies of unhealthy commodities including tobacco, alcohol, and sugar-sweetened drinks.\(^8-11\) The WHO, politicians, civil society, and academics have therefore called for increased attention to the synergies and tensions between trade promotion and the protection and promotion of health and health equity.\(^12,13\) Achieving this requires timely assessments of empirical evidence and the integration of findings from different disciplines. Reviews up to 2016 identified associations between trade policy implementation and harmful commodity sales, and called on scholars to examine a wider range of outcomes using methodological approaches that better account for concurrent economic and political changes.\(^14,15\) Scholars in the field have since examined additional outcomes and utilised quasi-experimental methods, which are suited to evaluating policies like TIAs which cannot be feasibly randomized.\(^16\) It is, therefore, necessary to provide an updated evidence review. The aim of this systematic review is to examine studies from 2016-20 evaluating the impact of TIAs on the determinants of health and health outcomes.

Method

Search strategy and inclusion criteria

We followed the procedures in the preferred reporting items for systematic reviews and meta-analyses (PRISMA) statement set out by Moher et al.\(^17\) Figure 1 below shows the PRISMA diagram (see Appendix 1 for PRISMA checklist).

[Figure 1 about here]
We searched Web of Science, Scopus, PubMed, EMBASE, OVID, Global Health Online, EconLit, WestLaw, and Lexis on 10th July 2020 for studies assessing the impact of TIAs and trade and investment policies that are common components of TIAs (e.g. tariff changes) on health determinants and outcomes. We applied language and date restrictions to identify studies published in English since 19th January 2016 (the day after the previous search was undertaken). Appendix 2 details our search strings.

Studies were eligible for inclusion if they were quantitative empirical studies evaluating the impact of TIAs or a trade/investment policy that is typically incorporated within TIAs (e.g. tariffs, quotas) on a health determinant or outcome (see Appendix 3). Qualitative studies were excluded as our aim was to quantify policy impacts. Full-text eligibility assessment was performed by RS. PB independently assessed the eligibility of a sample of records (n=82) to ensure consistency in applying the exclusion criteria and to resolve any ambiguities. Forward and backward citation searching (i.e., identification of additional cited within an included study) and consultations with topic experts were also used in parallel to identify additional articles (n=2).

Data extraction and synthesis
Two review team members extracted the data and assessed risk of bias of included papers. The following information was obtained from each study following a pre-defined plan: study title, author(s), journal, publication year, research question, study design, countries analysed, treatment and comparison groups, data sources, variable measurement, mediating/ moderating variables, covariates, method of data analysis, results, and conclusions. We assessed the scientific quality and risk of bias in selected studies using the Effective Public Health Practice Project (EPHPP) Quality Assessment Tool for Quantitative Studies. Methodological components and aggregated scores were categorised into three levels: ‘strong’, ‘moderate’ or ‘weak’ (see Appendix 4). We further analysed
co-citation patterns. Co-citation patterns capture the extent to which sources are cited together by other documents and is a proxy for whether insights from different fields are being acknowledged collectively.\textsuperscript{19,20} Appendix 5 provides further details.

Data synthesis was performed following data extraction and quality rating. Furthermore, meta-analysis was not possible due heterogeneity of methods and measures studied. We therefore conducted a thematic analysis of included studies, with a greater weight to studies with higher quality scores.\textsuperscript{21} We note that risk of bias across studies may arise due to selective reporting and publication bias.

\textit{Role of the funding source}
The study's funders had no role in the study design, data collection, data analysis, or writing of the report. All authors had full access to all the data and had final responsibility for the decision to submit for publication.

\textbf{Results}
Our searches identified \(n=28,066\) articles. After excluding duplicates and ineligible articles, we identified \(n=21\) studies for inclusion (see Figure 1). Included studies are summarised in Table 1. Studies included data from various countries and regions: twelve were in Low- and Middle-Income Countries (LMICs), four in HICs and four had mixed samples.

[Table 1 about here]

Figure 2 shows the results from our full quality assessment (additional details in Appendix 6). Most studies controlled for relevant confounders (15/21 studies), and all studies used appropriate methods for data analysis (21/21 studies). All studies scored ‘moderate’ on ‘study design’, as papers were
either quasi-random or non-randomised studies, rather than Randomized Controlled Trials (RCTs), limiting definitive causal conclusions. Additional weaknesses arose because studies did not report or comment on measurement validity (e.g. content validity).

[Figure 2 about here]

Figure 3 plots the results from our co-citation analysis. There was a moderately weak tendency of studies to cite papers published in journals in different disciplines. Appendices 7-8 show that these results are consistent across alternative network clustering specifications.

[Figure 3 about here]

In terms of interventions, 9 analysed the impact of TIAs, including three of the USA’s. Six assessed the impact of trade taxes, ‘tariffs’; 2 studies used binary indicators of trade policy liberalisation, 2 used composite measures of trade liberality, and 1 analysed associations with a proxy for agricultural trade subsidies.

Below we discuss the studies in detail, grouped by outcome. Seven studies measured the direct impacts of policies on health outcomes, of which 4 assessed child health outcomes measured as child mortality and nutrition; 2 provided evidence on workers’ health outcomes; and 1 assessed nutritive health outcomes among adults (i.e. overweight and obesity). Thirteen assessed indirect impacts on health via changes to health-determinants, including 2 on healthcare and access to medicines. Eleven assessed NCD risks, with 6 assessing impacts on diets and food environments.

Turning first to child mortality, 3 ‘strong’ studies assessed trade policy impacts on child mortality and documented decreases in child mortality following trade liberalisation and/or TIA
ratification.\textsuperscript{8,22,23} One study analysing the impact the AGOA (African Growth and Opportunity Act, a US trade act) across 30 sub-Saharan African countries, 2000–2008, found that, on average, being born after the AGOA’s implementation reduced the probability of infant and neonatal deaths by approximately 9–12\%. The largest reductions were experienced among countries that exported large quantities of agricultural goods and mineral ores compared to oil exporting countries, among children who lived rurally, and whose mothers were uneducated and worked in agriculture or manual labour. Barlow (2018) further assessed the relationship between trade liberalisation and country-level rates of child mortality in 36 LMICs, 1963–2005, and documented “no universal association” between trade liberalisation and child mortality, with post-liberalisation changes in child mortality varying by \(\sim 40\%\) across liberalisation episodes. Olper et al. similarly found that rates of child mortality varied substantially following liberalisation reforms.\textsuperscript{22}

Two ‘strong’ studies assessed the relationship between trade policy and nutritive health outcomes, i.e. health outcomes related to nutrition.\textsuperscript{24,25} Adjaye-Gbewonyo et al. (2019) analysed tariffs and subsidies, which can distort agricultural prices and are captured in the Nominal Rate of Assistance (NRA). They found that increase in five-year average NRAs was associated with improved height-for-age and weight-for-age Z-scores. Improvements were greatest among children who had at least one parent earning wages in agriculture. Boysen et al. modelled the links between import tariffs on highly processed foods and the prevalence of both obesity and underweight among adults, finding that in middle-income countries in SSA, a 1\% increase in the tariff differential (larger tariffs on processed vs. unprocessed foods) corresponded to a 0.18\% decrease in obesity prevalence. Results were not significant in other sub-samples.

