



Interventions Reporting on Fruit and Vegetable Intake in High-, Middle- and Low-income Countries: A Scoping Review of Evidence and Knowledge Gaps

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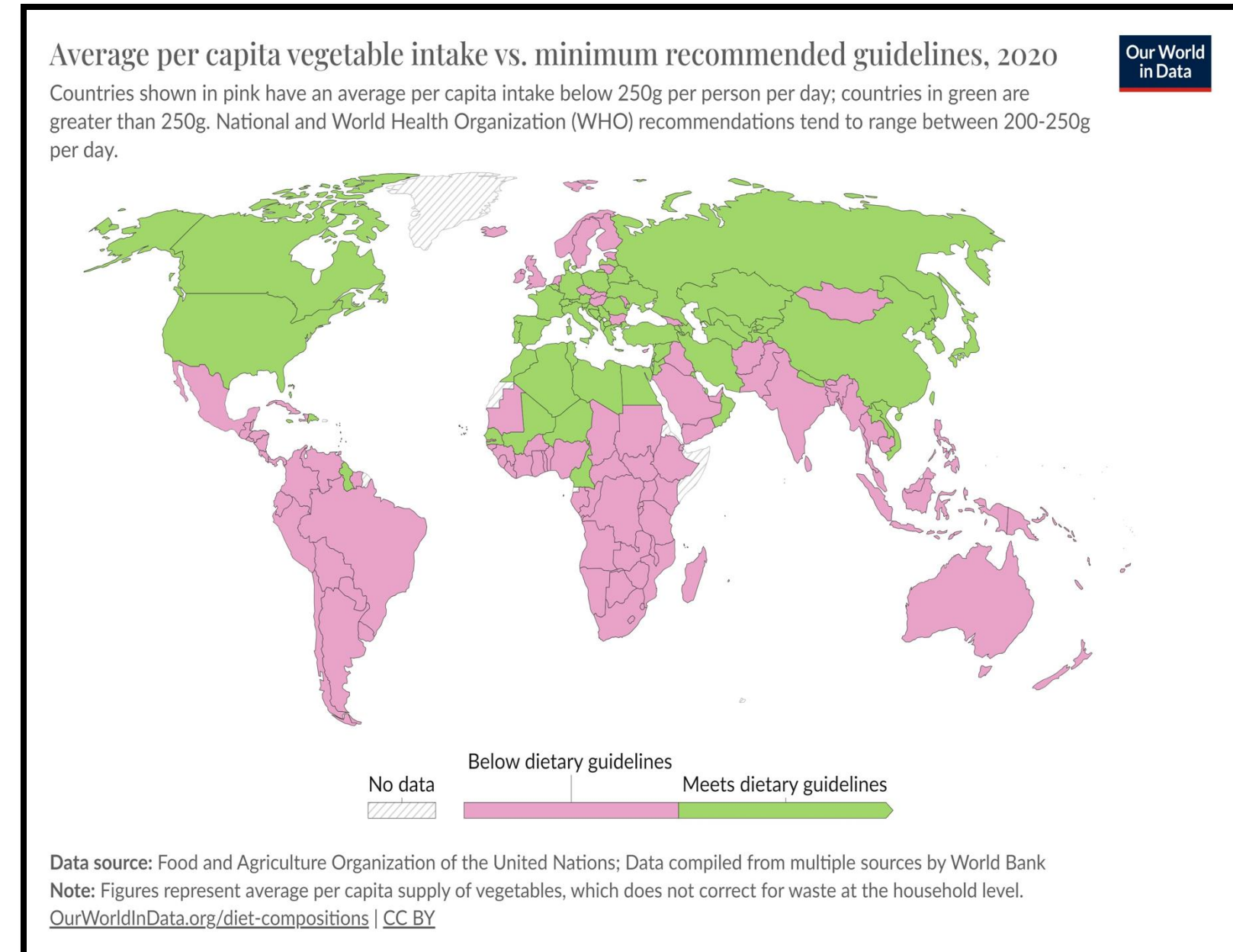
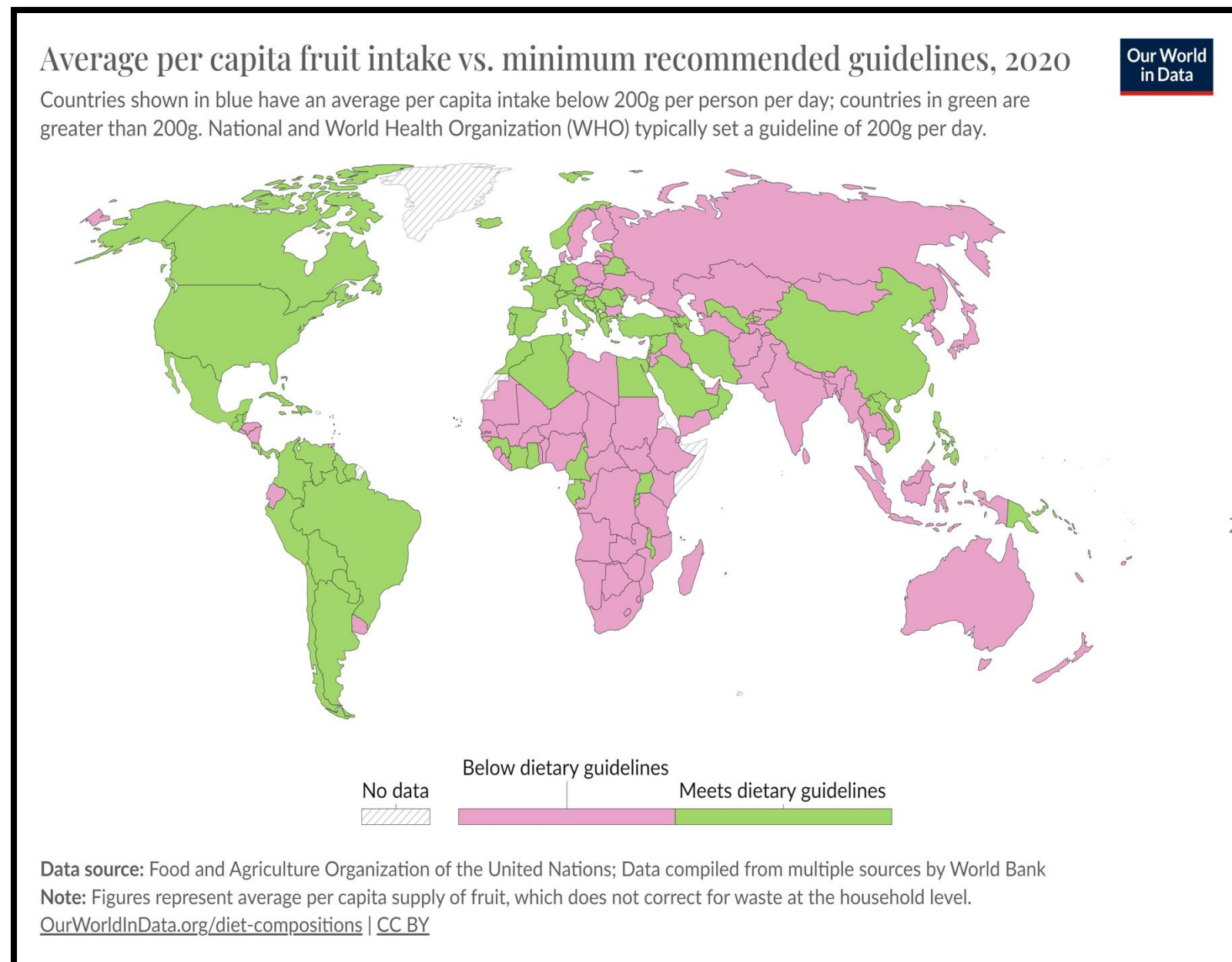
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Introduction

