International Initiative for Impact Evaluation

THE EVIDENCE ON FOOD SYSTEMS AND NUTRITION

Insights from a living evidence and gap map

Evidence Gap Map Report 35
December 2024

About 3ie

The International Initiative for Impact Evaluation (3ie) develops evidence on effectively transforming the lives of people experiencing poverty in low- and middle-income countries. Established in 2008, we offer comprehensive support and diverse approaches to achieve development goals by producing, synthesizing, and promoting the uptake of impact evaluation evidence. We work closely with governments, foundations, NGOs, development institutions and research organizations to address their decision-making needs. With offices in Washington DC, New Delhi, and London, as well as a global network of leading researchers, we offer deep expertise across our extensive menu of evaluation services.

3ie evidence and gap map reports

3ie evidence and gap maps are thematic collections of information about impact evaluations and systematic reviews of impact evaluations that measure the effects of international development policies and programmes. The maps provide a visual display of completed and ongoing systematic reviews and impact evaluations in a thematic area, structured around a framework of interventions and outcomes.

Evidence and gap map reports provide supporting documentation for the maps, including the background information for the theme of the map, the methods and results, the protocol, and the analysis of results.

About this evidence and gap map report

This report presents the findings of a series of systematic searches to identify and map the evidence base of impact evaluations and systematic reviews of impact evaluations that assess the effects of food systems interventions on food security and nutrition outcomes. It updates the work by Moore and colleagues (2021) and Lane and colleagues (2023). Some text of this report was copied directly from the original report. The content of this report is the sole responsibility of the authors and does not represent the opinions of 3ie, its donors, or its Board of Commissioners. Any errors and omissions are also the sole responsibility of the authors. Please direct any comments or queries to Ingunn Storhaug at istorhaug@3ieimpact.org.

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December 2024

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Summary of key findings

Background

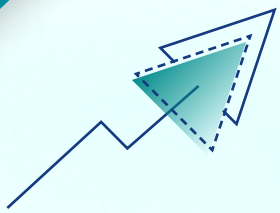
Malnutrition and food insecurity remain substantial global challenges, particularly in low- and middle-income countries. These challenges have reached crisis levels in recent years, owing to the COVID-19 pandemic, conflict (particularly the war in Ukraine), and the effects of climate change on food systems. Addressing these challenges will require improvements to global food systems, encompassing food production, processing, marketing, and consumption. Making such improvements will in turn require policy making and programming decisions that are informed by the best available evidence.

In February 2020, the International Initiative for Impact Evaluation (3ie) began developing an evidence and gap map (E&GM), collecting all available impact evaluations and systematic reviews of impact evaluations measuring the effects of food systems interventions on food security and nutrition in low- and middle-income countries (L&MICs). 3ie was funded by the German Federal Ministry for Economic Cooperation and Development (BMZ) through Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) through its "Knowledge for Nutrition" programme. The Innovative Methods and Metrics for Agriculture and Nutrition Actions (IMMANA) research group supported this project by contributing significant staff time, funded by the Bill and Melinda Gates Foundation (BMGF) and the UK's Foreign, Commonwealth, and Development Office (FCDO).

3ie developed the map into a living evidence product, updating it approximately every four months with the newest literature in the field. This report summarises the findings of the E&GM, including the period covered by the original map, but with special attention to whether and how the evidence base has evolved since 2021 as we performed regular updates.

AT A GLANCE

Key findings on the food systems and nutrition



Growth in the evidence base is concentrated in a few well studied areas.



Interventions like fortification, supplementation, and consumer education receive the most attention in the literature.

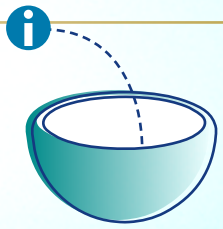


Final outcomes like food availability and diet quality receive more attention than intermediate outcomes like food production and distribution.



Evidence is concentrated in Latin America, South Asia, East Asia, and Sub-Saharan Africa.





There is a dearth of evidence from countries facing the most severe hunger-related challenges.

Key findings

We summarise the key findings from the E&GM below.



Growth in the evidence base is concentrated in a few well studied areas. The evidence base has grown significantly in the past four years, but most of the growth has been on topics that had significant coverage in the literature already.



Interventions like fortification, supplementation, and consumer education receive the most attention in the literature. There is a large concentration of evidence on a handful of interventions, including fortification, supplementation, direct provision of food, consumer education, and agricultural extension.



Final outcomes like food availability and diet quality receive more attention than intermediate outcomes like food production and distribution. There is much greater coverage of what we classify as *final* outcomes (like food availability, diet quality, and anthropometric measures) in the literature than of what we consider *intermediate* outcomes (like food production, food distribution, food loss/waste, and the economic, social, and political environment).



Evidence is concentrated in Latin America, South Asia, East Asia, and Sub-Saharan Africa. Within these regions, evidence is further concentrated in a handful of countries, including Brazil, Mexico, India, Bangladesh, China, Ethiopia, and Kenya.



There is a dearth of evidence from countries facing the most severe hunger-related challenges. However, there is a substantial volume of literature from countries with major, but somewhat less severe, hunger challenges.

CONTENTS

SUMMARY OF KEY FINDINGS iv

ABBREVIATIONS AND ACRONYMS viii

1. UNDERNOURISHMENT AND FOOD INSECURITY ARE MAJOR GLOBAL CHALLENGES 1

2. WHY THIS E&GM IS NEEDED 3

2.1 Why a living E&GM is valuable 4

3. WHAT ARE THE OBJECTIVES OF THIS E&GM? 5

4. OUR METHODS 6

4.1 Conceptual framework 6

4.2 Criteria for including and excluding studies 8

5. WHAT WE FOUND 10

5.1 Results of the search 10

5.2 Characteristics of evidence base 12

5.2.1 The evidence base has grown substantially during the update period, but with little change in where the evidence is concentrated 12

5.2.2 The evidence is concentrated on a handful of interventions, including fortification, supplementation, and educational interventions for consumers 13

5.2.3 Studies tend to measure "final" outcomes like diet quality and anthropometric measures; less attention is paid to intermediate outcomes, apart from those related to agricultural production. 15

5.2.4 Geographic coverage of the evidence is uneven, and there are significant gaps in evidence from the most hunger-stricken countries. 18

5.2.5 Most studies evaluate interventions targeting the whole population, rather than a particular sex or age group 20

5.2.6 The prevalence of quasi-experimental evaluation studies is increasing 23

6. CONCLUSIONS AND IMPLICATIONS 25

6.1 Reflections on the living nature of this E&GM 25

6.2 Research question 1- Coverage 26

6.3 Research question 2- Change 28

6.4 Research questions 3 & 4 – Gaps and research needs 32

6.4.1 Summary of selected new studies that address research gaps 33

6.5 Strengths and limitations of the E&GM 34

6.6 Implications for policy and practice 35

6.7 Implications for research 36

REFERENCES 38

Abbreviations and acronyms

BMGF	Bill and Melinda Gates Foundation
BMZ	Bundesministerium Für Wirtschaftliche Zusammenarbeit (German Federal Ministry for Economic Development Cooperation)
COP	Conference of the Parties
BRB	Building Resilience of Vulnerable Communities in Burkina Faso
IPC/CH	Food Security Phase Classification (IPC) and Cadre Harmonisé (CH)
DEP	Development Evidence Portal
E&GM	Evidence and Gap Map
EPPI	Evidence for Policy and Practice Information
FAO	Food and Agriculture Organization
FCDO	Foreign, Commonwealth, and Development Office
FEWSNET	Famine Early Warning System Network
GHI	Global Hunger Index
GIZ	Gesellschaft für Internationale Zusammenarbeit
GTA	Gender transformative approaches
GTO	Gender Transformative Outcomes
HLPE	High Level Panel of Experts
IEs	Impact Evaluations
IFPRI	International Food Policy Research Institute
IMMANA	Innovative Methods and Metrics for Agriculture and Nutrition Actions
MC	Multi-component
L&MICs	Low and Middle Income Countries
PICOS	Population, Intervention, Comparator, Outcome And Study Design
SRs	Systematic Reviews
USAID	US Agency for International Development
WFP	World Food Program

1 Undernourishment and food insecurity are major global challenges

Since this project began in 2019, the food systems landscape has changed drastically. In the six years before the project began (2013 – 2019), the prevalence of undernourishment was relatively stable, just under 8 per cent (FAO 2023).

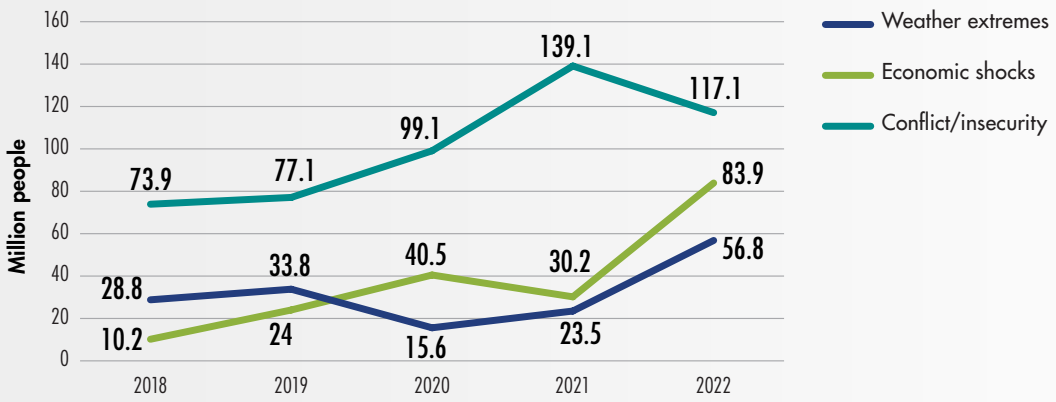
There were only two ongoing food catastrophes, the highest level of acute food insecurity, affecting 84,500 people (Global Network Against Food Crises 2024). And, the UN's Food and Agriculture Organization (FAO) predicted that, despite projected population growth, 141 million fewer people would be undernourished in 2030 relative to 2019. However, by 2021, there were 507,900 people in food crisis across three countries (Ethiopia, South Sudan, and Yemen), and in 2023, this had risen to 705,000 people in five countries and territories facing catastrophic food insecurity (the Gaza Strip, South Sudan, Burkina Faso, Somalia, and Mali; Global Network Against Food Crises 2024). By early 2024, this had risen to 1.3 million people, largely driven by the wars in Gaza and Sudan. As of 2023, the FAO projected the global prevalence of undernourishment will only decrease by 22.5 million people by 2030 (FAO 2023).

COVID-19, conflict, and climate change have altered the food systems landscape, driving this backsliding in global food security and nutrition (Hendriks 2022). Climate change, conflict over resources, and economic shocks all drive food-related instability (World Food Programme 2024). The COVID-19 pandemic's lasting effects on markets and on food and nutrition services increased food insecurity in 2020 and 2021 (Global Network Against Food Crises 2024; Hendriks et al. 2022, FAO 2023).

Conflict and food insecurity are mutually reinforcing. Conflict exacerbates food insecurity by disrupting markets and mobility, while food scarcity can in turn fuel socio-political unrest and conflict (Bruck & d'Errico 2019; Shemyakina 2022). The war in Ukraine has contributed to a nearly 300% rise in acute food insecurity from 2021 to 2022 (Global Report Network Against Food Crises 2023). Food inflation, an economic shock resulting from the pandemic and the conflict in Ukraine, is directly linked to increased risk of wasting and stunting (Heady & Ruel 2023). Challenges wrought by global health crises and conflict are worsened by climate change, which can decrease crop yield or completely destroy crops, driving up food prices (IFPRI, 2024). Simultaneously, unsustainable farming and supply chain practices contribute to climate change and environmental degradation (Willet et al. 2019; Golasa et al. 2021; IFPRI, 2024; Figure 1).

FIGURE 1

Number of people experiencing food insecurity due to conflict, economic shocks, and extreme weather



Note: Number of people in IPC/CH Phase 3 or above. Adapted from the Global Report on Food Crises.



2 Why this E&GM is needed

In response to these pressures, the global community is changing how it approaches food security and nutrition.

The Agroecology Coalition was born from the United Nations Food Systems Summit and now includes 48 governments, three intergovernmental regional commissions, and almost 250 other groups striving for a just, equitable, and environmentally sustainable food system (Agroecological Coalition 2024, Nicoletis et al. 2019). The remarks by the Secretary General at the Summit itself, in 2021, focused on the effects of COVID-19, climate, and conflict (UN, 2021).