A further two ‘strong’ studies assessed the effect of tariff changes on workers’ health.\textsuperscript{26,27} One study assessed changes in work-related injuries after China’s WTO accession due to increased working hours as a result of expanding trade. Fan et al. calculated exposure to changes in the tariffs on inputs
used by manufacturing firms and found a one standard-deviation reduction in the measure of tariff exposure was associated with a 0.27 standard-deviation (7.6%) increase in the probability of reporting experience of an illness/injury. However, for high-skilled-workers and those with the highest levels of educational attainment, tariff exposure correlated with a reduced probability of reporting illness or injuries. Pierce and Schott (2020) analysed changing county-level mortality rates in the US due to import competition with China and its consequences for local employment prospects. The authors compared mortality rates among US counties with different degrees of exposure to imports affected by the removal of uncertainty over tariff rates. They found that moving from the 25th percentile to 75th percentile of exposure was associated in an increase in the annual mortality rate from drug overdoses by 2 to 3 deaths per 100,000 people in each year after the policy.

Twelve studies evaluated impacts on NCD risk factors. Studies of strong quality demonstrated that implementing US FTAs associated with increases in the supply and sales of ultra-processed foods and sugars. For example, one study found that supply and likely use of High-Fructose Corn Syrup (HFCS) in Canadian food production tripled after a 5% HFCS tariff was abolished as part of the 1994 North American Free Trade Agreement (NAFTA). Another study found that implementation of the Canada-US Free Trade Agreement (CUSFTA) in 1989 was followed by a 170 kcal/person/day increase in the number of calories in the Canadian food supply. Consistent findings were reported in additional studies.

However, there were three exceptions to this general pattern of increased availability of harmful foods. One study found that following accession to WTO, member states experienced immediate increases in the domestic supply of fruits and vegetables of 55 g per person per day on average, compared to non-member countries. WTO membership was not associated with changes in supplies of red meats or edible oils, and changes in sugar availability were inconsistent across models. Another
study identified a 122% increase in Peruvian soft-drink production after the US-Peru FTA, although overall sales of SSBs did not increase.\textsuperscript{37}

We identified one ‘strong’ study which assessed the relationship between cross-sector trade liberalisation and food security and found that in high-income countries, liberalisation corresponded to reduced food insecurity, whereas in low-income countries, households in the lowest income group were more likely to report food insecurity where trade policy was more liberal.\textsuperscript{38} A study of the Dominican Republic also found that consumers faced increasing household food expenditures following the Dominican-Republic-Central-America-Free-Trade-Agreement (CAFTA-DR).\textsuperscript{34}

Two additional ‘moderate’ quality studies evaluated impacts on other unhealthy commodities. Schram et al. (2020) found that implementing an FTA with Australia corresponded with a 65% increase in the share of Australian alcoholic beverage imports in partner countries’ total alcoholic beverage import supply. Cowling et al. further identified increases in the mean supply of tobacco and alcohol of 6.2% and 3.6% per year respectively following WTO accession, compared to non-members.\textsuperscript{36} A further study by Appau et al. (2017) found mixed effects of trade liberalisation on tobacco investments and supply in sub-Saharan Africa, 1990-2013.\textsuperscript{39} Finally, two studies rated as ‘weak’ analysed relationships between trade policy and outcomes related to healthcare access and services. Son et al. (2020) analysed the association between the implementation of the Korea-US FTA and the time taken for new drugs approved in the US to become available in Korea (‘drug lag’). The study did not identify a statistically significant impact of the TIA on ‘drug lag’.\textsuperscript{40} A further study tested the hypothesis that tariff reductions correspond to declines in public health expenditure via changes to government tax revenues: they did so modestly in LMICs with low capacity to levy alternative taxes, whilst health spending increased where countries had moderate to strong capacities to levy alternative taxes.\textsuperscript{41}
Discussion

This systematic review has identified considerable variation in the estimated impact of TIAs on health and health determinants across outcomes, socio-economic groups, and country-contexts. Several studies showed that more educated individuals, higher income groups, and those working in export sectors experienced health gains (e.g. reduced food insecurity, child mortality and injuries), whereas poorer households, workers with less education, and/or those in less competitive industries experienced no such gains and experienced some health deteriorations (e.g. injuries, deaths of despair). Improvements in aggregate child mortality rates and food insecurity were also apparent primarily in wealthy societies with a strong, democratic governance, whereas the poorest countries without such institutions did not experience such benefits. TIAs also associated with increases in the supply of alcohol and tobacco, and rising supply, imports, and sales of ultra-processed foods, SSBs, and sugars. Overall, a majority of included studies was rated as either strong (35%) or moderate (45%), and there was a moderately weak tendency of studies to cite studies published in journals in different disciplines.

The inclusion of new evidence from recent, high-quality quasi-experimental studies in this field has generated new conclusions regarding the relationship between TIAs and health. First, in contrast to previous reviews, we identified studies examining a wide range of outcomes. We find that whether TIAs yielded changes that were beneficial or deleterious to health varied markedly according to the outcome studied. For example, some studies identified select improvements in child health, and others identified increasingly obesogenic food environments following TIA implementation. Second, studies have more recently examined socio-economic disparities, and studies in our review identified important differences in health consequences across socio-economic groups and country contexts. Several studies documented associations between trade liberalisation and improvements in health or health-determinants in relatively advantaged socio-economic groups, whereas lower socio-
economic groups experienced harms. Each of these sources of heterogeneity demonstrates that the nature, direction and scale of TIAs and trade policy impacts on health determinants and outcomes depends on the outcome under study, individual socio-economic circumstances, and country context.

We acknowledge several limitations. First, meta-analysis was not feasible given the heterogeneity of methods, outcomes, and measures used in the field. Second, we restricted our analysis to quantitative studies. Qualitative studies have provided useful evidence on mechanisms of TIA impacts on health, including assessments of how TIAs have exposed governments to pressure to delay, change or repeal diverse health policies in order to ensure alignment with trade treaty obligations. Third, we measured trans-disciplinary engagement of studies in the field using co-citation analysis, which may not fully capture the degree of inter-disciplinary engagement. Fourth, our findings may have limited representativeness due to publication bias.

For studies included in this review, there were also methodological challenges. Researchers in this field must necessarily rely on non-experimental observational analyses in the absence of feasible randomised experimentation. Several studies have sought to address challenges to causal inference by exploiting quasi-random trade policy assignment or by using methods to re-construct counterfactual comparison units. Whilst these methods can address observed and sometimes unobserved confounding; they remain limited in their capacity to account for the possible influence unknown factors beyond researchers’ control (e.g. coinciding policy changes).

There are also measurement challenges, even where stronger quasi-experimental designs are used. For example, some studies used sales indicators as proxy for consumption levels, and there are few cross-national comparative databases containing individual-level data. This has limited studies' capacity to link macro-level trade policy changes to individual outcomes and inequalities therein. Furthermore, researchers have typically focussed their studies on a limited range of outcomes associated with specific components of TIAs. Whilst this has helped identify quasi-random exposure
to trade policy, it precludes holistic assessments of the TIAs in question. Thus, while import competition from Chinese manufactures may be associated with deaths of despair as the USA liberalises trade with China, for example, there may well be social benefits from expanding US service sector employment and exports to China that the same policy engenders.46

The findings and limitations of this review identify important areas for future research on TIAs and health. There is a need for further improvements in cross-disciplinary engagement in this field to ensure future research tests hypotheses that integrate and advance existing research. There is also scope for quasi-experimental studies to evaluate individual-level changes to a wider range of health outcomes, including tobacco, alcohol, and healthcare provision and access, for example. Furthermore, we did not identify any studies assessing impacts on pollution and environment-related outcomes and pathways, although evidence elsewhere indicates possible impacts.47 Further research is also needed to investigate heterogeneity in TIA impacts to identify what interventions might help ensure health benefits are realised, and that harms are prevented.