Intake of fruits and vegetables (F&V) is low in most parts of the world, especially in low-and middle-income countries (<400g/person/day).



Specific objectives of global F&V literature review

To increase FV intake, we need evidence-based strategies, but significant gaps exist in identifying and understanding those that show positive impact.

1a. To identify and review the range of intervention strategies that have reported on F&V intake.

1b. To summarize the impact of these intervention strategies in promoting F&V intake in different population groups.

2. To identify promising interventions (a menu of options) and potential entry points for improving F&V intakes in LMICs.

Methods: SCOPING REVIEW

(Registered on Open Science Framework (OSF) <https://osf.io/gfe5n/>)

Eligibility criteria: Only publications that reported or assessed changes FV intake

-Study design: Quantitative interventions only

- ✓ RCTs, controlled before-after studies, time series analyses as well as feasibility and pilot studies
- ✓ Only studies with counterfactual/ comparison/ control groups

-Outcome measures: Dietary intakes of total F&V, F&V groups, or individual F&V measured as:

- ✓ portions, servings, or quantities,
- ✓ biomarkers of F&V intake,
- ✓ variety and diversity of F&V,
- ✓ frequency of F&V intake

-Intervention settings: Any, including schools, households, communities, workplaces, healthcare/ clinical settings, faith-based organizations, etc.

-Population of interest: Any age group, life stage, country or urban/ rural location, except populations with diseases

Methods: SCOPING REVIEW

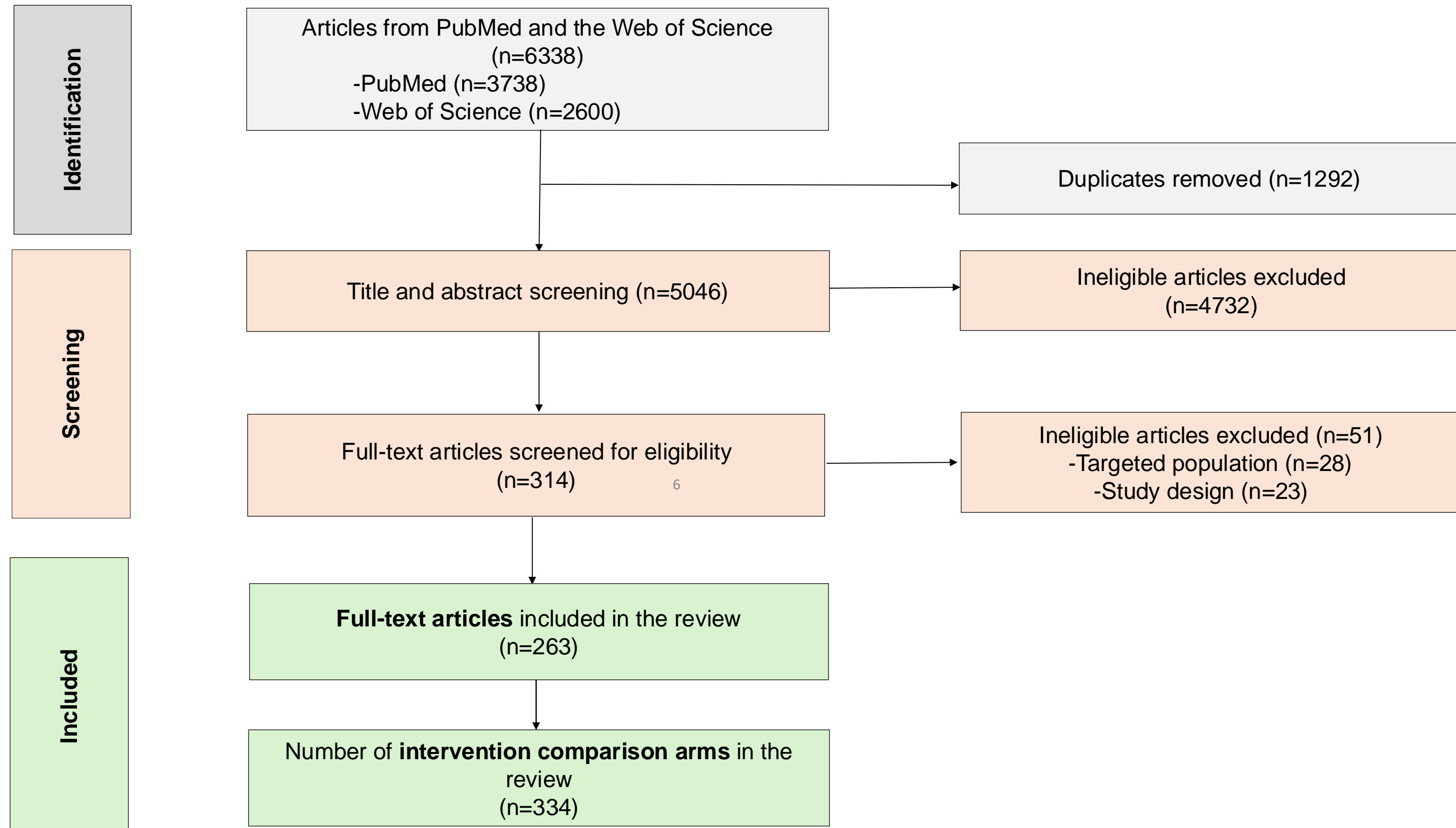
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Systematic review management system: Covidence (Veritas Health Innovation, Melbourne, Australia)