At the same time, the Bureau for Resilience and Food Security of the US Agency for International Development (USAID) has been expanded to the Bureau for Resilience, Environment, and Food Security, recognizing the relationship between the environment and food security, and their joint effects on resilience (USAID 2024). For the first time ever, the 28th Conference of the Parties (COP 28), which signed the United Nations Framework Convention on Climate Change, had an entire day dedicated to food, agriculture, and water (COP 28 n.d.). Food systems for sustainable, healthy diets have become a global priority (IFPRI, 2024).

As these priorities and approaches to food systems transformation shift, calls for more research are growing stronger. A group of over 50 experts in the field recently published a call to action in Nature Food, supported by BMGF and FCDO outlining necessary elements to achieve a sustainable, equitable, and nutritious food system (Wineman et al. 2024). More evaluative research, evidence, and data featured prominently among these. Better data is a crosscutting thematic area at the UN Food Systems Coordination Hub (United Nations Food Systems Coordination Hub 2024). The Hub's Science and Knowledge cluster aims to facilitate the science-policy interface to promote systems thinking. Part of that requires making evidence readily available, which is the goal of this work (United Nations Food Systems Coordination Hub 2024).

The research landscape is quickly shifting alongside the paradigm shift in food systems strengthening. Over 200 new impact evaluations and systematic reviews have been published each year since this project began. In order to be practically useful, the evidence needs to be systematically collated and presented in an easy-to-access manner. Evidence gaps need to be identified and appropriate research prioritised to fill them.

2.1 Why a living E&GM is valuable

Any systematic search and collation process would quickly become outdated if it were not updated on a regular basis. Living synthesis products, which are continually updated as new evidence enters the literature, can facilitate better use of evidence by ensuring decision makers always have access to the latest evidence (Elliott et al. 2014; Snilstveit et al. 2017). In particular, living E&GMs help us understand which gaps are being filled by emerging evidence, and which remain.



3 What are the objectives of this E&GM?

This living E&GM aims to facilitate the use of evidence to inform policy decisions.

To meet these aims, this living evidence and gap map has two specific objectives:

1. To identify and describe the evidence on the effects of food systems interventions on food security and nutrition outcomes in L&MICs.
2. To monitor the evolution of primary research and evidence synthesis in the field, focusing on the identification of emerging trends and changes in knowledge gaps.

The research questions shown in Table 1 address these objectives. Research questions one, three, and four are consistent with the original map. Research question two was added during the update period to allow for a deeper focus on the development of the evidence base over time.

Table 1: E&GM research questions

No.	Research question	Type
RQ1	What is the extent, range and nature of existing empirical evidence regarding the effects of food systems interventions on food security and nutrition outcomes in L&MICs?	Coverage
RQ2	How has the evidence changed over time?	Change
RQ3	What are the primary research and synthesis evidence gaps in the literature?	Gaps
RQ4	What intervention and/or outcome areas could currently be prioritised for primary research and/or evidence synthesis?	Research needs

4 Our methods

This E&GM followed standards and methods developed by 3ie (Snilstveit et al. 2017; White et al. 2020). The scope and methods for this E&GM were determined *a priori* during the original map construction in 2020.

This included a comprehensive literature search that was first completed in 2020, and approximately every three months from July 2021 until January 2024. After each search, studies were screened, data extracted from included studies, and critical appraisals completed for all systematic reviews. Impact evaluations were not critically appraised as this is outside the scope of an E&GM. Detailed methods are available in the technical Appendix A.

The process for keeping the E&GM up to date was integrated with another living 3ie evidence product, the Development Evidence Portal (DEP). Resources permitting, studies retrieved in monthly literature searches to populate the DEP were also screened for eligibility for this E&GM. Thus, the studies included in the E&GM are a combination of items retrieved via searches designed specifically for the E&GM and the more general DEP searches.

4.1 Conceptual framework

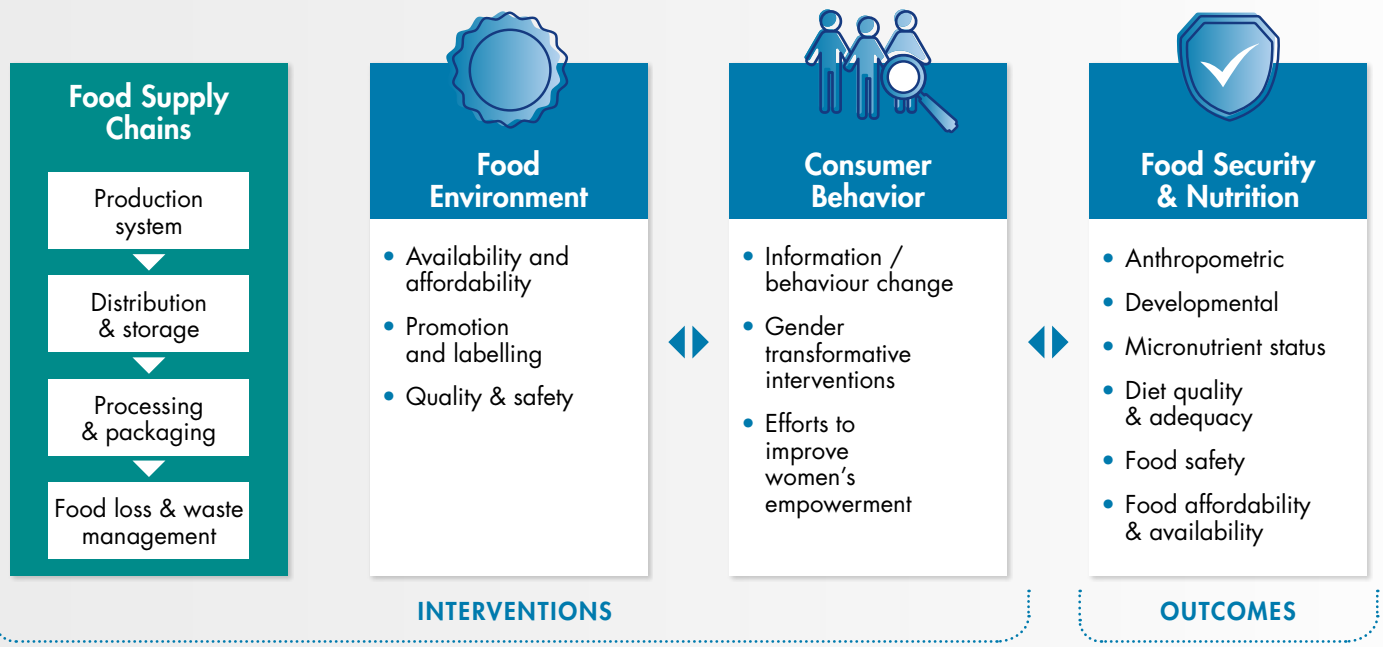
The High Level Panel of Experts established a framework to systematically map food systems (HLPE, 2017). In 2019, the International Food Policy Research Institute (IFPRI) extended this framework to include additional feedback mechanisms (de Brauw et al., 2019). We adopted this extended framework as the conceptual basis of our efforts to map the evidence relating food systems to nutrition and food security.[1]

[1] Since the inception of this work, a revised framework was published by the HLPE (2020). Although we acknowledge the importance of the changes to their framework, due to practical limitations and to maintain comparability of the map over time, we have not expanded the scope of our map to include these other systems, drivers, and outcomes.

Our framework comprises three intervention domains: the food supply chain, the food environment, and consumer behaviour. The domains reflect types of actions and interventions, not a sequential flow of activities leading to one another. The food supply chain is broken down into production activities, storage and distribution, processing and packaging, and food loss and waste management (Figure 2). The food environment is the physical, economic, political and sociocultural surroundings, opportunities, and context that create, prompt, and shape dietary preferences and choices and nutritional status (Swinburn et al. 2014; Beddington et al 2017). These include the availability, physical accessibility and provision of foods; affordability; promotion and labelling; and food quality and safety. Finally, consumer behaviour involves individual preferences related to consumption, food prices and income available for food (de Brauw et al., 2019). It includes prices, preferences, women's empowerment in the context of the food system, and information. For the full list of included interventions see Appendix A1.

FIGURE 2

Summary of E&GM theory of change



Source: Adapted from HLPE 2017 and de Braw et al., 2019. Changes include an omission of the drivers depicted in the original framework, re-orientation of the food supply chain presentation, focus of food security and nutrition outcomes, and the addition of bi-directional arrows, which highlight that intervening at one stage in the food system may have implications for activities at another stage. Only final outcomes are listed in the figure. The shading of the food supply chain along with the white arrow is meant to illustrate the flow of food through the value chain.



The framework outlines five drivers of change in global food systems: biophysical and environmental; innovation, technology and infrastructure; political and economic; sociocultural; and demographics (HLPE, 2017; de Braw et al., 2019). These drivers work outside the food system, but have significant impacts on food systems by altering food production and demand.

The framework includes outcomes related to food security and diet; nutrition; health; and social, economic and environmental well-being. Outcomes are divided into *intermediate* and *final* categories. Final outcomes are those related to food security, nutrition, health, and well-being. Intermediate outcomes are those measuring upstream aspects of the food system, including food loss and distribution, regulatory regimes, food advertising and labelling, and motivators of healthy food behaviours. For the full list of intermediate and final outcomes, see Appendix A1.

Over the past year, the framework has been refined to accommodate two key topics that intersect with food systems and nutrition. Firstly, we added a set of social protection interventions (social insurance, food vouchers, conditional cash transfers, and unconditional cash transfers) to the food environment category. Previously, the only social protection programs included were those that specifically provided cash-for-food, regardless of the exact mechanisms used in order to do this.

Secondly, we added gender transformative interventions and outcomes to the framework to complement the existing "women's empowerment" categories.[2] We further expanded the definition of the existing "women's empowerment" intervention category in our framework to cover any women's empowerment intervention as long the study measures an included outcome (previously only women's empowerment interventions directly related to the food system were included).

Although the studies identified as part of this framework expansion were added to the E&GM in the past year, in the remainder of the report we count these studies as having been included "as part of the original E&GM" or "during the update period" based on their publication dates. That is, a study of a social protection intervention added to the map in 2023 but published in 2010 would be counted as part of the "original E&GM". This allows us to report on trends in the literature for these areas of the expanded framework in the same way we do for topics that were part of the original framework.

4.2 Criteria for including and excluding studies

Table 2 presents the detailed criteria for including and excluding studies according to the population, intervention, comparator, outcome and study design (PICOS) framework. The PICOS framework sought to identify impact evaluations and systematic reviews of impact evaluations that assessed the effects of at least one food system intervention on food security and nutrition outcomes for any population based in an L&MIC.

[2] There is no universally accepted standard in the literature for distinguishing between outcomes that are empowering for women and those that are "gender transformative". For the purposes of this E&GM, we consider GTA to transform unequal and harmful gender relations, discriminatory norms and practices (UNFPA, 2023; FAO, 2020). While women's empowerment focus on increasing women's participation, agency, and access to resources in society (Richardson, 2018).

Table 2: PICOS summary of criteria for the inclusion and exclusion of studies

Criteria	Inclusion criteria	Exclusion criteria
Population	Studies of interventions with programme participants that were located in a L&MIC in the first year of implementation[i] Impact evaluations with at least one effect size for an L&MIC country population Studies focused on the prevention of clinical conditions	Studies focused on niche populations, such as athletes or the military Efficacy studies, unless completed in a sufficiently real-world setting Studies targeting participants with a clinical condition Studies focused on high-income country migrant populations in L&MICs and vice versa
Intervention	Studies of interventions that directly intervene on an aspect of the food system within its three primary domains: the food supply chain, the food environment and consumer behaviour Studies evaluating multiple food systems interventions	Interventions not in the food system or interventions targeting drivers of the food system without an explicit food system focus Interventions focused on the financing of a food systems intervention
Comparisons	Studies using appropriate comparisons included: business as usual, an alternative treatment, no treatment or an early- versus-late comparison (where those that took part in earlier years are compared to those that took part in later years)	Studies that did not justify and make use of an appropriate comparison group
Outcomes	Final outcomes relating to anthropometry, physical and mental development outcomes, micronutrient status, diet quality and adequacy, food safety affordability and availability Intermediate outcomes were included for all interventions that were deemed relevant to the food system	Health and non-food-system related education outcomes Mortality and morbidity outcomes, unless a disease is directly linked to a specific micronutrient deficiency (e.g. anaemia or goitre)
Study design	Effectiveness studies, based in real- world settings, employing one of the following methods: randomised controlled trials (where treatment assignment is random); and quasi- experimental designs (where treatment is assigned as if it were random; e.g. regression discontinuity design, instrumental variables, panel methods, difference-indifference, synthetic control groups, interrupted time series analysis and statistical matching) Systematic effectiveness reviews, which employ recognised search and synthesis methods (Snilstveit et al., 2016)	Before-after studies or cross- sectional studies that do not attempt to control for selection bias or confounding in any way Case-control studies Randomised block designs where farm field sections are the blocking unit Willingness-to-pay and hypothetical experiment studies
Other	Studies published in or after the year 2000[ii] Complete or ongoing studies (i.e. protocols are included) Studies in any publication format	Studies in any language other than English

i As defined using the World Bank Atlas method. More information on this approach is available at: https://bit.ly/3eBAWKJ.
ii The cut-off at the year 2000 was made arbitrarily to make the volume of search results more manageable.