Taken together, the findings of this systematic review demonstrate that TIAs can have diverse impacts on health, both for better and for worse, although these effects vary significantly across contexts and socio-economic groups. Our findings emphasise that for any specific TIA the expected benefits (eg in terms of incomes) must be weighed against this evidence base and the varying impacts of TIAs across socio-economic groups we identify. The effects of a TIA depend, at a minimum, on the provisions it contains and the nature of the trade it affects. There can be no general statements about the effects of TIAs and no alternative to a detailed analysis of specific agreements. Nonetheless, the evidence provided in this review can inform national and global strategies to ensure health and trade policy goals are aligned, as we have identified how TIAs can create both opportunities and harms for health promotion. This evidence, in turn, supports a ‘Health in All Policies’ approach to trade negotiations. There are opportunities for policymakers to align TIAs with health goals, such as
reductions in child mortality. However, the adverse impacts we identified on the consumption of unhealthy commodities and worker health can also have long-term, harmful consequences and lead to rising healthcare costs.\textsuperscript{48} Recognising the long-term economic impacts of these harmful health consequences may provide an economic incentive for effective mitigation and help to align the goals of trade policymaking, which typically targets economic outcomes, with health goals.

Action to raise the political priority and attention to health within trade policy will also be required. First, governance systems must ensure opportunities to protect and promote health are realised through cross-disciplinary engagement in trade policy scrutiny.\textsuperscript{49,50} Second, it may be fruitful to prevent adverse impacts through changes to TIA design (e.g., avoiding tariff reductions on unhealthy commodities) or policy mitigations (e.g. increased access to social security). Third, re-framing TIA evaluations using a human-rights framework can draw attention to how the right to health under international law, including among children, can be either sustained or undermined by TIAs.
Author contributions

PB, AMT, AG, LAW and AM conceptualised the study and designed the methodology. RS conducted the literature searches, extracted the data, and conducted a preliminary analysis of the data. PB verified the literature searches, data extraction, and analysis. RS and PB wrote the initial draft of the paper. All authors reviewed and edited the final draft.

Declarations of interests
The authors declare no competing interests.
References

1. Waage, J. *et al.* Governing the UN Sustainable Development Goals: interactions, infrastructures, and institutions. *Lancet Glob. Heal.* 3, e251–e252 (2015).

2. UN. *Resolution adopted by the General Assembly on 25 September 2015.* (2015).

3. Dür, A., Baccini, L. & Elsig, M. The design of international trade agreements: Introducing a new dataset. *Rev. Int. Organ.* 9, 353–375 (2014).

4. WHO. *The 8th Global Conference on Health Promotion, Helsinki, Finland, 10-14 June 2013: The Helsinki Statement on Health in All Policies.* (2013).

5. WTO. *Regional Trade Agreements.* (2020). Available at: https://www.wto.org/english/tratop_e/region_e/region_e.htm. (Accessed: 23rd December 2020)

6. Blouin, C., Chopra, M. & van der Hoeven, R. Trade and social determinants of health. *Lancet* 373, 502–507 (2009).

7. Gleeson, D. *et al.* Analyzing the impact of trade and investment agreements on pharmaceutical policy: provisions, pathways and potential impacts. *Global. Health* 15, 78 (2019).

8. Panda, P. Does trade reduce infant mortality? Evidence from sub-Saharan Africa. *World Dev.* 128, 104851 (2020).

9. Barlow, P., Loopstra, R., Tarasuk, V. & Reeves, A. Liberal trade policy and food insecurity across the income distribution: an observational analysis in 132 countries, 2014–17. *Lancet Glob. Heal.* 8, e1090–e1097 (2020).

10. Thow, A.-M. Trade liberalisation and the nutrition transition: mapping the pathways for public health nutritionists. *Public Health Nutr.* 12, 2150–8 (2009).

11. Ogunseitan, O. A., Schoenung, J. M., Saphores, J.-D. M. & Shapiro, A. A. The electronics revolution: from e-wonderland to e-wasteland. *Science (80-. ).* 326, 670–671 (2009).

12. Smith, Blouin, C., Mirza, Z., Beyer, P. & Drager, N. Trade and Health: Towards Building a National Strategy. (WHO, 2015).

13. McNeill, D. *et al.* Political origins of health inequities: trade and investment agreements. *Lancet* 389, 760–762 (2017).

14. Barlow, P., McKee, M., Basu, S. & Stuckler, D. The health impact of trade and investment agreements: a quantitative systematic review and network co-citation analysis. *Global. Health* 13, 13 (2017).

15. Cowling, K., Thow, A. M. & Pollack Porter, K. Analyzing the impacts of global trade and investment on non-communicable diseases and risk factors: a critical review of methodological approaches used in quantitative analyses. *Global. Health* 14, 53 (2018).

16. Craig, P. *et al.* Using natural experiments to evaluate population health interventions: new Medical Research Council guidance. *J. Epidemiol. Community Heal.* 66, 1182–1186 (2012).

17. Liberati, A. *et al.* The PRISMA statement for reporting systematic reviews and meta-analyses of studies that evaluate health care interventions: Explanation and elaboration. *Annals of Internal Medicine* 151, (2009).

18. Thomas, H., Ciliska, D. & Dobbins, M. A process for systematically reviewing the literature: providing the research evidence for public health nursing interventions. *Worldviews Evidence-Based Nurs.* 1, 176–184 (2004).
19. Small, H. Co-Citation in Scientific Literature: A new measure of the relationship between two documents. *Journal of the American Society for Information Science* 24, 265–269 (1973).

20. van Eck, N. J. & Waltman, L. Software survey: VOSviewer, a computer program for bibliometric mapping. *Scientometrics* 84, 523–538 (2010).

21. Baxter, S., Killoran, A., Kelly, M. P. & Goyder, E. Synthesizing diverse evidence: the use of primary qualitative data analysis methods and logic models in public health reviews. *Public Health* 124, 99–106 (2010).

22. Olper, A., Curzi, D. & Swinnen, J. Trade liberalization and child mortality: a synthetic control method. *World Dev.* 110, 394–410 (2018).

23. Barlow, P. Does trade liberalization reduce child mortality in low- and middle-income countries? A synthetic control analysis of 36 policy experiments, 1963-2005. *Soc. Sci. Med.* 205, 107–115 (2018).

24. Adjaye-Gbewonyo, K., Vollmer, S., Avendano, M. & Harttgen, K. Agricultural trade policies and child nutrition in low-and middle-income countries: a cross-national analysis. *Global. Health* 15, 21 (2019).

25. Boysen, O., Boysen-Urban, K., Bradford, H. & Balié, J. Taxing highly processed foods: What could be the impacts on obesity and underweight in sub-Saharan Africa? *World Dev.* 119, 55–67 (2019).