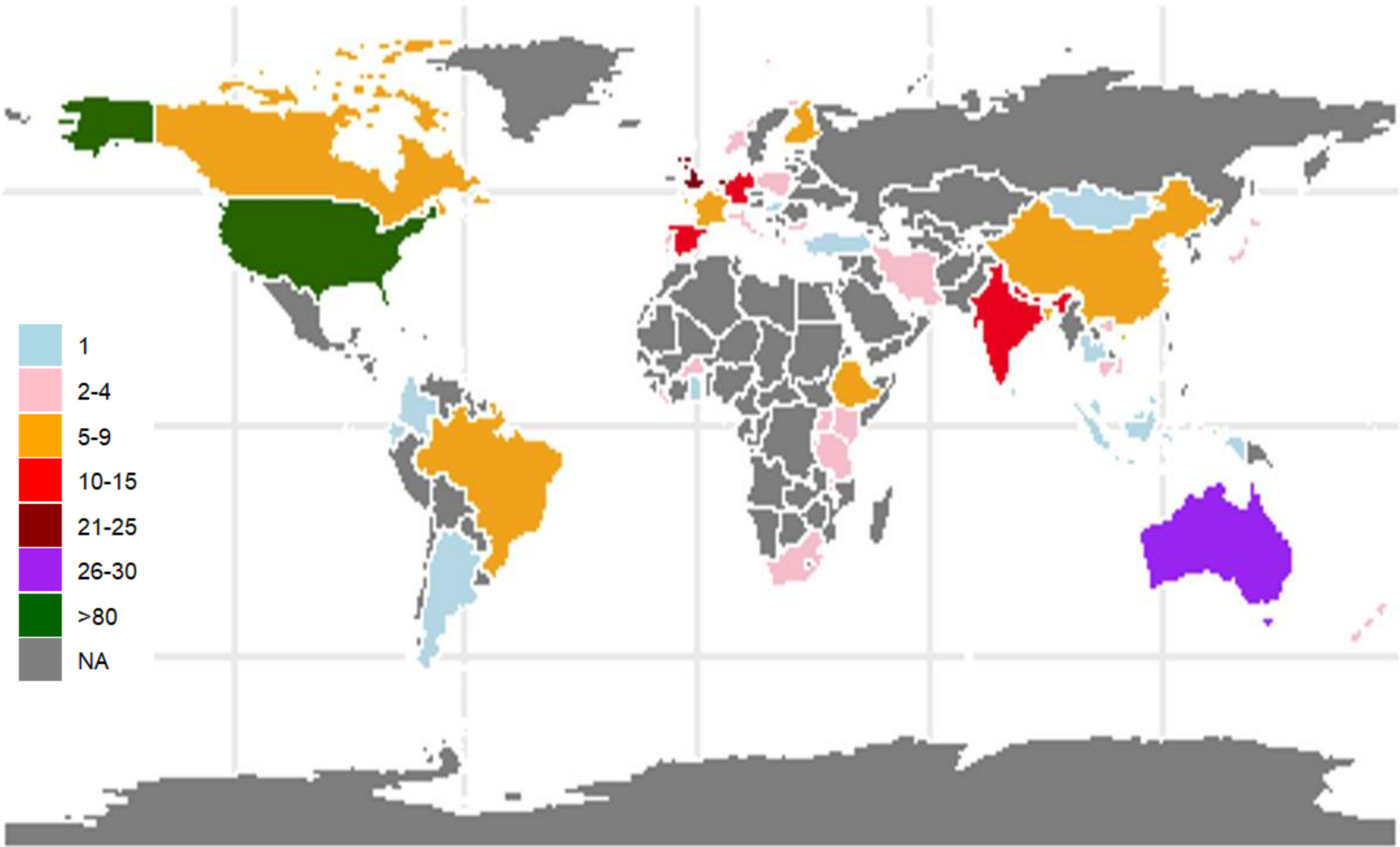
Guidelines: Preferred Reporting Items for Systematic reviews and Meta-Analyses Extension for Scoping Reviews (PRISMA-ScR)

- **Article selection:** (2012-2022)
 - ✓ Titles and abstracts screened by two independent reviewers.
 - ✓ Disagreements resolved by third reviewer who remained blinded to the vote of the other two independent reviewers.
 - ✓ Articles that met the inclusion criteria were then subjected to a full reading for further evaluation.
- **Data extraction:** Author, year, objective of study, target population, outcome assessed, effect of intervention on outcome, dietary assessment method, intervention description, sample size, duration of intervention, duration of follow-up if any and results at the end of follow-up
- **Reporting:** Frequencies and percentages of interventions showing significant increase in intake. No meta-analysis due to differences in type of measures of associations reported across studies.