5 What we found

5.1 Results of the search

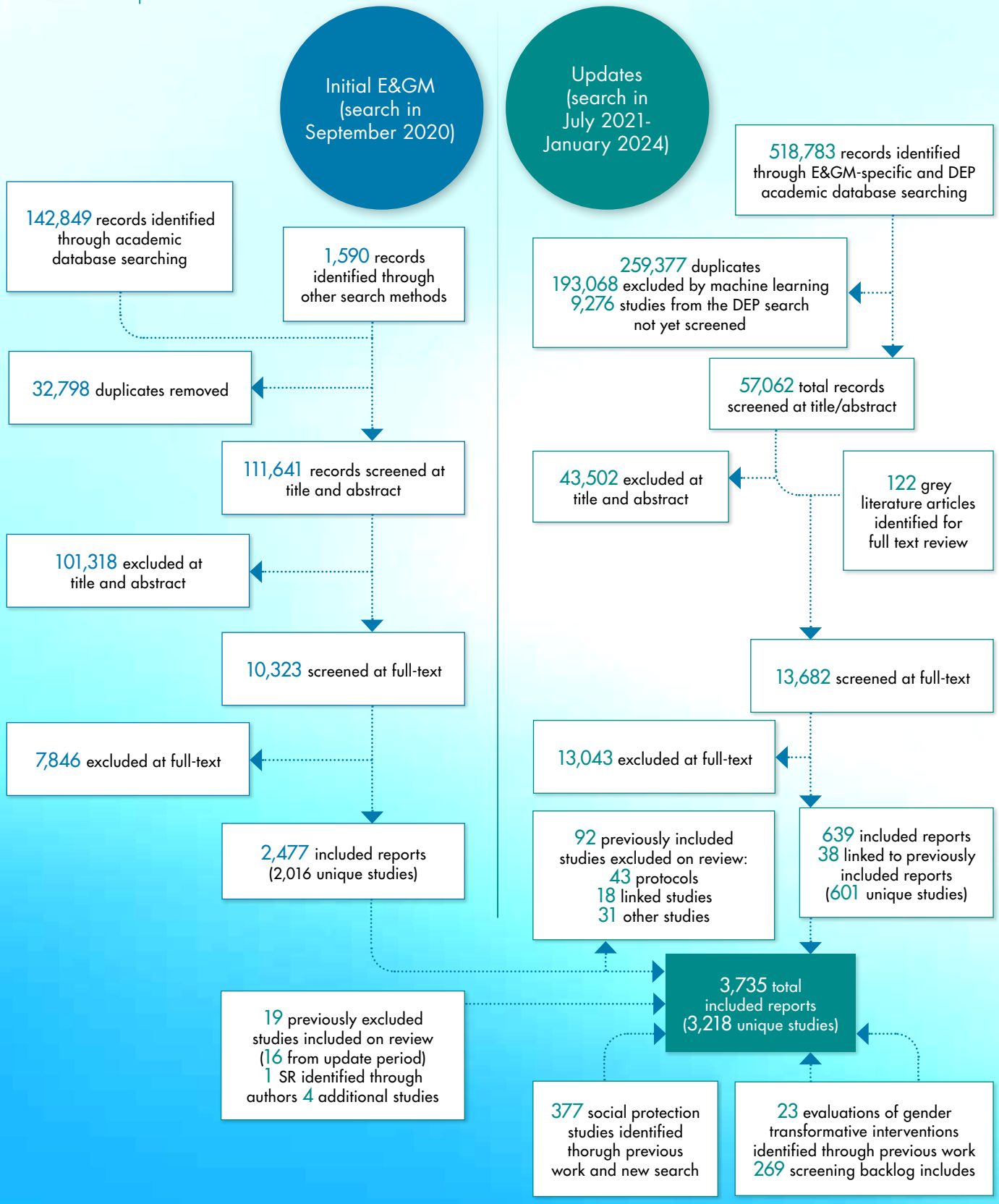
During the update period, 559,852 articles were retrieved through the search of academic databases (Figure 3). We excluded 283,487 as duplicates and 205,945 using a machine learning classifier applied in EPPI-Reviewer 6. In addition, 9,276 studies from the DEP searches were set aside until resources become available to screen them. Therefore, a total of 61,144 articles were screened on title and abstract from all update rounds.

Items that were not excluded at the abstract screening stage were included for full-text screening. We screened 14,314 articles at full text, including 122 articles identified through the grey literature search. In total, the map has 2,295 (IE n=2,104, SR n=191) original studies and 923 (IE n=875, SR n=48) update studies. Thus, the map now contains 3,218 unique studies (IE n=2,979; SR n=239). We use these numbers as the denominators for all percentages reported, unless otherwise specified.



FIGURE 3

Overview of search and screening process (Original map – Updates)



5.2 Characteristics of evidence base

5.2.1 The evidence base has grown substantially during the update period, but with little change in where the evidence is concentrated

The evidence base has seen significant growth in the last decade, particularly since 2016. In every year since then, except 2020, at least 200 impact evaluations have been published (Figures 4a and 4b). The publication trends for the systematic reviews show more fluctuation. Overall, research output peaked in 2019 with 260 impact evaluations and 30 systematic reviews, followed by a drop in 2020 that could have been caused by disruptions from COVID-19. The 875 impact evaluations and 48 systematic reviews added during the update period represent a 40 per cent increase in the evidence base. Publications appear low in 2024, as the final search was completed in January 2024.

FIGURE 4A

Distribution of included studies by publication year (Impact Evaluations)

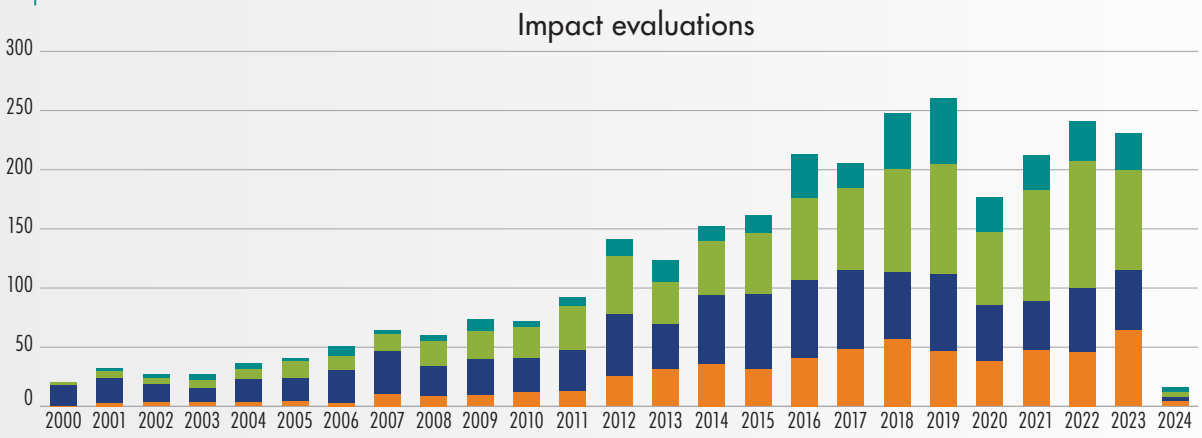
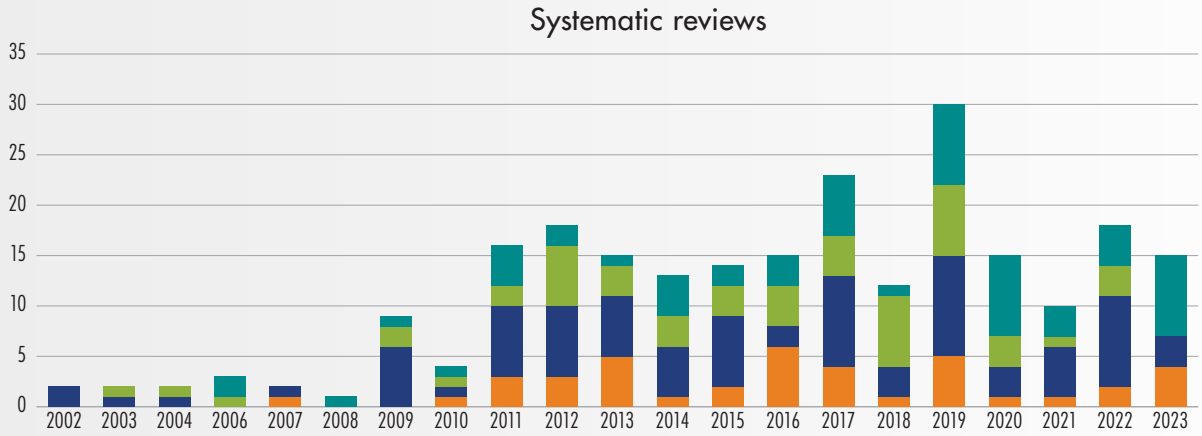


FIGURE 4B

Distribution of included studies by publication year (Systematic Reviews)





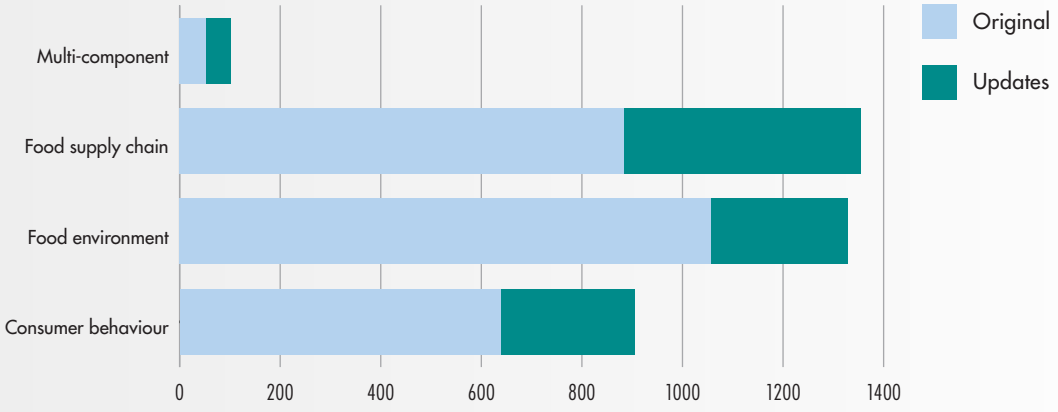
Overall, the food supply chain is the most common domain, with 42 per cent of all studies, followed by food environment with 41 per cent, and consumer behaviour with 28 per cent (Figure 5). The proportions for the food supply chain domain increased from 38 per cent (IE n=815, SR n=68) in the original E&GM to 51 per cent (IE n=453, SR n=18) in the update periods. The proportion of food environment interventions decreased from 46 per cent (IE n=957, SR n=100) in the original E&GM to 29 per cent (IE n=241, SR n=31) for the update period. The proportion of studies focusing on the consumer behaviour domain went from 2 per cent (IE n=587, SR n=51) in the original to 5 per cent (IE n=247, SR n=20) in the update period.

5.2.2 The evidence is concentrated on a handful of interventions, including fortification, supplementation, and educational interventions for consumers

The most common interventions in the original E&GM were the *provision of supplements* (IE n=374, SR n=68), *fortification* (IE n=272, SR n=47), and educational interventions (*classes*) in the consumer behaviour domain (IE n=271, SR n=27). The overall trends have remained similar; however, for the update period *food provision* (IE n=89, SR n=11) is the most common, followed by *supplements* (IE n=75, SR n=16) and *classes* (IE n=91, SR n=8). Compared to the original E&GM, the focus on *fortification* and *supplementation* interventions has reduced slightly, by 7 per centage points and 9 percentage points respectively. The new *cash transfer* interventions are also very common: if we combine the unconditional and conditional cash transfers they would be the second most common intervention (IE n=432, SR n=28, Figure 6).