26. Fan, H., Lin, F. & Lin, S. The hidden cost of trade liberalization: Input tariff shocks and worker health in China. *J. Int. Econ.* 103349 (2020).

27. Pierce, J. R. & Schott, P. K. Trade liberalization and mortality: evidence from US counties. *Am. Econ. Rev. Insights* 2, 47–64 (2020).

28. Barlow, P., McKee, M., Basu, S. & Stuckler, D. Impact of the North American free trade agreement on high-fructose corn syrup supply in Canada: A natural experiment using synthetic control methods. *CMAJ* 189, (2017).

29. Barlow, P., McKee, M. & Stuckler, D. The Impact of U.S. Free Trade Agreements on Calorie Availability and Obesity: A Natural Experiment in Canada. *Am. J. Prev. Med.* 54, (2018).

30. Cowling, K. et al. The relationship between joining a US free trade agreement and processed food sales, 2002–2016: a comparative interrupted time-series analysis. *Public Health Nutr.* 23, 1609–1617 (2020).

31. Unar-Munguía, M., Flores, E. M. & Colchero, M. A. Apparent consumption of caloric sweeteners increased after the implementation of NAFTA in Mexico. *Food Policy* 84, 103–110 (2019).

32. Baker, P. & Friel, S. Transnational Food and Beverage Corporations, Food Systems Transformations and the Nutrition Transition in Asia. (RegNet Research Paper No. 2015/61. Retrieved October 11, 2015 (https://ssrn.com/abstract=2553640), 2015).

33. Mendez Lopez, A., Loopstra, R., McKee, M. & Stuckler, D. Is trade liberalisation a vector for the spread of sugar-sweetened beverages? A cross-national longitudinal analysis of 44 low- and middle-income countries. *Soc. Sci. Med.* 172, 21–27 (2017).

34. Werner, M., Contreras, P. I., Mui, Y. & Stokes-Ramos, H. International trade and the neoliberal diet in Central America and the Dominican Republic: Bringing social inequality to the center of analysis. *Soc. Sci. Med.* 239, 112516 (2019).

35. Ofa, S. & Gani, A. Trade policy and health implication for Pacific island countries. *Int. J. Soc. Econ.* (2017).
36. Cowling, K. *et al.* World Trade Organization membership and changes in noncommunicable disease risk factors: a comparative interrupted time-series analysis, 1980–2013. *Bull. World Health Organ.* 97, 83 (2019).

37. Baker, P., Friel, S., Schram, A. & Labonte, R. Trade and investment liberalization, food systems change and highly processed food consumption: a natural experiment contrasting the soft-drink markets of Peru and Bolivia. *Global. Health* 12, 24 (2016).

38. Barlow, P., Loopstra, R., Tarasuk, V. & Reeves, A. Liberal trade policy and food insecurity across the income distribution: an observational analysis in 132 countries, 2014–17. *Lancet Glob. Heal.* 395, (2020).

39. Appau, A., Drope, J., Labonté, R., Stoklosa, M. & Lencucha, R. Disentangling regional trade agreements, trade flows and tobacco affordability in sub-Saharan Africa. *Global. Health* 13, 81 (2017).

40. Son, K.-B. Do Free Trade Agreements Matter to Drug Lag? Recent Evidence From Korea After the Korea–US Free Trade Agreement. *Int. J. Heal. Serv.* 50, 147–155 (2020).

41. Barlow, P. Global disparities in health-systems financing: A cross-national analysis of the impact of tariff reductions and state capacity on public health expenditure in 65 low- and middle-income countries, 1996–2015. *Heal. Place* 63, 102329 (2020).

42. Thow, A.-M., Jones, A., Hawkes, C., Ali, I. & Labonté, R. Nutrition labelling is a trade policy issue: lessons from an analysis of specific trade concerns at the World Trade Organization. *Health Promot. Int.* 33, 561–571 (2017).

43. Barlow, P., Labonte, R., McKee, M. & Stuckler, D. Trade challenges at the World Trade Organization to national noncommunicable disease prevention policies: A thematic document analysis of trade and health policy space. *PLoS Med.* 15, e1002590 (2018).

44. Lencucha, R., Drope, J. & Labonte, R. Rhetoric and the law, or the law of rhetoric: how countries oppose novel tobacco control measures at the World Trade Organization. *Soc. Sci. Med.* 164, 100–107 (2016).

45. O’Brien, P. & Mitchell, A. D. On the bottle: health information, alcohol labelling and the WTO Technical Barriers to Trade Agreement. *QUT L. Rev.* 18, 124 (2018).

46. Feenstra, R. C. & Sasahara, A. The ‘China shock,’exports and US employment: A global input–output analysis. *Rev. Int. Econ.* 26, 1053–1083 (2018).

47. Zhang, Q. *et al.* Transboundary health impacts of transported global air pollution and international trade. *Nature* 543, 705–709 (2017).

48. Bloom, D. E. *et al.* The Global Economic Burden of Non-communicable Diseases. (Geneva, Switzerland: World Economic Forum. Retrieved August 22, 2017 (http://www3.weforum.org/docs/WEF_Harvard_HE_GlobalEconomicBurdenNonCommunicableDiseases_2011.pdf), 2011).

49. Jarman, H. Trade policy governance: What health policymakers and advocates need to know. *Health Policy (New. York).* 121, 1105–1112 (2017).

50. Townsend, B., Friel, S., Schram, A., Baum, F. & Labonté, R. What Generates Attention to Health in Trade PolicyMaking? Lessons From Success in Tobacco Control and Access to Medicines: A Qualitative Study of Australia and the (Comprehensive and Progressive) Trans-Pacific Partnership. *Int. J. Heal. Policy Manag.* (2020). doi:10.34172/ijhpm.2020.80

51. Friel, S., Hattersley, L. & Townsend, R. Trade Policy and Public Health. *Annu. Rev. Public Health* 36, 325–344 (2015).
52. Labonté, R. & Schrecker, T. Globalization and social determinants of health: Introduction and methodological background (part 1 of 3). *Global. Health* 3, 5 (2007).

53. Waltman, L., Van Eck, N. J. & Noyons, E. C. M. A unified approach to mapping and clustering of bibliometric networks. *J. Informetr.* 4, 629–635 (2010).

54. Evans, J. A. & Foster, J. G. Metaknowledge. *Science (80-. ).* 331, 721–725 (2011).

55. Trinquart, L., Johns, D. M. & Galea, S. Why do we think we know what we know? A metaknowledge analysis of the salt controversy. *Int. J. Epidemiol.* 45, 251–260 (2016).

56. Van Raan, A. F. J. Measuring science. in *Handbook of quantitative science and technology research* 19–50 (Springer, 2004).