PRISMA flowchart

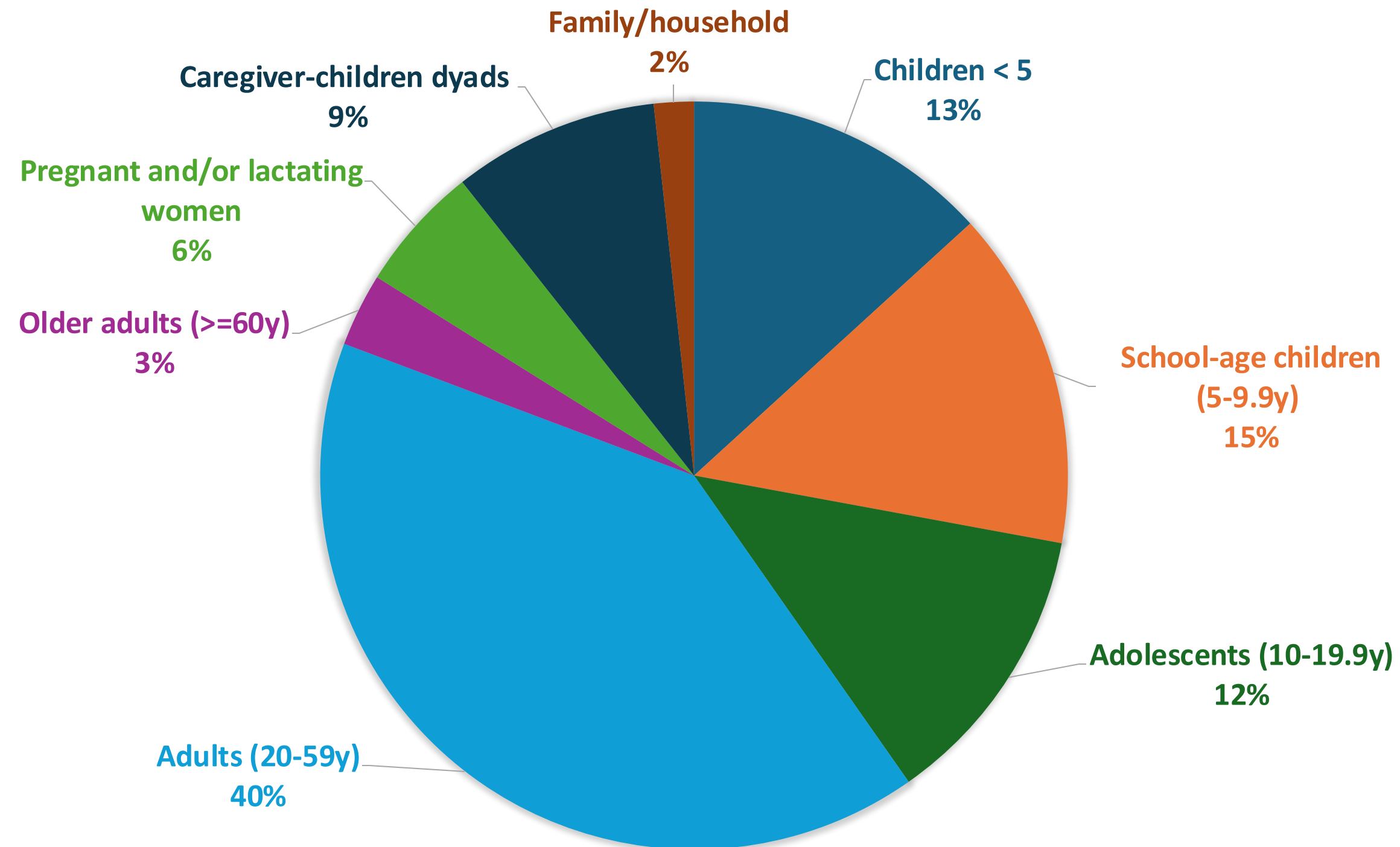


Number of intervention comparisons worldwide (n=334)



Region	N	%
High-income countries	237	70.3
Low- and middle-income countries	97	29.7
Total	334	100

Target populations in intervention comparisons identified



Intervention characteristics

	N	%
Study design		
Cluster RCT	150	44.9
RCT	147	44.0
Controlled before-after	4	0.9
Feasibility/pilot studies	10	3.0
Quasi-experimental	22	6.6
Non-randomized controlled trial	1	0.3
Assessment time points		
Pre-endline assessment	41	12.3
End of intervention	297	88.9
Post-endline follow-up	121	36.2
Comparison groups		
No intervention	257	76.9
Other intervention	62	18.6
Not specified	15	4.5

Intervention characteristics

Characteristics	Statistics
Sample size, n	
Intervention arm (median, IQR)	179 (76, 376)
Min – Max	5 – 41,012
Control arm (median, IQR)	182 (73, 414)
Min – Max	5 – 68,120
Intervention duration in weeks	
Intervention endline (median, IQR)	26.0 (12.0, 52.0)
Min – Max	0.1 – 1,040.0
Post-intervention follow-up (median, IQR)	52.0 (20.0, 73.7)
Min – Max	2.0 – 624.0

Outcomes assessed and number of interventions showing significant impact

Characteristics	N	%
Outcomes assessed		
Fruit intake	197 /334	58.9
Vegetable intake	202 /334	60.5
Combined F&V intake	158 /334	47.3
Significant increase in F&V intake (n)		
Fruit intake	83 /197	42.1
Vegetable intake	86 /202	42.6
Combined F&V intake	84 /158	53.2

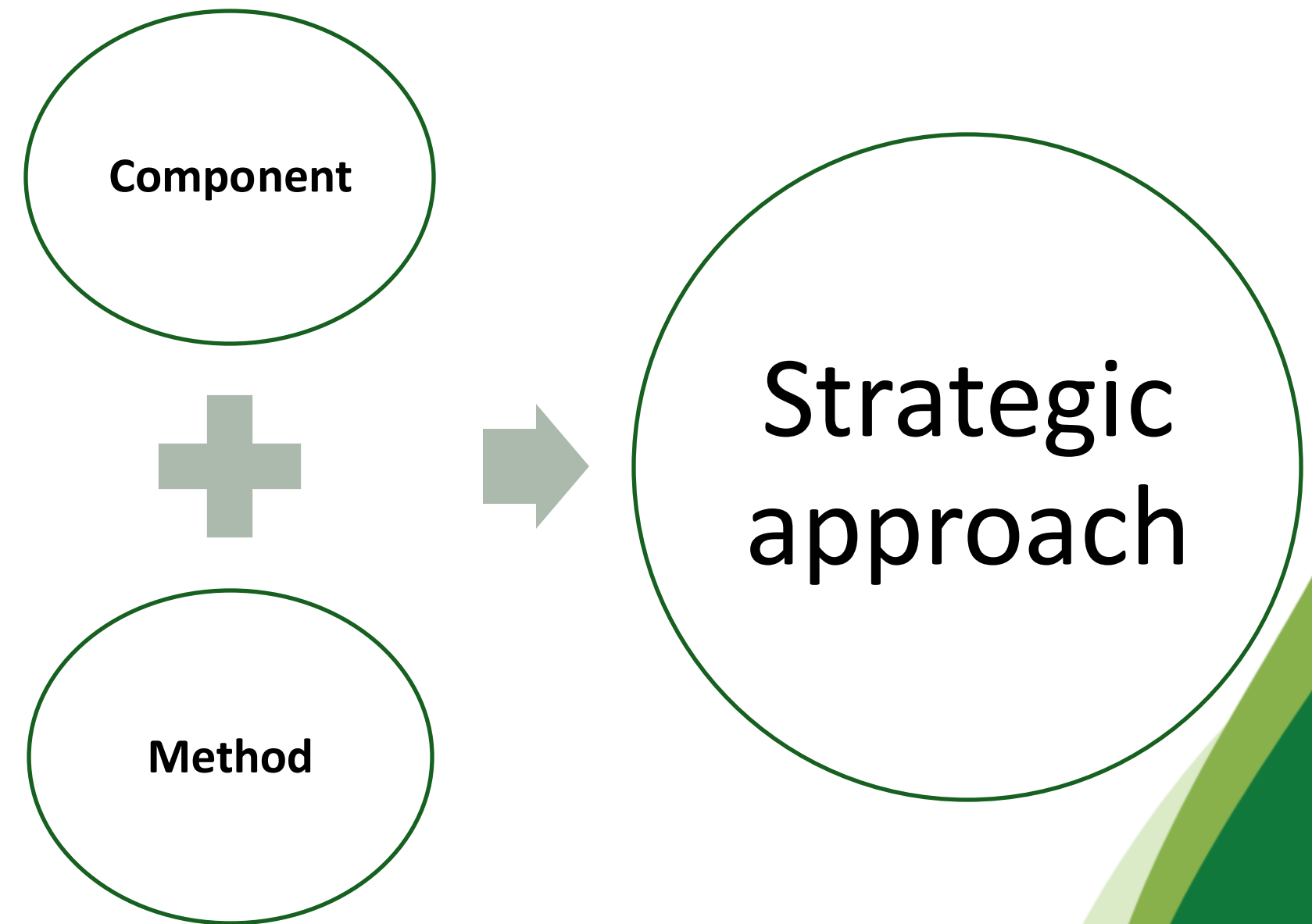
Definition of strategic approach of interventions

- **Intervention component:**

Specific elements or tactics that are part of an intervention designed to effect change