FIGURE 5

Proportion of intervention domains evaluated in impact evaluations and systematic reviews



Notes: "Multi-component" refers to a set of interventions with multiple components that we added as distinct categories in our framework because they are frequently evaluated together. See Appendix A1. If a study evaluated a different multi-component intervention with components in multiple domains, it is counted multiple times in the figure.

FIGURE 6

Distribution of included studies by intervention domain and intervention



Notes: If a study evaluated multiple interventions, it was counted multiple times.

Several intervention categories identified as gaps in the original E&GM have seen additions during the update period, while others remain neglected. The updates found 15 additional studies on *food subsidies*, bringing the total to 30. One study each was added to *on-farm, post harvest processing* (IE n=5), *farm-to-market transport* (IE n=6), and *food taxes* (IE n=10), while 3 studies were added to the *food safety regulation* category (IE n=4), 9 *women's empowerment* interventions (IE n=50), and *7 gender transformative* interventions (IE n=19). The expanded scope of the women's empowerment categories in the revised framework resulted in the addition of 23 studies on *women's empowerment* interventions and *7* additional studies of *gender transformative* interventions. However, the following gaps have no new studies identified since the original E&GM: *innovative store design* (IE n=*5*), *advertising and labelling regulation* (IE n=1), *packaging* (IE n=0) and *cold chain* initiatives (IE n=1).

The original E&GM also identified several interventions that may benefit from additional synthesis of the evidence. The update period has identified a systematic review in one of these areas, *agricultural insurance*, bringing the number of SRs on this intervention to two. While the original E&GM identified a number of SRs on *educational approaches in agriculture* (SR n=9) and *provision of free or reduced-cost farm inputs* (SR n=*7*), we suggested that there were still synthesis gaps in these areas because of the wide range of interventions in these domains. The update period did not identify any new SRs in these categories, meaning that the synthesis gaps remain.

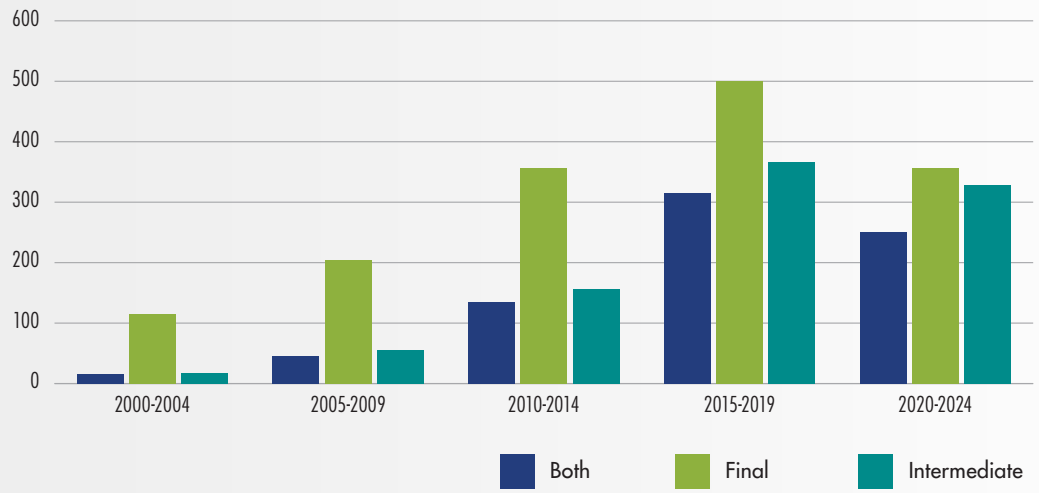
5.2.3 Studies tend to measure "final" outcomes like diet quality and anthropometric measures; less attention is paid to intermediate outcomes, apart from those related to agricultural production.

The E&GM reveals a trend over the past 25 years of more balance in the measurement of intermediate and final outcomes (Figure *7*): while studies tended to focus almost exclusively on final outcomes in the early years covered by the E&GM, recent years have seen more studies measuring intermediate outcomes (or both intermediate and final). Over six times as many studies measured final outcomes than intermediate outcomes in 2000-2004. This reduced to just over double in 2010-2014 and about equal numbers for 2020-2024. However, it is still less common for studies to measure both intermediate and final outcomes: about 100 fewer studies measure both outcome types than either individually.



FIGURE 7

Disaggregation of outcomes by intermediate and final categories and publication year

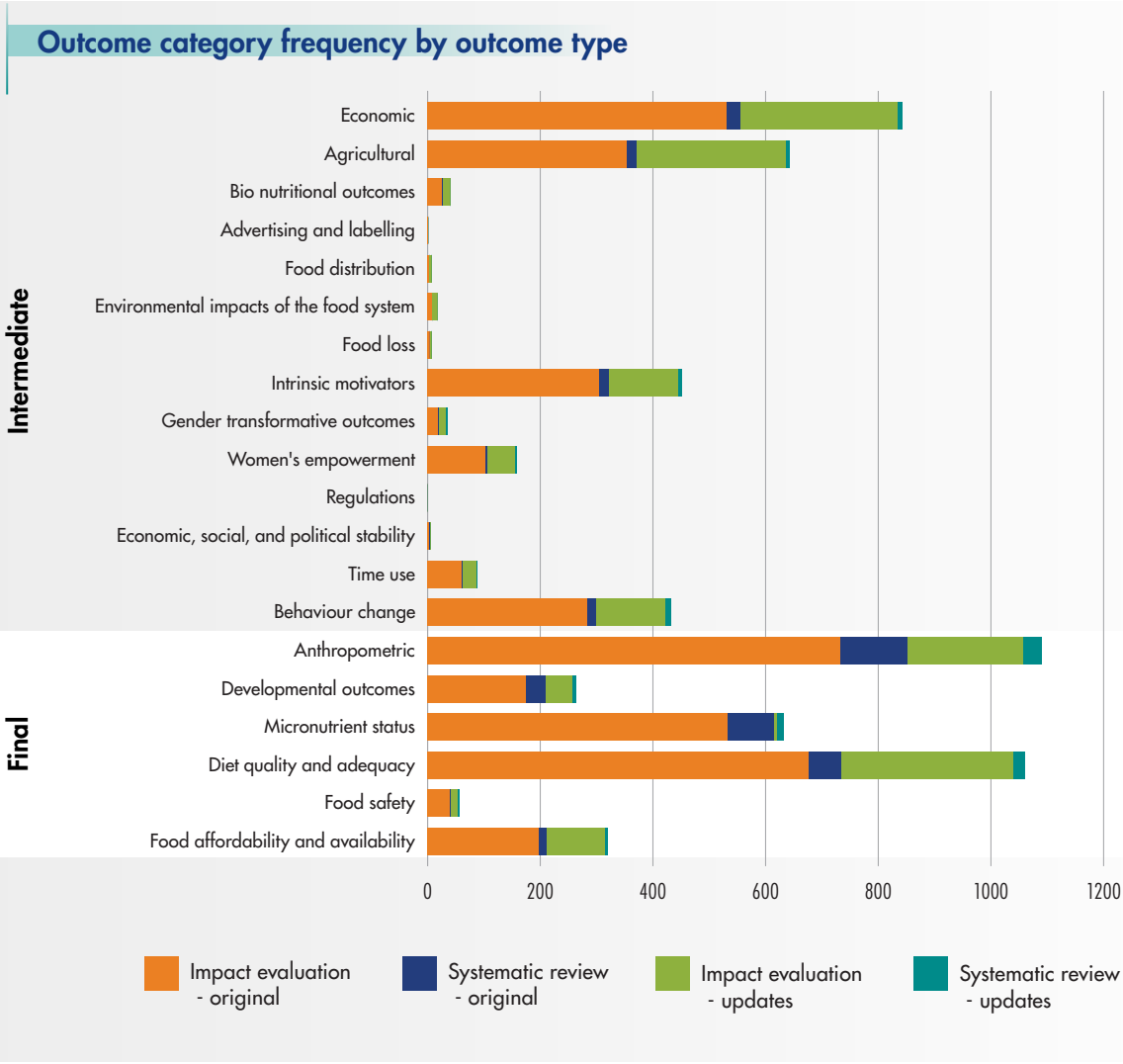


The most commonly measured final outcome groups in the original E&GM were *anthropometrics* (IE n=732, SR n=121), *diet quality and adequacy* (IE n=677, SR n=58), and *micronutrient status* (IE n=534, SR n=81; Figure 8). During the updates, *diet quality and adequacy* (IE n=306, SR n=20), *anthropometrics* (IE n=204, SR n=33), and *food affordability and availability* (IE n=102, SR n=5) have been the most common ones. Outcomes in the *Food safety* group have remained the least measured, appearing in only 57 studies.

The most common intermediate outcome groups have also remained similar since the original E&GM. Overall, *economic* outcomes are most common (IE n=811, SR n=31), followed by *agricultural* (IE n=620, SR n=23), and *intrinsic motivators* (IE n=430, SR n=22). During the update period, *behaviour change* was the third most commonly measured outcome type, and *intrinsic motivators* fourth.

We still see a number of gaps in coverage of intermediate outcomes. The intermediate outcome group *regulations* has not been measured in any studies. *Advertising and labelling* has been measured only once in the original E&GM and zero times in the update period. Several outcome groups have been measured five times or less: *economic/social/political stability, food distribution centres, food spoilage, movement of food, non-food waste produced, accuracy of advertisement,* and *agricultural cooperatives*.

FIGURE 8



Notes: If a study measured multiple outcomes it was counted multiple times.

Table 3: Overall 10 least studied outcomes evaluated by impact evaluations

Final		Intermediate	
Outcome	**No. IEs update (original)**	**Outcome**	**No. IEs update (original)**
Food borne illness	2 (29)	Caloric requirement	6 (1)
Iodine	7 (24)	Food prices	7 (0)
Food availability and supply	4 (14)	Food loss	3 (3)
Affordability	2 (11)	Import/export	3(2)
Other food safety outcome	7 (6)	Economic/social/political stability	1(3)
Food access	1 (12)	Agricultural cooperatives	2 (2)
Physical	3 (9)	Accuracy of advertisement	0 (1)
Food toxins	5 (4)	Food distribution centres	1 (0)
Other food security outcome	4 (3)	Movement of food	1 (0)
Food stressed households	2 (2)	Non-food waste produced	0 (1)

The table only reflects the outcomes that have been evaluated. Some outcomes have not been measured in any included impact evaluation.