57. Aagaard-Hansen, J. The challenges of cross-disciplinary research. *Soc. Epidemiol.* 21, 425–438 (2007).

58. Mori, A. & Taylor, M. Dimensions metrics api reference & getting started. *Digit. Sci. Res. Solut.* (2018).

59. Newman, M. E. J. & Girvan, M. Finding and evaluating community structure in networks. *Phys. Rev. E* 69, 26113 (2004).
Full funding acknowledgment

This work was supported by the UK Prevention Research Partnership (insert award reference), which is funded by the British Heart Foundation, Cancer Research UK, Chief Scientist Office of the Scottish Government Health and Social Care Directorates, Engineering and Physical Sciences Research Council, Economic and Social Research Council, Health and Social Care Research and Development Division (Welsh Government), Medical Research Council, National Institute for Health Research, Natural Environment Research Council, Public Health Agency (Northern Ireland), The Health Foundation and Wellcome.
Table 1. Studies on trade agreements and health meeting inclusion criteria

| Ref | Author(s)       | Country or countries | Years                  | Trade policy exposure                        | Outcome measure(s)                                                                 | Outcome category                                      |
|-----|-----------------|----------------------|------------------------|----------------------------------------------|------------------------------------------------------------------------------------|-------------------------------------------------------|
| 1   | Son K.-B., 2020 | South Korea          | 2007–2011, 2012–2015  | Korea US (‘KORUS’) FTA                        | Binary indicator of whether a drug approved in the US was available in Korea; Number of years between the US approval date and availability date on the Korean market | Healthcare & services - access to medicines            |
| 2   | Panda P., 2020  | 30 LMICs in Sub-Saharan Africa | 2000 - 2008       | African Growth and Opportunity Act (AGOA)    | Binary indicator of whether a mother’s child had died before their first birthday (1) or not (0). | Health outcomes - child mortality                      |
| 3   | Barlow P., 2020 | 65 LMICs             | 1996 - 2015           | Tariff rate                                  | Government spending on healthcare and services per capita, in USD                    | Healthcare & services - health expenditure             |
| 4   | Barlow P. et al., 2020 | 132 LMICs and HICs | 2014 - 2017    | KOF index of tariff and non-tariff trade policy liberalisation | Binary indicators of whether an individual experienced moderate and/or severe food insecurity, based on an 8-point questionnaire | NCD risks – diets and food environment                 |
| 5   | Fan, H., Lin, F., Lin, S., 2020 | China | 1993 - 2011 | WTO accession                                 | Binary indicator of whether an individual has experienced illness or injury in the past 4 weeks (1) or otherwise (0) | Workers’ health outcomes                              |
| 6   | Cowling, K., et al., 2020 | 10 LMICs and HICs with US FTAs | 2002 - 2016 | US FTAs                                      | Per capita sales of foods and beverages, in kg, grouped into three categories: ultra-processed, processed ingredients, minimally processed, and baby food | NCD risks – diets and food environment                 |
| 7   | Schram A. et al., 2020 | 16 LMICs and HICs with Australian FTAs | 1988 - 2016 | Australian FTAs | Volume of imports of alcohol products from Australia; binary indicator of whether the country imports any alcohol from Australia | NCD risks - alcohol                                   |
| 8   | Pierce J R. et al., 2020 | United States | 1990 - 2013 | US Permanent Normal Trade Relations bill | Deaths per 100,000 inhabitants, in each county, disaggregated by cause, gender, age group | Workers’ health outcomes                              |
| 9   | Adjaye-Gbewonyo, K. et al., 2019 | 22 LMICs | 1991 - 2010 | Nominal Rate of Assistance to agricultural products that are considered tradable | Height-for-age Z-scores, weight-for-height z-scores, and weight-for-age Z scores | Health outcomes – child nutrition                       |
|   | Study | Countries | Year(s)          | Trade Agreement | Economic variables                                                                 | Health outcomes/ NCD risks                                                                 |
|---|-------|-----------|------------------|-----------------|------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------|
| 10| Werner, M. et al., 2019 | 6 LMICs in Central America | 1990 - 2010 | Dominican Republic-Central America Free Trade Agreement (CAFTA-DR) | Imports of meats, cereals, processed vegetables, oils, and sweetened beverages; share of household expenditure on food and beverages; index of food price changes across principal food categories compared with general price inflation. | NCD risks - diets and food environment |
| 11| Boysen, O. et al., 2019 | 101 LMICs | 2007 - 2013 | Tariff rate | Prevalence of obesity, measured as the percentage of the adult population aged 18 and above with a BMI equal to or greater than 30 kg/m²; prevalence of underweight, measured as the percentage of the adult population aged 18 and above with a BMI equal to or less than 18.5 kg/m². | Health outcomes – nutrition |
| 12| Unar-Munguia, M. et al., 2019 | Mexico | 1961 - 2013 | North America Free Trade Agreement (NAFTA) | Per capita supply of sugar and sweeteners, in kcal per day; Sugar and sweetener supply as a % of daily per capita food supplies | NCD risks - diets and food environment |
| 13| Cowling et al. 2019 | 47 LMICs, UMICS, and HICs | 1980 - 2013 | WTO accession | Per capita supply, in g or kg, per year, of tobacco, alcohol, fruits and vegetables, nuts, seeds and legumes, seafood, red meats and animal fats, sugars, starches, and edible oils. | NCD risks – tobacco, alcohol, diets and food environment |
| 14| Barlow P., 2018 | 36 LMICs | 1963 - 2005 | Wacziarg and Welch’s (2003) dichotomous indicator of trade liberalisation | Number of new-born babies per 1,000 live births who died before age 5 | Health outcomes - child mortality |
| 15| Barlow P. et al., 2018 | Canada | 1978 - 2006 | Canada US Free Trade Agreement (CUSFTA) | Per capita supply of caloric sweeteners including High-Fructose Corn Syrup, in kcal per day; per capita supply of total sugars and sweeteners, in kcal per day. | NCD risks - diets and food environment |
| 16| Olper A. et al., 2018 | 41 LMICs | 1960 - 2010 | Wacziarg and Welch’s (2003) dichotomous indicator of trade liberalisation | Number of new-born babies per 1,000 live births who died before age 5 | Health outcomes - child mortality |
| 17| Appau A. et al., 2017 | 39 LMICs in Sub-Saharan Africa | 2007, 2010, 2012, and 2014. | Import taxes, KOF Index, bilateral investment treaties (with multiple countries) | Price of cigarettes, in USD; affordability of cigarettes, calculated using price data and % of GDP required to purchase 100 packs; investments in tobacco manufacturing by company; foreign exports of tobacco products, in USD | NCD risks - tobacco |
|   | Author et al., Year | Region(s) | Time Period(s) | Trade Agreement(s) | Variables measured | NCD risks - diets and food environment |
|---|---------------------|-----------|----------------|--------------------|--------------------|----------------------------------------|
| 18 | Barlow, P. et al., 2017 | Canada | 1985 - 2000 | NAFTA | Total supply of calories per capita, per day; imports of processed foods to Canada from the US, in USD; US FDI in the Canadian food and beverage sector, in USD | NCD risks - diets and food environment |
| 19 | Mendez L A. et al., 2017 | 44 LMICs | 2001 - 2014 | Tariff rate | Per capita sales of sugar-sweetened beverages, in litres; total imports of sugar-sweetened beverages, in USD | NCD risks - diets and food environment |
| 20 | Ofa et al., 2017 | 11 Pacific Island Countries | 2003 - 2013 | WTO membership, tariff rate | Per capita imports of processed foods, in kg, from each trade partner | NCD risks - diets and food environment |
| 21 | Baker, P. et al., 2016 | Peru and Bolivia | 1990 - 2013 | US-Peru FTA | Per capita foreign direct investment (FDI) inflows, un USD; per capita soft-drink imports, in litres, and annual growth rate therein, in %; per capita sales of soft-drinks, in litres, and annual growth rate therein, in %; and the volumes of sugar from soft-drinks, in kg, and annual growth rate therein, in % | NCD risks - diets and food environment |
## Figures