- **Intervention method:**

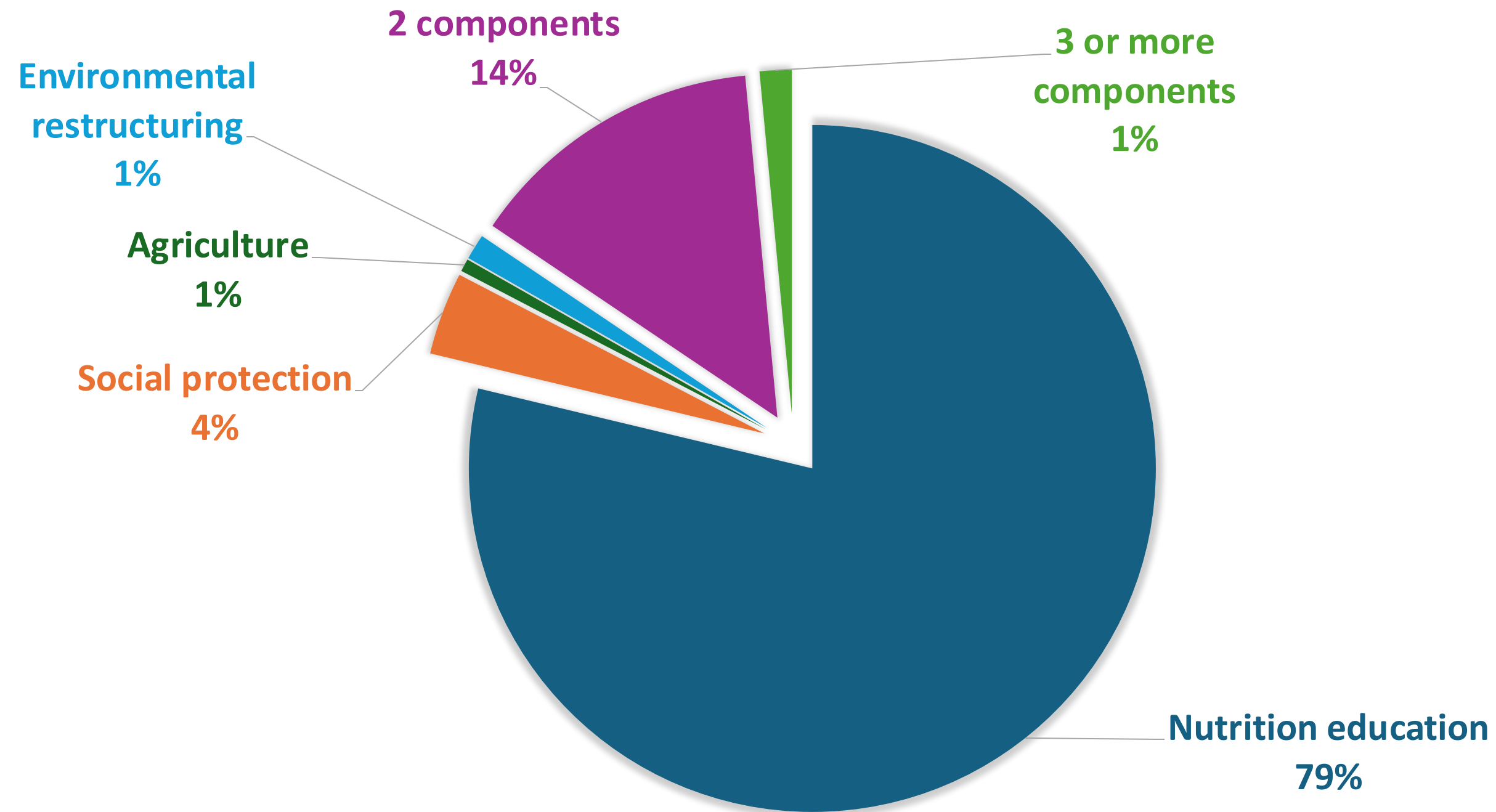
Ways in which intervention components are implemented and delivered to the target audience