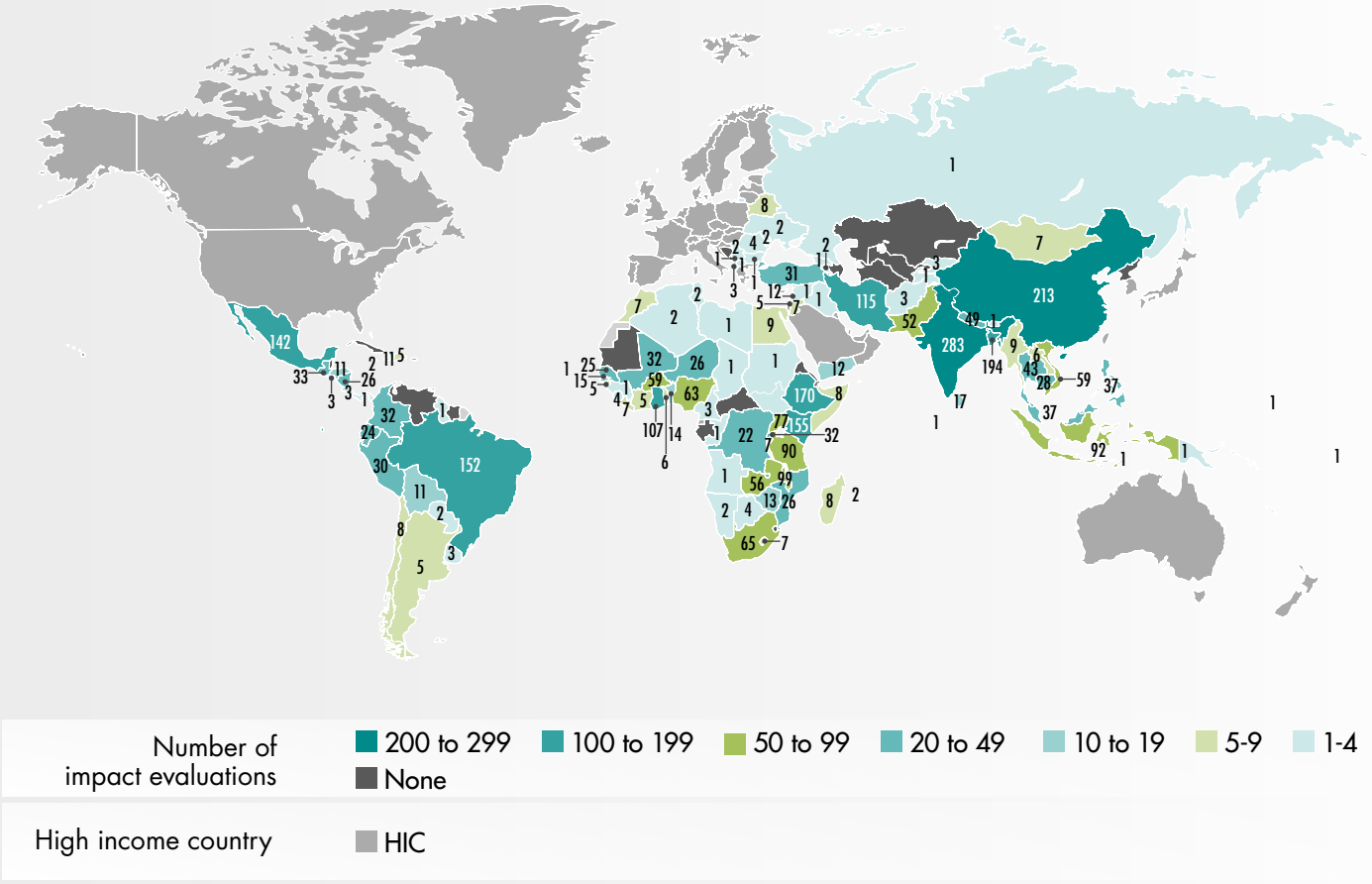
5.2.4 Geographic coverage of the evidence is uneven, and there are significant gaps in evidence from the most hunger-stricken countries.

Sub-Saharan Africa has been the most studied since the original E&GM, with 1,148 impact evaluations, or 39 per cent of all impact evaluations . South Asia has remained the second most frequently studied region (IE n=599, 20%), followed by Latin America and the Caribbean.

The update period has seen some notable changes in where evaluations are conducted. In the original E&GM, India was the most studied country (IE n=193, 9%), followed by Bangladesh (IE n=141, 7%), and Brazil (126, 6%). However, during the update period the most studied countries were China (IE n=102, 12%), India (IE n=94, 11%), and Ethiopia (IE n=74, 8%). Considering both the original E&GM and the update period, India is the most studied (IE n=287, 10%), followed by China (IE n=218, 7%), and Bangladesh (IE n=194, 7%; Figure 9).

FIGURE 9

Country coverage (IEs)



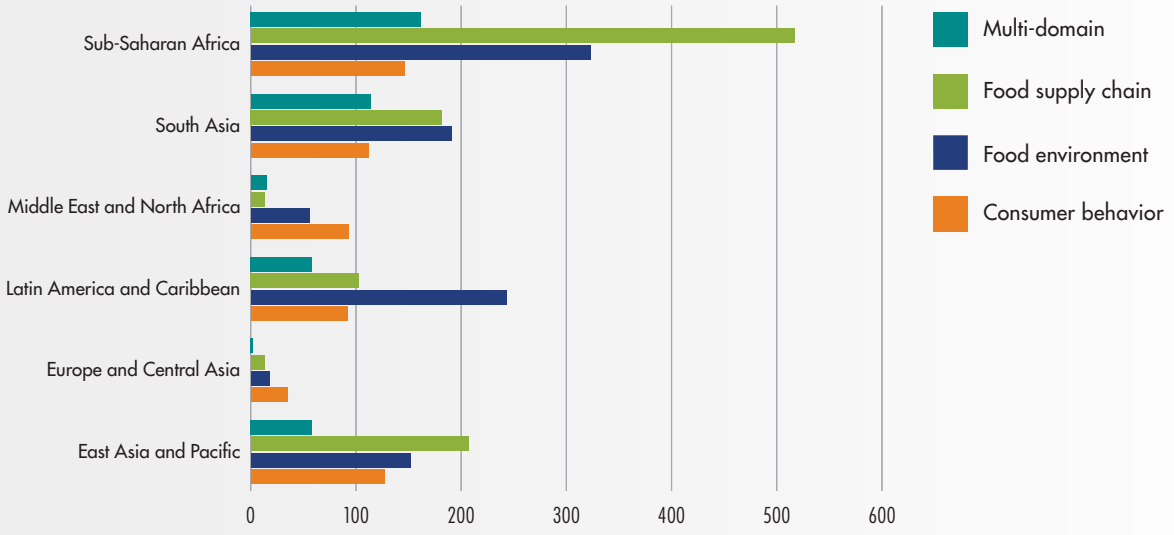
Notes: If an IE took place in multiple countries it was counted once for each country.

Different intervention domains tend to be evaluated in different regions. For instance, evaluations in Sub-Saharan Africa have a strong focus on *food supply chain* interventions (IE n=517, 43%; Figure 10). Evaluations in Latin America and Caribbean have a greater focus on *food environment* interventions (IE n=243, 52%). The Middle East and North Africa, while home to a relatively small number of evaluations overall, is the only region where *consumer behaviour* interventions are the most common (IE n=93, 54%). In South Asia, *food environment* (IE n=191, 32%) and *food supply chain* (n=181, 30%) interventions are both common, while *food supply chain* interventions predominate in East Asia and Pacific (IE n=207, 40%).

When we compare the availability of evidence in individual L&MICs with the severity of hunger in those countries (according to the Global Hunger Index, GHI), we find a striking lack of evidence from those countries facing the most significant challenges today.[3] The average number of IEs in countries with "Alarming" rates of hunger severity is only 12.2, less than half the average from any of GHI's other severity categories (Figure 11). However, while evidence is lacking from countries facing the most severe hunger challenges, a promising sign is that there is a significant evidence base from countries whose hunger challenges are somewhat less severe, but still serious: countries in GHI's "Serious" category have over 40 IEs on average.

FIGURE 10

Distribution of studies by region and intervention domain (IEs)

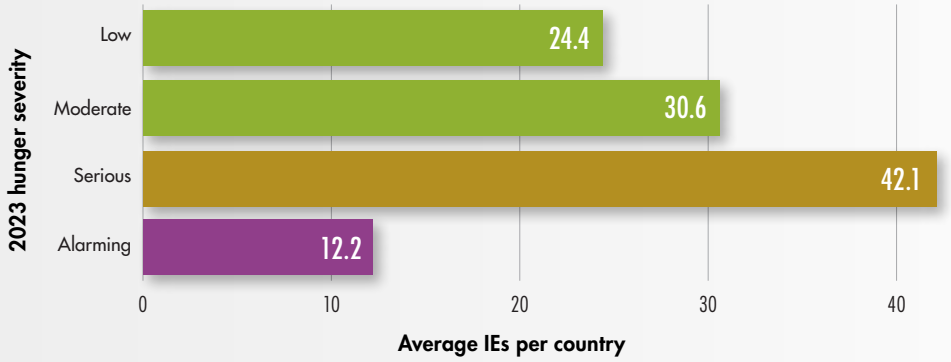


Notes: If an IE took place in multiple regions it was counted once for each region.

[3] There are several possible reasons for this pattern. One is that it is simply more difficult to conduct rigorous impact evaluations in contexts with severe hunger challenges, which often co-occur with other contextual challenges. Another possibility is that substantial evaluation research has been conducted in these contexts, but this research has been published in languages like French and Portuguese, and was thus ineligible for the E&GM. However, we note that a recent analysis of evidence for Sustainable Development Goal 2 (Zero Hunger), using a similar dataset that includes non-English literature, found a similar pattern (Engelbert et al. 2023). Whatever the reasons for the lack of evidence from contexts with severe hunger challenges, the effect is the same: limited evidence is available to guide key policy decisions in these contexts.

FIGURE 11

Evidence is severely lacking from the most hunger-stricken countries



5.2.5 Most studies evaluate interventions targeting the whole population, rather than a particular sex or age group

Most evaluated interventions do not have a specific focus on either male or female participants (both sexes are targeted in 64 per cent of studies in the original report and 84 percent in the update period; Figure 12). When one sex is targeted, it tends to be women, a trend that is consistent between the update period: studies targeting women accounted for 18 percent of the original map and 13 percent of studies identified in the updates. In contrast, studies targeting men specifically are less than 1 percent in both periods.



Among the studies that targeted a specific age group we find that impact evaluations targeting children under two account for almost 26 per cent of the total studies included original map but for 11 percent in the update period (Figure 13). In contrast, studies targeting the whole population, increased from 12 percent in the original database to 59 percent in the updates. Children under two years old and adults over 20 and under 60 are the two most targeted age groups overall. People over 60 years old also continue to be the least targeted group in the original map and across the update period, with a constant 3 per cent share of studies.

FIGURE 12

Distribution of impact evaluations by targeted sex

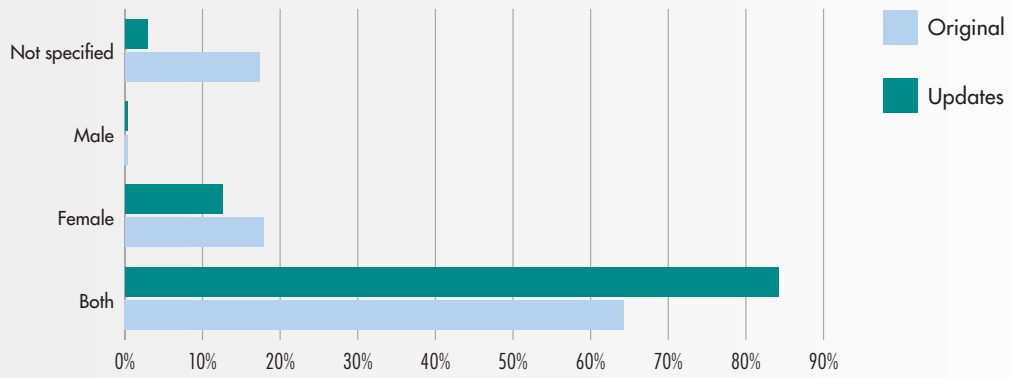
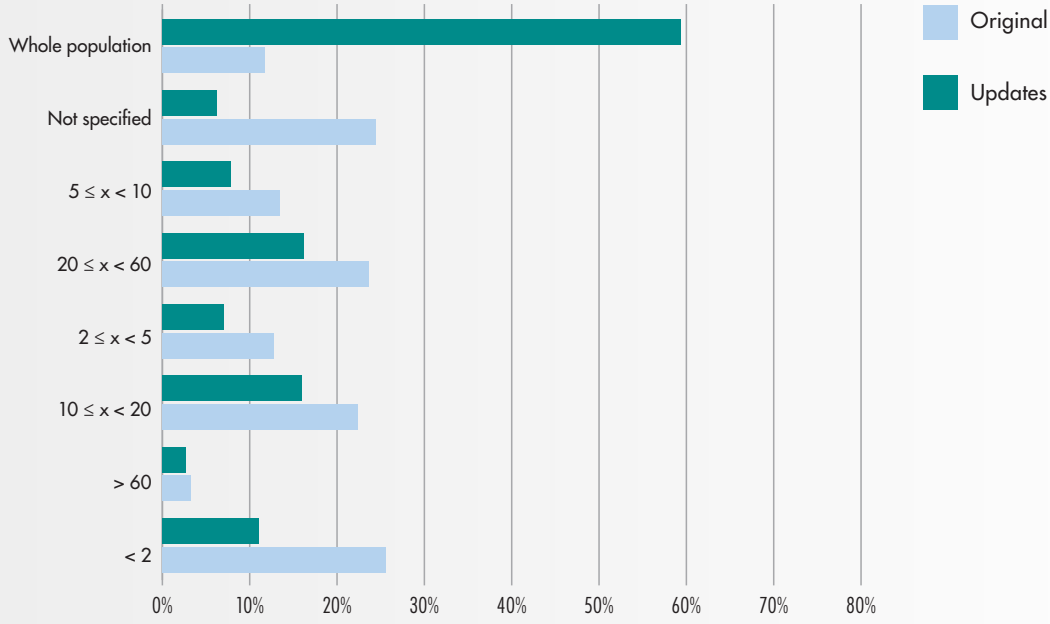