*Figure 1. PRISMA diagram showing study identification procedures*

| Identification | Records identified through database searches \( (n = 28,065) \) | Records identified through other sources \( (n = 2) \) |
|----------------|-----------------------------------------------------------------|--------------------------------------------------|
| Screening      | Records after duplicates were removed \( (n = 27,105) \)       | Records excluded following screening because abstract and title did not indicate goal of assessing trade policy or FTIA impacts on health or health determinants \( (n = 25,838) \) |
| Eligibility    | Full text of articles assessed for eligibility using exclusion criteria \( (n = 1,267) \) | Articles excluded because: full text not available \( (n = 19) \), review or theoretical study \( (n = 308) \), not a quantitative study \( (n = 90) \), not an analysis of a health outcome or determinant \( (n = 613) \), not an analysis of FTIA or trade/investment policy \( (n = 216) \). |
| Included       | Studies included in qualitative synthesis \( (n = 21) \)        |                                                  |


Figure 2. Quality assessment

Notes: See Thomas et al. (2004) for category definitions.
Figure 3. Co-citation analysis

Notes: Figure plots co-citation (tendency for sources to be cited collectively) of journals which were referenced at least 10 times across included studies.
## Appendix

### Appendix 1. PRISMA checklist

| Section/topic       | # | Checklist item                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Reported on page # |
|---------------------|---|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|
| **TITLE**           |   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                   |
| Title               | 1 | Identify the report as a systematic review, meta-analysis, or both.                                                                                                                                                                                                                                                                                                                                          | 1                 |
| **ABSTRACT**        |   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                   |
| Structured summary  | 2 | Provide a structured summary including, as applicable: background; objectives; data sources; study eligibility criteria, participants, and interventions; study appraisal and synthesis methods; results; limitations; conclusions and implications of key findings; systematic review registration number.                                                                                                      | 2                 |
| **INTRODUCTION**    |   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                   |
| Rationale           | 3 | Describe the rationale for the review in the context of what is already known.                                                                                                                                                                                                                                                                                                                              | 4 & 6             |
| Objectives          | 4 | Provide an explicit statement of questions being addressed with reference to participants, interventions, comparisons, outcomes, and study design (PICOS).                                                                                                                                                                                                  | 6                 |
| **METHODS**         |   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                   |
| Protocol and registration | 5 | Indicate if a review protocol exists, if and where it can be accessed (e.g., Web address), and, if available, provide registration information including registration number.                                                                                                                                                                           | NA                |
| Eligibility criteria| 6 | Specify study characteristics (e.g., PICOS, length of follow-up) and report characteristics (e.g., years considered, language, publication status) used as criteria for eligibility, giving rationale.                                                                                                                                                                         | 7                 |
| Information sources | 7 | Describe all information sources (e.g., databases with dates of coverage, contact with study authors to identify additional studies) in the search and date last searched.                                                                                                                                                                                                                                          | 7                 |
| Search              | 8 | Present full electronic search strategy for at least one database, including any limits used, such that it could be repeated.                                                                                                                                                                                                                                                                               | Appendix 2        |
| Section/topic         | #  | Checklist item                                                                                                    | Reported on page # |
|----------------------|----|-------------------------------------------------------------------------------------------------------------------|--------------------|
| Study selection      | 9  | State the process for selecting studies (i.e., screening, eligibility, included in systematic review, and, if applicable, included in the meta-analysis). | 7                  |
| Data collection process | 10 | Describe method of data extraction from reports (e.g., piloted forms, independently, in duplicate) and any processes for obtaining and confirming data from investigators. | 7-8                |
| Data items           | 11 | List and define all variables for which data were sought (e.g., PICOS, funding sources) and any assumptions and simplifications made. | 7-8                |
| Risk of bias in individual studies | 12 | Describe methods used for assessing risk of bias of individual studies (including specification of whether this was done at the study or outcome level), and how this information is to be used in any data synthesis. | 8                  |
| Summary measures     | 13 | State the principal summary measures (e.g., risk ratio, difference in means).                                       | n/a                |
| Synthesis of results | 14 | Describe the methods of handling data and combining results of studies, if done, including measures of consistency (e.g., I²) for each meta-analysis. | 8                  |
| Risk of bias across studies | 15 | Specify any assessment of risk of bias that may affect the cumulative evidence (e.g., publication bias, selective reporting within studies). | 8                  |
| Additional analyses  | 16 | Describe methods of additional analyses (e.g., sensitivity or subgroup analyses, meta-regression), if done, indicating which were pre-specified. | 8                  |

### RESULTS

| Section/topic         | #  | Checklist item                                                                                                    | Reported on page # |
|----------------------|----|-------------------------------------------------------------------------------------------------------------------|--------------------|
| Study selection      | 17 | Give numbers of studies screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally with a flow diagram. | 7-8                |
| Study characteristics | 18 | For each study, present characteristics for which data were extracted (e.g., study size, PICOS, follow-up period) and provide the citations. | 8                  |
| Risk of bias within studies | 19 | Present data on risk of bias of each study and, if available, any outcome level assessment (see item 12).                | 9-12               |
| Section                                      | Item Number | Description                                                                                                                                                                                                 | Page |
|----------------------------------------------|-------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|
| Results of individual studies                | 20          | For all outcomes considered (benefits or harms), present, for each study: (a) simple summary data for each intervention group (b) effect estimates and confidence intervals, ideally with a forest plot. | 9-12 |
| Synthesis of results                         | 21          | Present results of each meta-analysis done, including confidence intervals and measures of consistency.                                                                                                         | 9-12 |
| Risk of bias across studies                  | 22          | Present results of any assessment of risk of bias across studies (see Item 15).                                                                                                                                 | n/a  |
| Additional analysis                          | 23          | Give results of additional analyses, if done (e.g., sensitivity or subgroup analyses, meta-regression [see Item 16]).                                                                                         | 9-12 |
| DISCUSSION                                   |             |                                                                                                                                                                                                             |      |
| Summary of evidence                          | 24          | Summarise the main findings including the strength of evidence for each main outcome; consider their relevance to key groups (e.g., healthcare providers, users, and policy makers). | 12-14|
| Limitations                                  | 25          | Discuss limitations at study and outcome level (e.g., risk of bias), and at review-level (e.g., incomplete retrieval of identified research, reporting bias).                                                  | 13-15|
| Conclusions                                  | 26          | Provide a general interpretation of the results in the context of other evidence, and implications for future research.                                                                                       | 15   |
| FUNDING                                      |             |                                                                                                                                                                                                             |      |
| Funding                                      | 27          | Describe sources of funding for the systematic review and other support (e.g., supply of data); role of funders for the systematic review.                                                                  | 3    |
Appendix 2. Search terms and Boolean operators