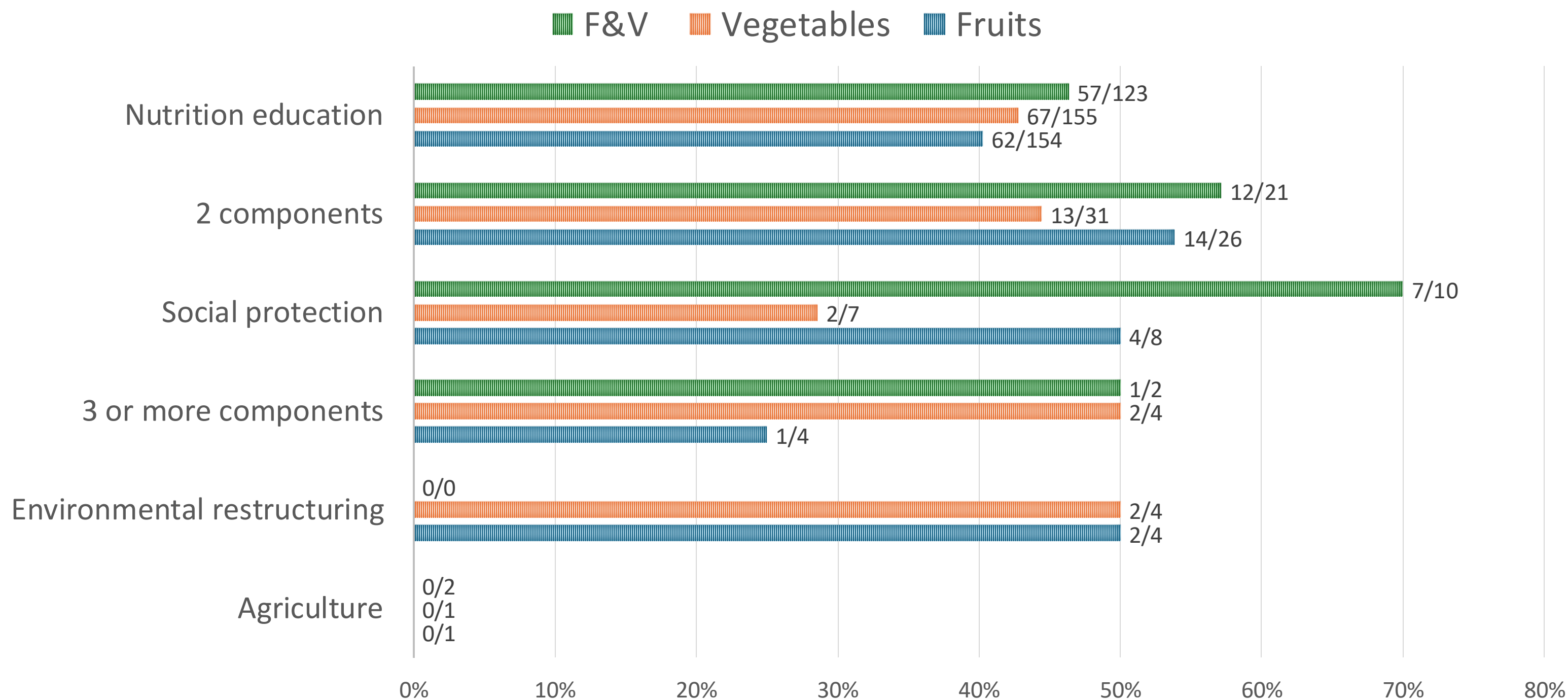
Intervention Components

1. Health/ Nutrition education
2. Social protection
3. Agriculture
4. Environmental restructuring

Prevalence of intervention components



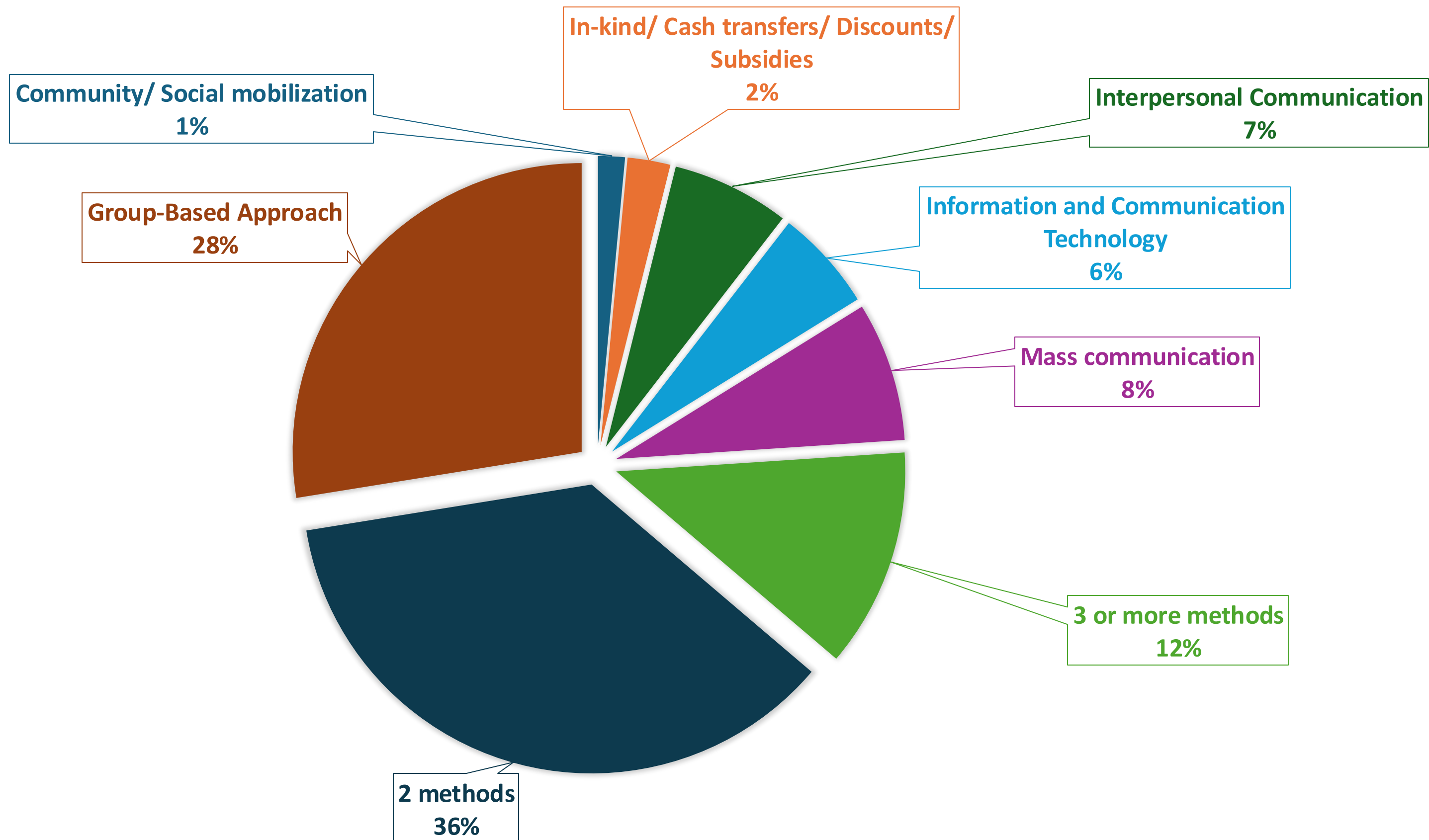
Interventions reporting significant increase in fruit, vegetable and F&V intake by component