FIGURE 13

Distribution of impact evaluations by targeted age

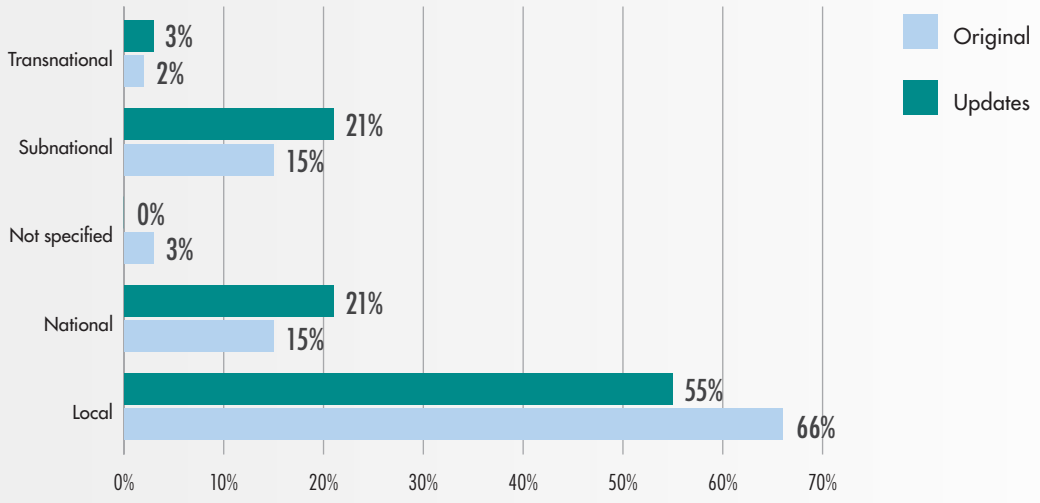


Notes: If a study measured targeted multiple age groups it was counted multiple times.

There is a significant shift in the scale at which interventions are implemented. Local interventions decreased from 66 per cent in the original map to 55 per cent in the update period (Figure 14). This is consistent with the findings in our midterm report, where there was a slight increase in studies taking place at a larger scale compared to our original map. Studies focusing on national interventions increased from 15 per cent in our original map to 21 percent in the update period. Similarly, transnational interventions went from 2 to 3 per cent. Studies evaluated at this level focused mainly on *the direct provision on foods* (24%) in our original map, however, this percentage decreased to 11 percent in the update period. The updated evidence shows that transnational level evaluations focused mainly on the *provision and use of supplements* which represent 15 percent of the total studies. *Fertiliser access*, for which we found no evaluation studies at a transnational level in our original map, accounted for 11% of studies in the update period. At the subnational level, there has been a significant increase in the number of studies on *conditional* (21%) and *unconditional cash transfers* (19%) during the update period. In contrast, in the original evidence base, each of these two intervention groups constituted 3 percent of the overall included studies.

FIGURE 14

Distribution of impact evaluations by scale of implementation

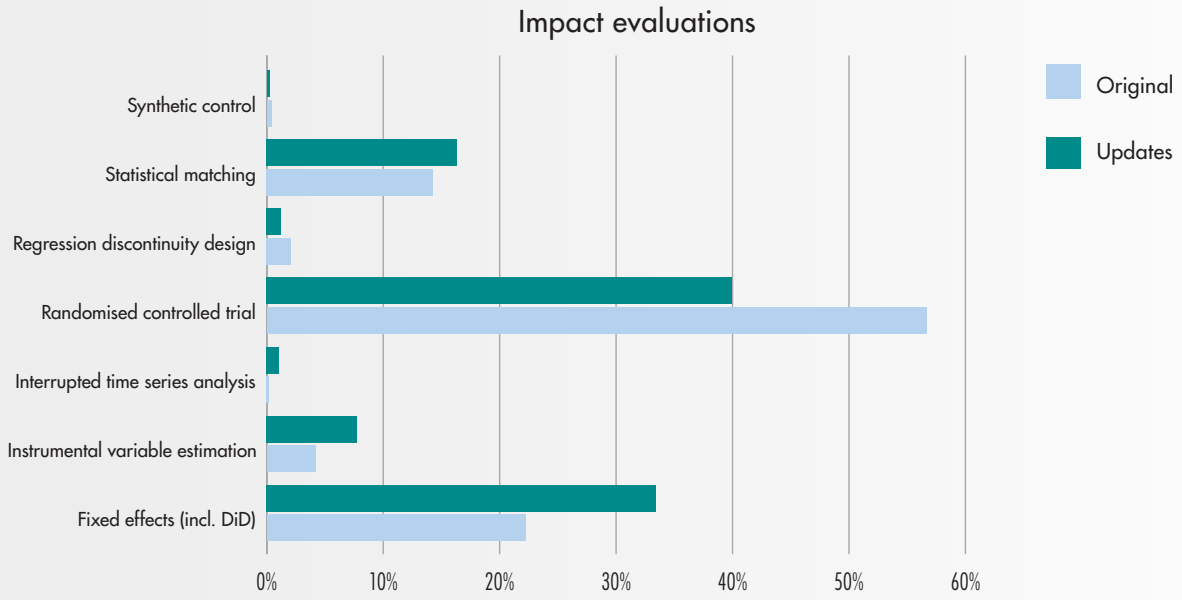


5.2.6 The prevalence of quasi-experimental evaluation studies is increasing

The original E&GM included 70% randomized controlled trials (IE n=1471). In total, 53% of included studies in the update period were randomized controlled trials (IE n=468). This means that overall for the E&GM the proportion of experimental studies has decreased to 65% (IE n=1939). Fixed effects have increased from 25 per cent in the original E&GM (IE n=530) to 42 per cent (IE n=365) in the update period. Instrumental variable estimation increased from 5 per cent (IE n=113) to 10 per cent (IE n=88) . The trends of the other quasi-experimental methods remain similar to the original E&GM. Overall synthetic controls (IE n=12, 0%) and interrupted time series (IE n=16, 1%) are the least common (Figure 15).

FIGURE 15

Distribution of impact evaluation by study design



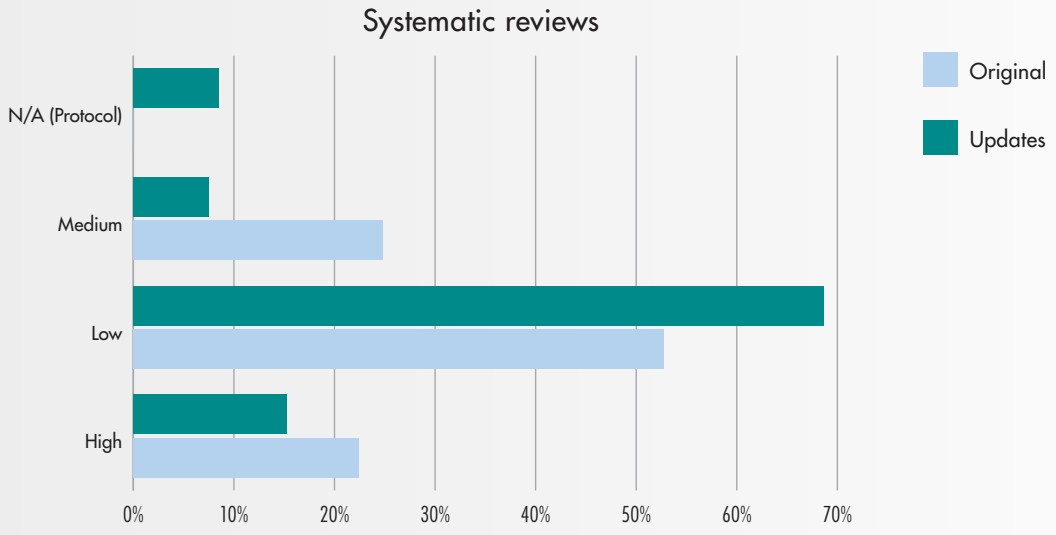


Mixed methods decreased from 10 per cent (IE n=211) in the original E&GM to 5 per cent (IE n=48) in the updates. Overall, 9 per cent (IE n=259) of the included studies still apply mixed methods.

During the update period we have identified 48 systematic reviews. The adherence of these reviews to gold-standard methods for evidence synthesis has declined over time. We have identified only 8 high-confidence and 4 medium-confidence systematic reviews published over the past 4 years. These numbers are low compared to 2019 when 30 systematic reviews were published where 10 of them were high-confidence and 10 were medium-confidence. The original E&GM included 49 per cent high- and medium-confidence systematic reviews, while during the update period only 25 per cent have been rated as high- and medium-confidence (Figure 16). Overall, the E&GM includes 106 high- and medium-confidence systematic reviews (44%).

FIGURE 16

Distribution of systematic reviews by confidence rating



6 Conclusions and implications

6.1 Reflections on the living nature of this E&GM

This E&GM demonstrates the importance of both systematic mapping exercises and "living" approaches to evidence aggregation and synthesis. By providing a view of where there are a cluster of evaluations but no synthesis, the E&GM can direct resources towards useful syntheses in these areas. Indeed, this map has served as the basis for four rapid evidence assessments (Berretta et al., 2022; Lane et al., 2023; Basak, 2024), a systematic review (Hammaker et al., 2022), and another evidence gap map (Lane et al., 2023). Although the map was commissioned by GIZ, both USAID and Norad commissioned research projects using the map (Lane et al. 2023 & 2023). Thus, multiple organisations have been able to access this evidence base in ways that are aligned with their own priorities, without having to develop a completely new evidence map.

The E&GM has been useful for several groups working in the food systems and nutrition space, having been referenced in documents from the Millennium Challenge Corporation (Laborde and colleagues, 2021); International Food Policy Research Institute (Njuki and colleagues, 2021); FCDO (Carter and colleagues, 2021); and European Commission (European Commission, 2022). It was cited eight other times by various other reports, journal articles, and protocols.

Our continuous update process holds several lessons for living synthesis. A major benefit of living syntheses is that they become more efficient over time. The early stages of a living synthesis generate data that can be used to train machine learning classifiers and other artificial intelligence tools that can largely automate later stages. In our case, we used screening data from the original E&GM to build a machine learning classifier that was highly efficient in filtering out irrelevant search results: with the classifier we were able to exclude approximately 75 per cent of search results without human review.

6.2 Research question 1 COVERAGE

What is the extent, range and nature of existing empirical evidence regarding the effects of food systems interventions on food security and nutrition outcomes in L&MICs?

Our living evidence mapping process has identified 2,979 impact evaluations and 239 systematic reviews considering the effect of food systems interventions on food security and nutrition in low- and middle-income countries.

Interventions:

The most studied interventions, each examined by over 300 impact evaluations and over 30 systematic reviews, are *fortification, direct provision of foods, supplements,* and *classes about consumer behaviour*. These interventions tend to be evaluated at the local level and require continuous inputs, which can make them less sustainable than other interventions which foster self-sufficiency.

Private food donation, food packaging interventions, education on the use of food waste, and *advertising regulations* still have not been evaluated. These interventions each provide unique opportunities for improving the food system; however, because they are not being widely implemented in a way that affects a large number of people, they may not represent the most pressing evidence gaps. Nonetheless, while still requiring inputs, *private food donations* shift the party providing the inputs from traditional actors (governments and NGOs) to private individuals, offering a new avenue for resource mobilization. *Education on the use of food waste or nontraditionally used food* could make food systems more efficient, increase food production, and reduce the food systems' carbon footprint. *Advertising regulations* have the potential to improve consumer's dietary choices without the need to directly engage with them, potentially making them a low-cost way to affect a large audience.

Agricultural extension programs, agricultural information/guidance programs, other agricultural educational programs, gender transformative interventions, free or reduced cost access to livestock or livestock equipment, provision of mechanical equipment for agriculture, improved water access and management systems for agriculture, and social insurance interventions have been considered by 15 or more impact evaluations and no high- or medium-confidence systematic reviews. There are, however, currently two systematic review protocols for gender transformative interventions, one protocol for free or reduced cost access to livestock or livestock equipment, and one protocol on improved water access and management systems for agriculture.