Boolean operators were used to combine the below search terms for trade policies and health outcomes, risk-factors and policy variables:

| Keywords                                                                 | AND | OR          | OR          | OR          |
|--------------------------------------------------------------------------|-----|-------------|-------------|-------------|
| "trade liberalisation*" OR "investment liberalisation*" OR "trade agreements*" OR "investment agreements*" OR "bilateral agreements*" OR "bi-lateral agreements*" OR "multilateral agreements*" OR "multi-lateral agreements*" OR "preferential trade agreements*" OR "PTA" OR "trade and investment agreement*" OR "TIA" OR "regional trade agreement*" OR "RTA" OR "trade policy*" OR "investment policy*" OR "globalisation" OR "globalization" OR "regionalism" OR "multilateralism" OR "multinationalism" OR "economic integration" OR "trade regulation*" OR "FTA" OR "FTIA" OR "tariffs*" OR "tariff" OR "trade tax*" |     | health OR “health service*” OR “health-service” OR “health-spending” OR “health-expenditure” OR healthcare OR “healthcare” OR “social protection” OR “social policy*” OR “health policy*” | food OR nutrition OR “chronic” OR OR alcohol OR “chronic” diseases | “disease OR “disease” OR “non-communicable” OR disease” OR “non” OR communicable OR “NCD” OR “NCDs” OR “obesity” OR diabetes OR “mortality” OR expectance” OR “life-expectancy” |
Appendix 3. Inclusion and exclusion criteria

Studies were eligible for inclusion in our review if they were quantitative empirical studies evaluating the impact of TIAs or a trade/investment policy that is typically incorporated within TIAs (e.g. tariffs, quotas) on a health determinant or outcome. We defined quantitative studies as those that primarily analysed numerical data, conducted statistical tests, and reported numerical summaries of these tests with p-values or confidence intervals. We included studies examining TIAs as the primary explanatory variable of interest (e.g. a US FTA). We also included studies examining trade/investment policy that is typically incorporated within TIAs (e.g. tariffs, quotas). We further included studies that examined composite or binary indicators of trade policy liberalisation which are primarily calculated based on policies that are impacted by TIAs (e.g. WTO membership, mean tariffs, and business regulations affecting cross-border investment). This includes, for example, studies using binary indicators of trade liberalisation and the KOF de jure economic globalization index, but not overall globalization indices.

With respect to outcomes, we included studies which examined health outcomes and determinants that have previously been identified as potentially impacted by TIAs in existing conceptual studies of trade and health. These include health determinants and outcomes related to employment and living conditions, the environment, health-care and access to medicines, environment, and harmful commodity consumption. We also included outcomes which existing research identified as an important mediator of potential TIA impacts on health outcomes but were not directly discussed in previous conceptual frameworks and reviews, provided evidence on a pathway to health impacts was discussed and considered a primary rationale for examining the outcome under study.
Appendix 4. Methodological quality assessment

We rated methodological quality and risk of bias using the Effective Public Health Practice Project (EPHPP) Quality Assessment Tool for Quantitative Studies. This rates methodological quality according to sample selection bias, study design, confounders, blinding, data collection methods, intervention integrity, and analysis.

We rated each study on each of the above components using detailed guidance provided by the EPHPP. Briefly, a questionnaire is used to provide ‘yes’/’no’ answers on a range of questions within each component. Some components score similarly across studies due to a lack of variation in e.g. study designs (e.g. all studies are observational rather than RCTs). With respect to confounders, in all cases, where there were multiple studies of the same or similar explanatory/outcome variables, we cross checked the confounders discussed in studies to determine whether they included confounders deemed relevant by other studies examining the same intervention/outcome. We further considered whether confounders discussed in studies examining different interventions/outcomes may be relevant to include in a particular case.

To determine a final rating for each sub-component, the number of yes and no responses to these questions are then used to determine whether the study is ‘strong’, ‘moderate’ or ‘weak’ on each sub-component. Final scores are then determined based on the sub-component ratings.
Appendix 5. Co-citation analysis methods

Bibliometric analyses of reference lists can improve our understanding of the sources that inform a research area and the extent to which concepts, theories, methods, and findings from disparate fields are acknowledged or overlooked elsewhere \(^{53-55}\). This is especially important for studies of TIAs as the biomedical and social sciences can both offer theoretical and methodological insights to advance understanding of FTIA impacts on health, but these fields and their sub-disciplines are often located in disciplinary siloes \(^{56,57}\). We therefore analysed co-citation patterns as a proxy for the extent to which research on trade policy and health acknowledges the insights from other relevant fields and sub-disciplines. Co-citation measures the frequency with which two sources are cited together by other documents and is a proxy for whether insights from different fields are being acknowledged collectively (van Eck and Waltman 2010).

To map co-citation patterns we extracted reference lists from all included articles from Dimensions.ai \(^{58}\). We then applied network-mapping and clustering procedures developed by van Eck and Waltman using VOSViewer software \(^{20}\). This first identifies a list of journals that had published papers which were referenced a pre-specified number of times by the studies included in the review; here we set this minimum to 10 for comparability with Barlow et al. (2017). As a robustness check for the sensitivity of this analysis to the reference threshold we further mapped co-citation patterns when setting this minimum to 2 and 5 citations.

Co-citation of journals was then captured in a matrix, where each referenced journal is listed in the rows and columns. Each cell in the matrix \(c_{ij}\) refers to the number of times a paper in journal \(i\) (in the rows) is cited in a paper that also cites a paper in journal \(j\) (in the columns); this is normalised according to the total number of citations of journal \(i\) and \(j\). The network-graphing algorithm developed by van Eck and Waltman (2010) then maps the spatial locations of each journal by minimising the Euclidean distances between journal pairs, whilst also ensuring that journals with
higher values of $c_{ij}$ are mapped closer to one another. The algorithm also identifies journal communities or ‘clusters’ which have similar co-citation patterns; these are colour coded on the network map. Waltman and van Eck’s clustering procedure for identifying communities with similar co-citation patterns is a variant of the widely applied procedure developed by Newman and Girvan (2004). This identifies a cluster classification scheme which maximises the difference between the observed number of co-citations within an assigned subgroup and the number that occur when co-citations are assigned randomly in the network $^{53,59}$. 
### Appendix 6. Disaggregated study quality assessment ratings