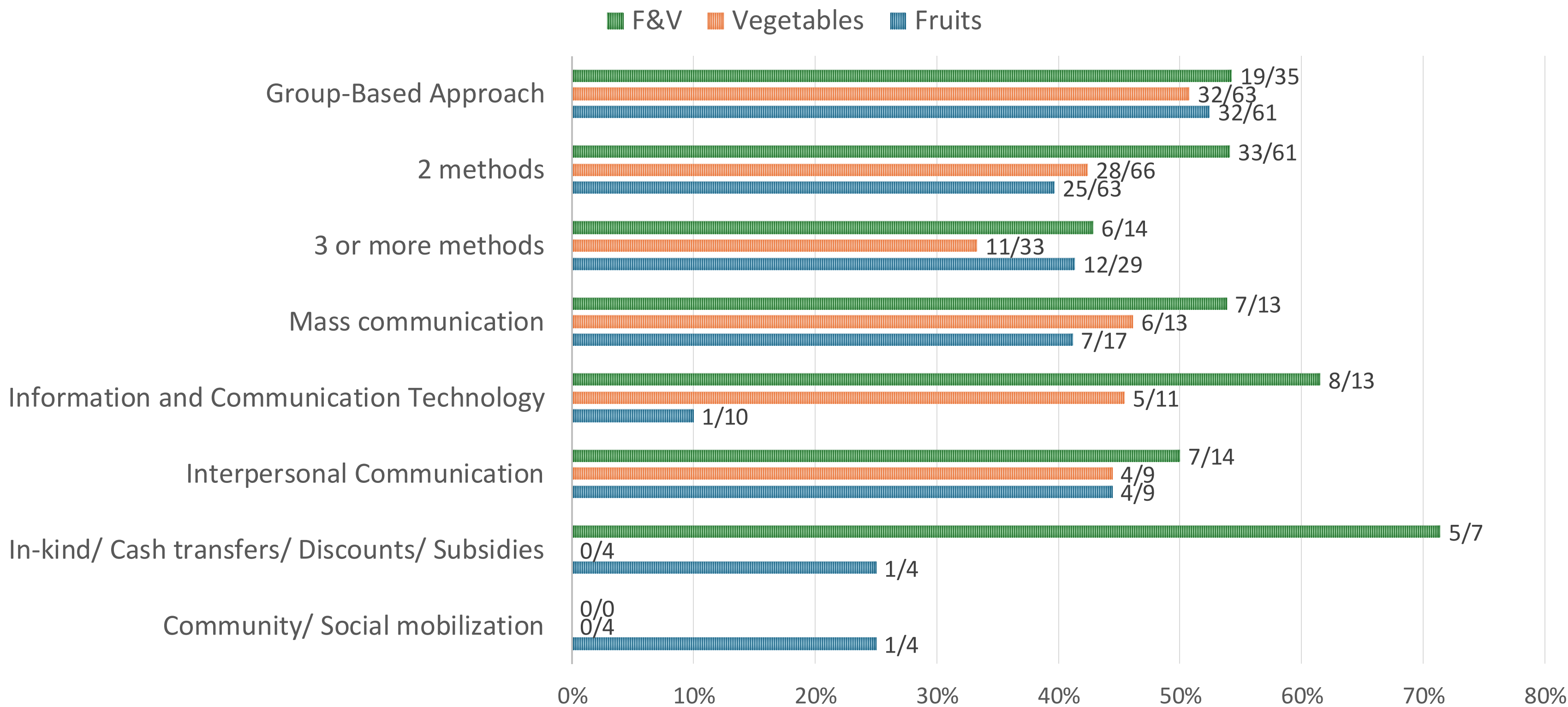
Intervention methods

1. Community/ Social mobilization
2. Group based approaches (GBA)
3. Interpersonal communication (IPC)
4. Information and communication technology (ICT)
5. Mass communication
6. Transfers (in-kind/cash), discounts, etc.

Prevalence of delivery method



Interventions reporting significant increase in fruit, vegetable and F&V intake by method of delivery



**Which combination(s) of
component(s) and delivery method(s)
are most likely to report significant
improvements in fruit, vegetable and
F&V intakes?**

Combined strategic approaches used in interventions reporting on *fruit* intake

Component/ Method	Health/ nutrition education	Social protection	Agriculture	Environmental restructuring	Education + Social protection	Education + Agriculture	Education + environmental restructuring	Other combinations of 2 components	3 or more components
Community/ social mobilization	0/3			1/1					
Mass comm.	6/12				1/5				
IPC	4/9								
GBA	25/51	3/3		0/1	2/4	1/1			1/1
ICT	1/9	0/1							
In-kind/ cash transfers/ discounts		1/4							
Community/ social mobilization + GBA	0/5			1/2	0/1		2/3		0/1
Mass comm. + GBA	3/10			0/1					
IPC + GBA	1/2								
IPC + ICT	6/16								
ICT + GBA	3/8		0/1						
Other combinations of 2 methods	3/7							2/3	
3 or more methods	8/21				3/5	1/1			0/3

Summary and Conclusion

- Adults (40%) vs families/ households, older adults, and pregnant and/ or lactating women (<5%) and children/ adolescents (<15%)
 - gap in population targeted
 - tailored interventions needed
- Variable sample size
 - influences robustness and reliability
- Variable duration of intervention and follow-up
 - magnitude of impact
 - sustainability of impact
- Differences in comparison groups
 - influence outcome and impact in real life settings

Summary and Conclusion

- Intervention components fell into 4 categories used alone or in combination.
- Few interventions using social protection (4%) agriculture (1%) or environmental restructuring (1%) alone reported changes in FV intake.
- Health/ nutrition education interventions most prominent (79%)
 - < 50% significant improvement in F&V intake
 - emphasis on increasing knowledge/ awareness
- 2 components combined (13%) and ≥ 3 components combined (1%)
 - usually education *plus*
 - narrow focus - not addressing multiple factors/ food system as whole
- Impact based on objective of study: F&V specific vs. lifestyle/ other?

Summary and Conclusion

- 6 categories of intervention delivery method used alone or in combination.
- Combinations of 2 methods (36%) and ≥ 3 methods (12%)
 - usually group-based approach *plus*
 - may address multiple determinants of behavior
 - only slightly $> 50\%$ reported impact
- Group-based approaches second most common method (28%)
 - usually school-based
 - only slightly $> 50\%$ reported impact
- Small n: Mass communication, ICT, social mobilization
 - can reach broader audiences
 - complexity may be a challenge



Thank You



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OSF concept note
<https://osf.io/gfe5n/>

We would like to thank all funders who support this research through their contributions to the CGIAR Trust Fund:
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Introduction

- In 2017, 3.9 million deaths worldwide were attributable to inadequate F&V intake. (WHO, 2019)
- Promoting increased intake of these food groups has the potential to significantly improve health outcomes and reduce the burden of chronic diseases.
- Determinants of F&V intake are complex, with factors including food environments, food supply, food value chains, affordability, access, food safety, and individual preferences and behaviors being important influencers.
- Over 100 countries also have food-based dietary guidelines with recommendations for F&V intake.
- Significant gaps remain in identifying and understanding effective strategies that increase F&V intake in different settings and across diverse populations.

We need evidence-based strategies to promote healthy eating habits, including F&V intake.

Intervention components

Specific elements or tactics that are part of an intervention designed to effect change

Intervention component	Definition
Health/ Nutrition education	Programs or activities designed to inform individuals or communities about good health practices, nutrition, and the importance of balanced diets.
Social protection	Range of policies and programs aimed at reducing poverty and enhancing access to food, healthcare, and income security e.g. cash transfers, livelihood enhancement, women empowerment, etc.
Agriculture	In the context of nutrition interventions, this approach focuses on agricultural practices and policies that ensure food security and improve access to nutritious foods, e.g. crop diversification, agricultural productivity, and supporting small-scale farmers to grow more nutritious foods.
Environment restructuring	Modifying the physical or organizational environment to make healthier choices more accessible, convenient, and normative, e.g. redesigning food environments in schools or workplaces to promote the consumption of healthier foods.