Outcomes:

The final outcomes that have not been evaluated at least 10 times were food toxins (IE n= 9), food stressed households (IE n=4), other food security outcome (IE n=7), and other food borne illness (IE n=0). However, several intermediate outcomes have never been considered: *advertisement topics, exposure to advertisements, fines, location of food in stores, other regulatory outcomes, other steps taken due to non-compliance, tax revenue, time food remains unspoiled, and violations.*

Evaluating these intermediate outcomes, especially in combination with the evaluation of final outcomes, could support a better understanding of how food systems are changed, by elucidating the whole system and not only the final result. This could lead to more effective food systems transformation by identifying promising pathways of changed. However, as process-oriented outcomes, they may not represent the most pressing evidence gaps for impact evaluation. The focus on *iron status, linear growth, relative weight,* and *weight* as final outcomes, each evaluated over 400 times, is useful in so far as these are measures of overall health and well-being, which is an ultimate goal in food systems interventions.

Geography:

Evaluations focus on sub-Saharan Africa (n=1148, 39%), low income (n=1114, 37%), and lower middle-income countries (n=1115, 37%). The distribution of evaluations by country does not align with the countries with the most severe hunger according to the Global Hunger Index. As such, we are not learning about the countries experiencing the most severed food security and nutrition issues. Instead, studies seem to be concentrated in large countries with strong traditions of impact evaluation research (India, China, Bangladesh, and Ethiopia).

Population and scale:

Studies tend to consider all genders (n=2090, 70%) and all or unspecified age groups (n =1337, 45%). This is not inherently problematic as outcomes do need to be improved for all groups. However, it could suggest that the unique needs of individually vulnerable groups and the differences in vulnerabilities between groups are not being addressed. There is a strong focus on evaluations that take place at the local level (n=1876, 63%). Local interventions are inherently limited in the number of people they affect. In order to meet the scale of the global food security and nutrition crisis, interventions need to be implemented and evaluated at the national and transnational level. However, we find relatively few evaluations of interventions implemented at this scale (n=556, 19%), although it is unclear whether this is because such interventions are less frequentsly implemented, or because they are less frequently evaluated. Innovations proven to be effective at the local level can face challenges related to demand, finances, institutional capacity, policies and incentives, politics, the environment, partnership, and leadership which prevent them from being implemented effectively at scale (Cooley & Linn, 2024).

Methods:

Most impact evaluations used randomized designs (n=1939, 65%). Among quasi-experimental studies, fixed effects estimation was the most common (n=895, 30%). Few studies used interrupted time series (n=16, 1%), synthetic control analysis (n=12, 0%), or regression discontinuity (n=60, 20%). This pattern could explain some the focus on local interventions, which are often difficult to randomize and do not lend themselves to interrupted time series, synthetic control, and regression discontinuity analysis. Systematic reviews tended to have significant methodological limitations (n=129, 54% are "low confidence") and focused on supplementation (n=84, 34%) and fortification (n=58, 24%).

6.3 Research question 2 CHANGE

How has the evidence changed over time?

Our map experienced a 40 per cent increase in size during the update period when the studies from the framework expansion published in the years of the original E&GM are considered original studies.

There was a decrease in the number of new publications in 2020, possibly resulting from the COVID-19 pandemic. The rate of publication has not yet recovered fully to pre-pandemic levels. Nonetheless, the addition of 875 impact evaluations and 48 systematic reviews during the update period represent rapid growth. When considering only interventions included in the original map, the evidence base expanded most rapidly in the food supply chain (n=452, 55% growth), followed by the food environment (n=241, 25% growth), and consumer behaviour (n=267, 42% growth). Although fewer multi-component interventions were evaluated, because there were few in the original map, this still represents significant growth (n=48, 91% growth).

Direct provision of food **(n=100), classes on consumer behaviour (n=99), and** ***provision of supplements*** **(n=91) were the most commonly evaluated interventions in the updated period (Figure 6).**[4] Fortification which was very common in the original map dropped to the 9th most common intervention for the update period. Direct provision of food, *professional services (dieticians / nurses), agricultural extension services, other agricultural education programs,* and *peer support and counselling* all increased their position on the list of most studied interventions.

The focus on final outcomes diminished from 77 per cent in 2000 to 2004 to 38 per cent in 2020 to 2024. This has been accompanied by corresponding increases in the number of studies that evaluate intermediate outcomes (23 percentage point increase) and both types of outcomes (16 percentage point increase). The rank order of outcome groups changed meaningfully in the update period, with diet quality and adequacy outcomes being the most commonly evaluated (n=326), followed by economic (n=287), agricultural outcomes (n=272), and anthropometric outcomes (n=237). In the original map, anthropometric outcomes were the most common. This change could reflect a growing understanding that anthropometric outcomes take years to change, making them less useful in short-term evaluations, and that changes in anthropometry are not end-goals in themselves.

During the update period, there was a 17 percentage point reduction in the number of evaluations on food availability and affordability interventions (Table 6).[5],[6] The evaluation of anthropometric and micronutrient outcomes reduced by 11 and 14 percentage points respectively.

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4 This value considers only evaluations that were *published* in the update period to make it comparable with interventions which were included in the original map. It does not include evaluations which did not meet the original inclusion criteria and were added during the expansion of the E&GM.

5 Although many studies on the food environment were added during the update period, these were mostly published in the period covered by the original E&GM and would have been included at that time had the current inclusion criteria been in place. Therefore, for the sake of comparability, they are counted as studies from the original E&GM.

6 Values in Table 6 refer only to studies considering final outcomes whereas those provided in text include studies considering intermediate outcomes as indicated.

Consequently, there were moderate reductions in the evaluation of the effects of food availability and affordability interventions on anthropometric and micronutrient outcomes. However, there was a three percentage point increase in the proportion of studies that considered food affordability and availability outcomes. **There was 20 percentage point increase in the evaluation of food production interventions, mostly considering agricultural (15 percentage point increase) and economic (10 percentage point increase) outcomes.**

Table 6: High-level summary of the evidence mapping of impact evaluations and systematic reviews to final outcomes

Intervention/ Outcome	Anthropometric	Developmental outcomes	Diet quality and adequacy	Food affordability and availability	Food safety	Micronutrient status	Total
Behaviour change communication	104, 11% (301, 13%)	19, 2% (47, 2%)	168, 18% (352, 15%)	19, 2% (29, 2%)	5, 1% (11, 0%)	32, 3% (82, 4%)	226, 24% (525, 23%)
Distribution and storage	0, 0% (1, 0%)	0, 0% (0 0%)	1, 0% (2, 0%)	0, 0% (1 ,0%)	1, 0% (0 0%)	0, 0% (0 0%)	1, 0% (4, 0%)
Food availability and affordability	124, 13% (488, 21%)	36, 4% (142, 6%)	101, 11% (322, 14%)	51, 6% (125, 5%)	5, 1% (27, 1%)	58, 6% (352, 15%)	232, 25% (917, 40%)
Food loss and waste management	0, 0% (0 0%)	0, 0% (0 0%)	0, 0% (1, 0%)	0, 0% (0, 0%)	0, 0% (0, 0%)	0, 0% (0, 0%)	0, 0% (1, 0%)
Food production	30, 3% (61, 3%)	3, 0% (9, 0%)	77, 8% (199, 5%)	65, 6% (80, 3%)	3, 0% (6, 0%)	9, 1% (27, 1%)	120, 13% (193, 8%)
Food transport/ storage	1, 0% (2, 0%)	0, 0% (0 0%)	4, 0% (4, 0%)	0, 0% (8, 0%)	3, 0% (0 0%)	0, 0% (0 0%)	6, 1% (12, 1%)
GTA and women's empowerment	0, 0% (15, 1%)	0, 0% (3, 0%)	5, 1% (21, 1%)	2, 0% (10, 0%)	0, 0% (0 0%)	1, 0% (4, 0%)	9, 1% (30, 1%)
Multi-component	13, 1% (29, 1%)	5, 1% (5, 0%)	29, 3% (28, 1%)	1, 0% (10, 0%)	0, 0% (0 0%)	11, 1% (16, 1%)	38, 4% (48, 2%)
Processing and packaging	35, 4% (166, 7%)	7, 1% (56, 2%)	22, 2% (55, 2%)	1, 0% (8, 0%)	0, 0% (6, 0%)	36, 4% (239, 10%)	61, 7% (321, 14%)
Promotion and labelling	0, 0% (2, 0%)	0, 0% (0 0%)	1, 0% (0 0%)	0, 0% (1, 0%)	1, 0% (0 0%)	0, 0% (0 0%)	1, 0% (4, 0%)
Total	237, 26% (853, 37%)	54, 6% (210, 9%)	326, 35% (735, 32%)	107, 12% (41, 9%)	16, 2% (41, 2%)	117, 13% (615, 27%)	567, 61% (1726, 75%)

(Notes: Numbers in each cell reflect the number of new studies identified considering the corresponding intervention-outcome combination with the number from the original map in parentheses. per centages are based on the corresponding period, not the total in the final map, i.e. the per centage for studies in the update period reflects a total of 923 studies. As noted elsewhere, studies added due the expansion of the inclusion criteria but published during the period covered by the original map are counted as part of the original map to improve comparability. Colours reflect the per centage point change over time with blue colours reflecting a decrease and grey colours reflecting an increase. If a study evaluated multiple interventions and outcomes across different categories, the study was counted multiple times. As a result, the total number of studies reported here is higher than the actual number of studies included in the map.)

During the update period, there was a reduction in the number of studies that did not specify the gender or age of participants. However, there were no meaningful changes in the distribution of the targeted population among studies that specified the gender and age of beneficiaries. Similarly, the geographic distribution of regions studied did not change; although, the most common countries shifted from India, Bangladesh, and Brazil in the original to China, India, and Ethiopia in the updates.

The scale of interventions evaluated did change, with the number of evaluations considering national interventions increasing from 15 per cent to 21 per cent and resulting in a 62 per cent increase in the evidence base on national and transnational interventions (Table 7). As noted in the mid-term report, this shift may be related to a change in the types of evaluation approaches leveraged. The reliance on randomized reduced from 70 per cent in the original map to 53 per cent in the update period. However, this was largely driven by increases in fixed effects estimation and statistical matching, both of which tend to work better on local interventions than national interventions.

The overall quality of systematic reviews peaked around 2019. In the original report, we noticed a trend of increasing quality in the systematic review evidence base; however, this has not continued. Despite a 25 per cent increase in the evidence base overall, there was only an 18 per cent increase in the number of high-confidence systematic reviews during the update period.

The evidence base has expanded drastically in several previously identified priority areas. In our original report, we identified *food subsidies, food loss,* and *the environmental impacts of the food system* as research priorities (Table 7). These have all experienced more than 100 per cent growth in the update period, but the evidence base remains small in absolute terms. During the update period, we identified *food safety regulations* as a priority for future research. This area experienced a 300 per cent increase, but only improved from one study to four studies. The evidence base on *women's empowerment* and *gender transformative interventions* and *outcomes* increased during the update period. This increase is not simply the result to the expansion in the inclusion criteria as studies added during the update period due to the expansion, but published during the period covered by the original map are counted in the original map period.

During the entire update period, there was no growth in studies considering *advertising and labelling regulations; on-farm, post-harvest processing; innovative store design;* or *cold chain initiatives*, despite these being identified as priority evidence gaps. All originally identified synthesis gaps remain, with no major growth in evidence synthesis for any research priority area.

Table 7: Newly identified studies addressing previously identified evidence priorities

Interventions	Updates (original)	Per cent change (update vs original)
Previously identified gaps *Illustrative list of interventions to priorities for evaluation*		
Food taxes	1(9)	10%
Food subsidies	15(15)	100%
Advertising and labelling regulations	0(1)	0%
On-farm, post-harvest processing	0(5)	0%
Interventions to support food packaging	0(0)	0%
Efforts to support women's empowerment **	9(41)	22%
Gender transformative interventions **	7(12)	58%
Innovative store design	0(5)	0%
Cold chain initiatives*	0(1)	0%
Improved farm to market transport*	1(5)	20%
Food safety regulations*	3(1)	300%
Illustrative list of outcomes to priorities for evaluation		
Women's empowerment**	49(102)	251%
Gender transformative outcomes **	12(19)	343%
Economic, social, and political stability	1(3)	33%
Food loss	3(3)	100%
Environmental impacts of the food system	9(9)	100%
Measures of diet insufficiency	8(34)	24%
Illustrative list of evidence synthesis priorities		
Provision of free or reduced-cost farm inputs to crop production	0(7)	0%
Educational approaches within the food value chain	0(9)	0%
Agricultural insurance products	1(1)	100%
Outcome related to other diet quality and adequacy measures	3(24)	13%
Illustrative list of methods and scale priorities		
Cost evidence	43 (194)	22%
Mixed methods research	48 (211)	23%
High-confidence systematic reviews	8 (45)	18%
National and trans-national evaluations	212 (344)	62%

* These represent new priority areas identified through our mid-term report
** Studies added during the update period due to the expansion in the inclusion criteria but published during the period covered by the original map are counted as part of the original map to increase comparability. These studies would have been in the original map had the current inclusion criteria been in place at that time.