| STUDY TITLE                                                                 | SELECTION BIAS | STUDY DESIGN | CONFOUNDERS | BLINDING | DATA COLLECTION METHOD | WITHDRAWALS AND DROP-OUTS | INTERVENTION INTEGRITY | ANALYSES | GLOBAL RATING          |
|-----------------------------------------------------------------------------|----------------|--------------|-------------|----------|------------------------|---------------------------|------------------------|-----------|------------------------|
| Do Free Trade Agreements Matter to Drug Lag? Recent Evidence From Korea After the Korea–U.S. Free Trade Agreement | 2 - Moderate   | 2 - Moderate | 3 - Weak    | 2 - Moderate | 3 - Weak               | Not applicable            | 1 - Strong             | 1 - Strong | 3 - Weak (two or more WEAK ratings) |
| Does trade reduce infant mortality? Evidence from sub-Saharan Africa        | 2 - Moderate   | 2 - Moderate | 1 - Strong  | 2 - Moderate | 1 - Strong             | Not applicable            | 1 - Strong             | 1 - Strong | 1 - Strong (no WEAK ratings)        |
| Global disparities in health-systems financing: A cross-national analysis of the impact of tariff reductions and state capacity on public health expenditure in 65 low- and middle-income countries, 1996–2015 | 2 - Moderate   | 2 - Moderate | 1 - Strong  | 2 - Moderate | 3 - Weak               | Not applicable            | 1 - Strong             | 1 - Strong | 3 - Weak (two or more WEAK ratings) |
| Liberal trade policy and food insecurity across the income distribution: an observational analysis in 132 countries, 2014–17 | 1 - Strong     | 2 - Moderate | 2 - Moderate | 2 - Moderate | 1 - Strong             | Not applicable            | 1 - Strong             | 1 - Strong | 1 - Strong (no WEAK ratings)        |
| Study                                                                                       | Strength 1 | Strength 2 | Strength 3 | Not Applicable | Strength 4 | Not Applicable | Strength 5 | Strength 6 | Strength 7 | Not Applicable |
|---------------------------------------------------------------------------------------------|------------|------------|------------|----------------|------------|----------------|------------|------------|------------|----------------|
| The hidden cost of trade liberalization: Input tariff shocks and worker health in China     | 1 - Strong | 2 - Moderate | 1 - Strong | 2 - Moderate | 1 - Strong | Not applicable | 3 - Weak   | 1 - Strong | 1 - Strong | 2 - Moderate (one WEAK rating) |
| The relationship between joining a US free trade agreement and processed food sales, 2002-2016: A comparative interrupted time-series analysis | 1 - Strong | 2 - Moderate | 1 - Strong | 2 - Moderate | 3 - Weak   | Not applicable | 1 - Strong | 1 - Strong | 1 - Strong | 2 - Moderate (one WEAK rating) |
| Toxic trade: the impact of preferential trade agreements on alcohol imports from Australia in partner countries | 1 - Strong | 2 - Moderate | 1 - Strong | 2 - Moderate | 3 - Weak   | Not applicable | 1 - Strong | 1 - Strong | 1 - Strong | 2 - Moderate (one WEAK rating) |
| Trade Liberalization and Mortality: Evidence from US Counties                               | 1 - Strong | 2 - Moderate | 1 - Strong | 2 - Moderate | 1 - Strong | Not applicable | 1 - Strong | 1 - Strong | 1 - Strong | 1 - Strong (no WEAK ratings) |
| Agricultural trade policies and child nutrition in low- and middle-income countries: A cross-national analysis | 1 - Strong | 2 - Moderate | 1 - Strong | 2 - Moderate | 1 - Strong | Not applicable | 1 - Strong | 1 - Strong | 1 - Strong | 1 - Strong (no WEAK ratings) |
| Topic                                                                 | Rating 1 | Rating 2 | Rating 3 | Rating 4 | Rating 5 | Rating 6 | Rating 7 | Rating 8 | Rating 9 | Rating 10 |
|----------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| International trade and the neoliberal diet in Central America and the Dominican Republic: Bringing social inequality to the center of analysis (Not an empirical study) | 1 - Strong | 2 - Moderate | 3 - Weak | 2 - Moderate | 3 - Weak | Not applicable | 1 - Strong | 1 - Strong | 3 - Weak | (two or more WEAK ratings) |
| Taxing highly processed foods: what could be the impacts on obesity and underweight in sub-Saharan Africa? | 1 - Strong | 2 - Moderate | 1 - Strong | 2 - Moderate | 1 - Strong | Not applicable | 1 - Strong | 1 - Strong | 1 - Strong | 1- Strong (no WEAK ratings) |
| Apparent consumption of caloric sweeteners increased after the implementation of NAFTA in Mexico. | 1 - Strong | 2 - Moderate | 1 - Strong | 2 - Moderate | 3 - Weak | Not applicable | 1 - Strong | 1 - Strong | 1 - Strong | 2 - Moderate (one WEAK rating) |
| Does trade liberalization reduce child mortality in low- and middle-income countries? A synthetic control analysis of 36 policy experiments, 1963-2005 | 1 - Strong | 2 - Moderate | 1 - Strong | 2 - Moderate | 1 - Strong | Not applicable | 1 - Strong | 1 - Strong | 1 - Strong | 1- Strong (no WEAK ratings) |
| Study                                                                 | Strength of Evidence | Trade Liberalization and Child Mortality: A Synthetic Control Method | Disentangling Regional Trade Agreements, Trade Flows and Tobacco Affordability in Sub-Saharan Africa | Impact of the North American Free Trade Agreement on High-Fructose Corn Syrup Supply in Canada: A Natural Experiment Using Synthetic Control Methods | Is Trade Liberalisation a Vector for the Spread of Sugar-Sweetened Beverages? A Cross-National Longitudinal Analysis of 44 Low | |
|----------------------------------------------------------------------|----------------------|---------------------------------------------------------------------|-----------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------| |
| The Impact of US Free Trade Agreements on Calorie Availability and Obesity: A Natural Experiment in Canada             | 1 - Strong           | 2 - Moderate                                                        | 1 - Strong                                                                                       | 2 - Moderate                                                                                                                 | 1 - Strong                                                                                                                   | |
| Trade Liberalization and Child Mortality: A Synthetic Control Method                                                 | 1 - Strong           | 2 - Moderate                                                        | 1 - Strong                                                                                       | 2 - Moderate                                                                                                                 | 1 - Strong                                                                                                                   | |
| Disentangling Regional Trade Agreements, Trade Flows and Tobacco Affordability in Sub-Saharan Africa                   | 1 - Strong           | 2 - Moderate                                                        | 3 - Weak                                                                                         | 2 - Moderate                                                                                                                 | 1 - Strong                                                                                                                   | |
| Impact of the North American Free Trade Agreement on High-Fructose Corn Syrup Supply in Canada: A Natural Experiment Using Synthetic Control Methods | 1 - Strong           | 2 - Moderate                                                        | 1 - Strong                                                                                       | 2 - Moderate                                                                                                                 | 1 - Strong                                                                                                                   | |
| Is Trade Liberalisation a Vector for the Spread of Sugar-Sweetened Beverages? A Cross-National Longitudinal Analysis of 44 Low | 1 - Strong           | 2 - Moderate                                                        | 1 - Strong                                                                                       | 2 - Moderate                                                                                                                 | 1 - Strong                                                                                                                   | |
and middle-income countries

| Trade policy and health implication for Pacific island countries | 1 - Strong | 2 - Moderate | 1 - Strong | 2 - Moderate | 3 - Weak | Not applicable | 1 - Strong | 1 - Strong |
|---------------------------------------------------------------|-----------|-------------|-----------|-------------|---------|---------------|-----------|-----------|
| Trade and investment liberalization, food systems change and highly processed food consumption: A natural experiment contrasting the soft-drink markets of Peru and Bolivia | 1 - Strong | 2 - Moderate | 2 - Moderate | 2 - Moderate | 3 - Weak | Not applicable | 1 - Strong | 1 - Strong | 2 - Moderate (one WEAK rating) |
| World Trade Organization membership and changes in noncommunicable disease risk factors: a comparative interrupted time-series analysis, 1980–2013 | 1 – Strong | 2 – moderate | 1 – Strong | 2 - Moderate | 3 - Weak | Not applicable | 1 - Strong | 1 - Strong | 2 - Moderate (one WEAK rating) |
Appendix 7. Co-citation analysis: minimum 5 references

*Notes:* Figure plots co-citation (tendency for sources to be cited collectively) of journals which were referenced at least 5 times across included studies.
Appendix 8. Co-citation analysis: minimum 2 references

Notes: Figure plots co-citation (tendency for sources to be cited collectively) of journals which were referenced at least 2 times across included studies.