Intervention components by population group

Type of component/ Population group	Health/ nutrition education	Social protection	Agriculture	Environment restructuring	Two components	Three or more components
Children under five	31	1	0	1	12	1
School-age children	36	4	1	2	7	1
Adolescents	41	0	0	1	1	0
Adults	116	4	1	0	17	3
Older adults	11	0	0	0	0	0
Pregnant and/or lactating	14	0	0	0	5	0
Adult women only	3	1	0	0	4	0
Caregiver-child dyads	24	4	0	0	3	0
Household/ Family	1	3	0	0	2	0

Interventions method of delivery

Ways in which intervention components are implemented and delivered

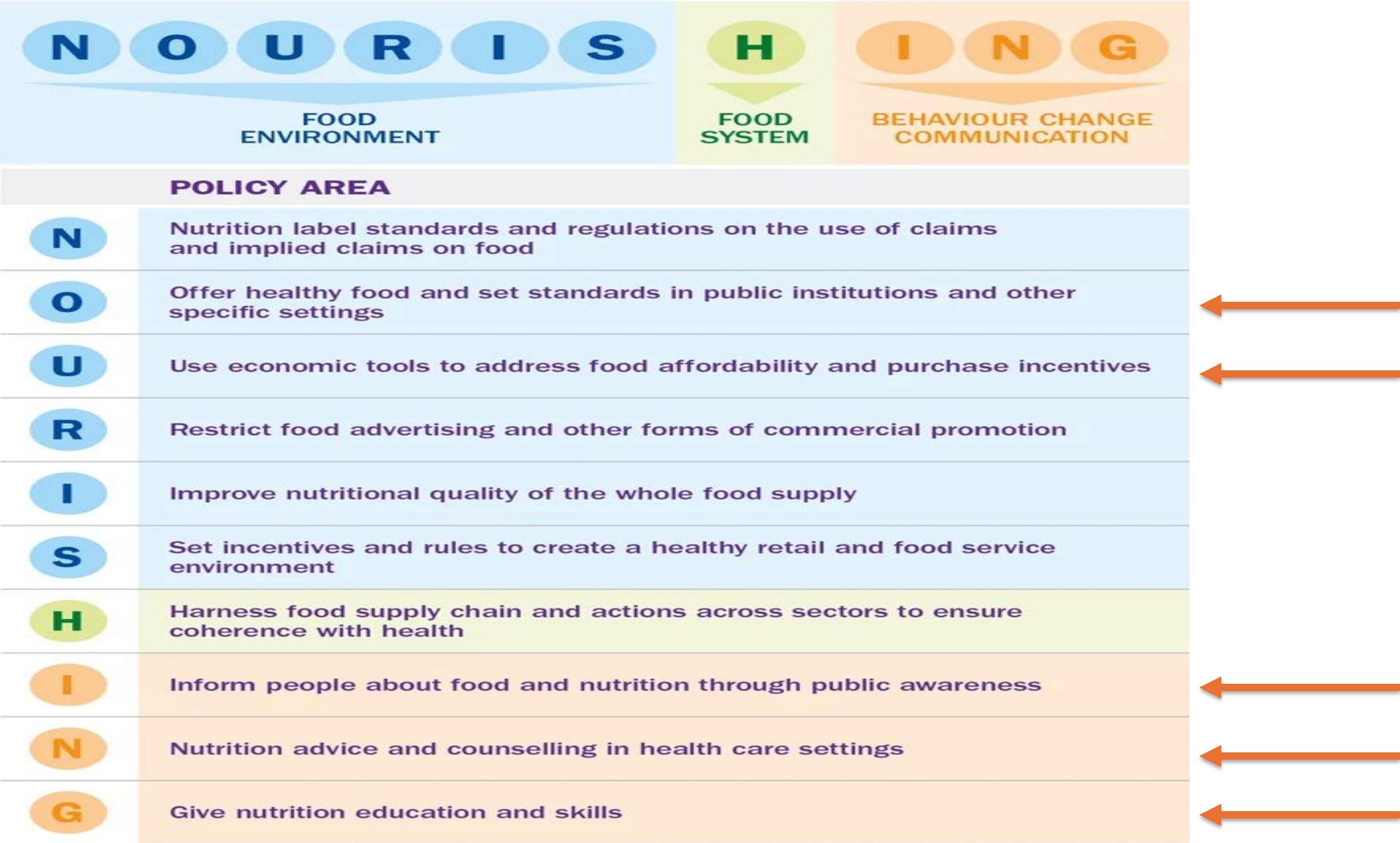
Intervention method	Definition
Community/ Social mobilization	Engaging and motivating a wide range of partners and stakeholders at the community level to effect change or contribute to a specific cause, e.g. launching awareness campaigns, mobilizing local leaders and influencers.
Mass communication	Utilizing media and communication technologies to disseminate messages to large audiences, e.g. public service announcements, educational campaigns, or social media campaigns
Information and communication technology	Leveraging digital tools and platforms (e.g., mobile apps, online platforms, SMS services) to deliver nutritional information, support behavior change, or facilitate access to nutrition services.
Interpersonal communication	Direct, face-to-face communication that allows for personal interaction and feedback, e.g. counseling sessions with dietitians.
Group-based approaches	Interventions or educational programs in group settings, e.g. nutrition workshops, cooking classes, or support groups

Intervention method of delivery by population group

Type of method/ Population group	Interpers. comm.	Group-based approach	Mass comm.	Information and communication technology	Community/ social mobilization	In-kind/ cash transfers/ discounts	Two methods	Three or more methods
Children under five	4	13	1	2	0	1	19	6
School-age children	1	32	0	0	0	2	16	0
Adolescents	1	20	0	3	1	0	16	2
Adults	8	22	24	9	1	2	52	23
Older adults	2	2	0	0	0	0	7	0
Pregnant and/or lactating	4	3	0	3	3	0	4	2
Adult women only	0	2	4	1	0	0	0	1
Caregiver-child dyads	2	4	1	2	0	3	11	8
Household/ Family	1	2	0	0	0	3	0	0

Discussion:

NOURISHING Framework



Discussion:

Nuffield Ladder

Refers to an ‘intervention ladder,’ where each higher rung represents a more intrusive intervention:

8. **Eliminate choice:** Regulate in such a way as to entirely eliminate choice, e.g., not allowing SSB in school canteens.
7. **Restrict choice:** Regulate in such a way as to restrict the options available to people with the aim of protecting them, e.g., removing unhealthy ingredients from foods
6. **Guide choice through disincentives:** Fiscal and other disincentives e.g., taxes on SSBs
5. **Guide choices through incentives:** e.g., offering discounts, or providing subsidies on healthy foods
4. **Guide choices through changing the default policy,** e.g., school canteens can provide options for F&V
3. **Enable choice:** Enable individuals to change their behaviours, e.g., providing free fruit in schools
2. **Provide information:** Inform and educate the public, e.g., as part of campaigns to encourage five portions of FV/d.
1. **Do nothing or simply monitor the current situation**



Core team



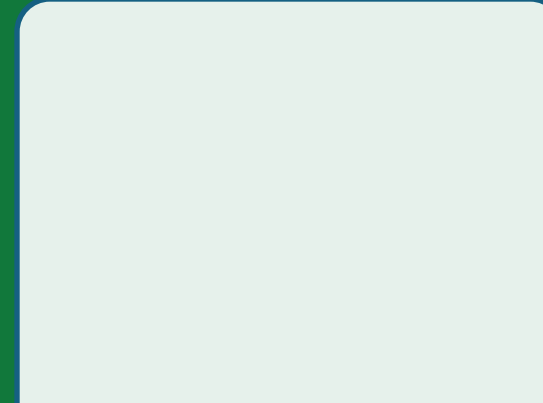
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