6.4 Research questions 3 & 4 GAPS AND RESEARCH NEEDS

What are the major primary and synthesis evidence gaps in the literature? What intervention and/or outcome areas could be prioritised for primary research and/or evidence synthesis?

Despite the evidence more than doubling in some priority areas, no previously identified gaps have been filled. Large relative increases were not sufficient to result in a robust evidence base when considering the absolute number of studies available and the importance of certain topics.

Not all evidence gaps need to be filled. Evaluations are not needed for intervention-outcome combinations for which there is no theoretical reason to expect a relationship. See Appendix B for more details on how to interpret the E&GM. Evaluations can be de-prioritised for interventions that are not widely implemented or do not have the scope to affect many people. Research should prioritise interventions that are widely implemented, affect a large group of people, or support vulnerable populations, such as women and children.

Although there has been significant growth in the evidence base, including in areas identified as key gaps in the original and midterm reports, the evidence in these areas was generally so small that large proportionate increases did not fill the evidence gaps (Table 7). There are three possible exceptions to this pattern: *women's empowerment interventions* and *outcomes, gender transformative interventions* and *outcomes,* and *national and transnational evaluations*. However, we believe that these continue to be priority areas of research, largely because of their extraordinary importance in the field and somewhat limited evidence bases.

The apparent growth in the evidence on *women's empowerment* and *gender transformative approaches* initially appears to indicate that they may no longer represent meaningful gaps. However, these represent potentially very large categories which should be addressed through correspondingly large evidence bases. We are grouping many very different approaches into just two categories. **Although 16 per cent of studies target women specifically, only 6 per cent consider the effects of included interventions on *women's empowerment* and *gender transformative outcomes.*** This is despite the potential for harm: nutrition interventions targeting women may reinforce social norms which relegate women to roles as cooks and caregivers, perpetuating social inequality.

Similarly, the existence of 556 evaluations of national and transnational programs indicates a strong evidence base. However, **the variation in types of approaches and contexts in which national and transnational programs are evaluated makes generalisation potentially quite difficult for these interventions, requiring significant replication in order to establish impacts.** In addition, these programs affect so many lives that there is a compelling argument that each one should be independently evaluated. While this may no longer be as glaring of an evidence gap, we believe it continues to represent an important area for future research.

Additional intervention priorities were identified in the 2024 Global Report on Food Policy (Table 8). Interventions reviewed in the report for which there is limited evidence are already in our evidence priority list. As such, our final list of suggested research needs is:

Illustrative list of interventions to prioritise for evaluation

- Advertising and labelling regulations
- On-farm, post-harvest processing
- Interventions to support food packaging
- Efforts to support women's empowerment
- Innovative store design, designations of space, and zoning
- Cold chain initiatives
- Improved farm to market transport
- Food safety regulations
- Food taxes
- Food subsidies

Illustrative list of outcomes to prioritise for evaluation

- Women's empowerment
- Economic, social, and political stability
- Food spoilage or loss
- Environmental impacts of the food system
- Measures of diet insufficiency

Illustrative list of evidence synthesis priorities

- Provision of free or reduced-cost farm inputs to crop production
- Educational approaches within the food value chain
- Agricultural insurance products
- Outcomes related to other diet quality and adequacy measures

Illustrative list of methods and scale priorities

- Cost evidence
- Mixed methods research
- High-confidence systematic reviews
- National and trans-national evaluations

6.4.1 Summary of selected new studies that address research gaps

The new study on farm to market transport identified during the update period provides evidence from Mozambique, where the government has aimed to modernise and commercialise the agricultural sector by implementing a variety of interventions including improving rural infrastructure such as the road network. The results showed that improving the connectivity resulted in increased agricultural production, although there was some variation across regions (Iimi, 2022).

One of the three new studies measuring food loss outcomes implemented an intervention providing bean farmers in Honduras and Guatemala with market-based incentives aiming to reduce food loss (Delegado et al. 2021). The farmers were provided with information of the standards required. If they met these standards they would receive a price premium. The results showed food loss was reduced amongst farmers in both Honduras and Guatemala.

Studies evaluating gender transformative interventions included one study evaluating the Building Resilience of Vulnerable Communities in Burkina Faso (BRB) project, a multi-component intervention providing financial services, agricultural extension, and learning conversations on nutrition and gender (Crookston et al., 2021). The results showed improvement on a composite measure of empowerment, which included indicators related to intimate partner violence, control over the income, and intra-household decision-making. Another gender transformative study focused on men in rural Ethiopia. This was a multicomponent intervention including cash transfers, gender dialogue, and a men's engagement group. The men's group focused on men's reflections on gender norms in their community. The evaluation found improvements in men's gender-equitable attitudes and their involvement in domestic tasks (Alderman et al., 2023).

Studies measuring environmental outcomes includes a study evaluating the effect of agricultural investment subsidies in Moldova (Mollers et al., 2022). The results demonstrated positive effects on a number of outcomes including decreased use of fertilisers, positive effect on erosion, and environmental protection. Another study in Western Kenya evaluated the effect of farmer field schools on food security and environmental conservation outcomes (Kithi, Mugera and Geza, 2021). The results showed that there was no significant effect on environmental conservation.

6.5 Strengths and limitations of the E&GM

The study has the following strengths:

- **Current:** By updating the map approximately every four months, we provide the most up-to-date characterisation of the available evidence on the effects of food systems interventions on food security and nutrition outcomes.
- **Timely:** The original map was commissioned in response to a direct policy need and has been developed into a living product based on ongoing interest. Despite changes in the food systems landscape, the map remains highly relevant to current developments in the field.
- **Broad:** The scope of the map is broad. Outcome information was collected for a range of final and intermediate outcomes reported in studies.
- **Useful:** The map responds to direct policy and practice priorities, including the call to collect and coordinate evidence in the field by Webb and colleagues (2022). It has been used as the basis for five synthesis pieces, one other evidence mapping project, and cited almost 20 times (Section 5).

The following limitations can be applied to this study:

- **No forward citation checking:** Due to the high volume of included studies, it was not feasible to screen records that cited included studies.
- **Focused data extraction:** Comprehensive characteristics relating to study equity considerations and research transparency were not extracted due to time constraints.

- **English language focus:** Studies only published in non-English languages were missed, which may introduce bias. Although this could induce some biases in the types of studies included, we expect these to be minimal and believe English language studies will be of the widest interest to the intended users of this map.
- **Quality of impact evaluations not assessed:** The standard analytical procedure for an E&GM is to appraise the quality of systematic reviews but not impact evaluations. While the impact evaluations included met our eligibility criteria, the quality of the evaluation specification or design (e.g. through an assessment of the theory of change or the completion of a risk of bias assessment) was not appraised. Critical appraisal of impact evaluations is very time intensive and generally considered to be outside the scope of an E&GM.

6.6 Implications for policy and practice

In the last four years, the evidence base has increased by 40 per cent, providing policymakers and implementers with an incredible amount of new information to access and digest. While this is an impressive and promising development, it can result in an overwhelming amount of evidence to serve as the basis of decision making. Policymakers and implementers will need support understanding and acting upon this information (Webb et al., 2022). This E&GM makes the information more accessible but does not synthesize it into readily actionable outputs. Evidence synthesis and translation can help policymakers and implementers access and understand the available evidence. However, the slow growth in the availability of high- and medium-confidence systematic reviews indicates that evidence synthesis efforts are not as rigorous as they should be.

The additions we made to the E&GM over the last year provide policymakers and implementers with ready access to evidence on a range of new interventions. In addition to the interventions already in the map, policymakers and implementers can now use the map to reference studies on *cash transfers, food vouchers, social insurance programs, women's empowerment interventions,* and *gender transformative approaches*.

USAID, FCDO, the Gates Foundation, and the World Bank are the most reported funders, and have the opportunity to drive the narrative on food systems transformation. Most studies do not report the intervention (68%) or research (62%) funders, so the actual most common funders are unknown. However, the ones that are most commonly reported have the opportunity to drive the international narrative on food systems transformation. They can use and are using, their platforms to advocate for a just, equitable, sustainable, and healthy food systems.

Several policy implications identified in the mid-term report remain relevant. Funders may continue investing in under-researched areas (Table 7) and those identified as policy priorities (Table 8). However, the availability of evidence related to key, policy-relevant activities is still highly variable. In addition, careful consideration of unintended consequences may be necessary to support positive outcomes for all and across a range of outcomes.

6.7 Implications for research

Research needs to be designed to meet the scale of the global food security and nutrition problem. We are not going to meet the global need by working one village at a time. We need to identify approaches that work at a large scale, and implement them at scale (Cooley & Linn, 2024). Research has the opportunity to help interventions move up the scaling ladder through two key approaches. First, research can prove if a food systems innovation is effective at the local scale. This is where most of the research in our map is concentrated. Then, second, research can examine interventions as they increase in scale to ensure that they remain effective and identify appropriate alterations for scale. This step requires mixed-methods research and cost evidence to understand not just if impacts are maintained, but how interventions can be modified to increase impact at scale while reaching realistic cost targets. At both of these steps, research can be used as an advocacy tool, to secure funding for promising interventions as they move up the scaling ladder.

Researchers need to work where the problem is most severe. Researchers have the greatest opportunity for making transformative impact if they focus their efforts where food crises are most severe. Countries facing the harshest food insecurity should be prioritised for intensive evaluative research, yet they often are not. Given the global consensus that conflict and climate change are critical threats to the food system, nations experiencing these challenges should also receive priority in research efforts; however, are these areas are also under-researched. Likely, this is because of the challenges associated with working in such extreme contexts. It is inappropriate to generalise findings from moderate contexts to these extreme situations. Nonetheless, these regions offer significant opportunities for substantial improvements in overall well-being, as interventions here could lead to fundamental changes rather than marginal adjustments. Addressing food systems in moderately affected areas will not transform the global narrative as profoundly as tackling the severe crises in regions impacted by conflict and climate change.

Given the dynamic relationship between conflict, climate change, and the food system, **researchers may wish to prioritise the evidence gap related to the effects of food systems interventions on the environment and economic, social, and political stability.** Knowing that the food system affects these outcomes is not sufficient to conclude that interventions which improve the food system will also improve these outcomes.

Several research implications identified in the mid-term report remain relevant. The research clustering identified in the original report continues to reduce, resulting in a more varied evidence base. However, key evidence gaps around policy priorities persist. There continues to be a shift towards quasi-experimental research. Cost evidence and mixed-methods research remains limited. And, research transparency could be improved through the reporting of research and implementation funders.

Table 8: Evaluations corresponding to selected implementation priorities.

Activity reviewed or discussed		Corresponding interventions in our evidence and gap map	IEs (SRs)
Activity type	**Specific activities**		
Social and behaviour change interventions	Nutrition education	Classes in consumer behaviour	362 (35)
	Other	Peer support / counsellors / professional services / community meetings / healthy food campaigns / door-to-door campaigns	514 (54)
Social protection programs	In-kind transfers, including school-meals	Direct provision of food	335 (34)
	Cash transfers	Conditional and unconditional cash transfers	432 (28)
	Other	Food vouchers/social insurance	39 (3)
Governance interventions	Taxes	Food taxes	10 (2)
	Subsidies	Food subsidies	30 (1)
	Food safety regulations	Food safety regulations	4 (0)
	Food labelling requirements	Labelling regulations	1 (0)
	Advertising regulations	Advertising regulations	0 (0)
	Other regulations	Trade regulations	17 (2)
Multisectoral approaches		Fortification and direct provision of food Large multiple component interventions	32 (10)
Placement of food in stores		Innovative store design	5 (0)
School-based programs		Filter setting: School	424
Nutrition sensitive agriculture		Production system interventions	908 (29)
Women's empowerment		Women's empowerment interventions	50 (4)
Infrastructure		Improved farm to market transportation	6 (1)
Food fortification and biofortification		Fortification	322 (58)

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