



(REVIEW ARTICLE)



Collaborative efforts between public health agencies and the food industry to enhance preparedness

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Abstract

Globalization in the food supply chain presents complex challenges, particularly regarding food safety and security, due to the risks of infectious diseases and outbreaks. These threats impact public health and economic stability, necessitating multifaceted interventions and collaborative efforts within the food industry. This review article explores the importance and challenges of collaboration between public health authorities and the food industry. It examines current partnerships, analyzes successful strategies through case studies, and identifies opportunities for enhancing cooperation. Key areas of focus include improved information exchange, joint training, and the development of standardized practices and policies.

Keywords: Public Health; Food Industry; Collaboration; Mental Health; Supply Chain

1. Introduction

The food supply chain is a complex network connecting producers and consumers globally, involving various actors such as farmers, food processors, distributors, retailers, and consumers. This intricate system is vital for ensuring food reaches consumers efficiently; however, it is susceptible to disruptions, particularly from foodborne diseases and events that threaten public health and economic stability. Recently, the food industry and public health agencies have recognized the critical need for synergy in developing approaches to enhance preparedness and mitigate risks to food safety and security [1,2].

Public health organizations possess expertise in disease identification, threat evaluation, and disaster management, while the food industry has extensive knowledge of supply chain logistics and food production processes [3,4]. To safeguard the food supply chain, it is imperative for these entities to collaborate in information and resource exchange, and jointly implement projects that strengthen their capabilities in risk identification, prevention, and response. Traditionally, the food industry and public health agencies have not collaborated much, and there has been limited interaction between the two. However, the growing complexity of the food system and the emergence of new and evolving food safety threats highlight the necessity of a more coordinated and systemic approach [5].

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The increasingly interconnected nature of the food supply chain has heightened its vulnerability to risks and contamination incidents. Foodborne diseases and outbreaks pose significant health risks, social impacts, and potential economic losses. Acknowledging these challenges, public health agencies and the food industry have realized the necessity of a unified approach to improve preparedness and prevent risks. Epidemiological bureaus within public health agencies are responsible for disease detection, risk evaluation, and disaster management, focusing on public health protection [6,7]. In contrast, the food industry, encompassing producers, processors, logistics, and retailers, offers valuable insights into supply chain management and food industry operations. The cooperation between these sectors is essential to establish effective systems for risk identification, prevention, and prompt response to potential threats, thereby ensuring the safety and security of the global food supply chain [8].

Although the need for collaboration between public health agencies and the food industry has been acknowledged, there is a lack of systematic knowledge about the current state of these collaborations, their efficacy, and the approaches that can be taken to address issues and enhance the quality of these partnerships [9]-[11]. Numerous papers focus on specific collaborative projects or cases, but a comprehensive literature review of the field is absent. For instance, Garayoa et al. (2014) [12] provided insights into the collaboration between public health entities and the food industry in the context of foodborne illness investigations, emphasizing the necessity of improved information flow. However, their study was region-specific, focusing on Europe, and did not explore other aspects of preparedness and risk. Similarly, Sing SU (2021) [13] conducted a localized study on the effectiveness of public-private partnerships (PPPs) in enhancing food security in Thailand, without comparing international collaborations or legal regulations.

Given this research gap, the objective of the current study is to conduct a systematic review of the partnership between public health agencies and the food industry from a global perspective, along with a qualitative cross-country and region comparison of experiences. The key research questions are: What are the main problems and successful practices in cooperation between public health agencies and the food industry? What areas need further development based on a review of existing literature and case studies? Previous literature has identified the advantages of cross-functional collaboration but often lacks detailed processes or addresses obstacles. For example, Lytras et al. (2016) [14] highlighted the importance of interactions to tackle food safety risks but only briefly discussed the issues and future possibilities.

Additionally, the current literature lacks information on integrating both public health and industry perspectives. This research aims to fill this gap by providing a comprehensive view of the perceptions, needs, and issues from both partners. The study offers an overview of the existing partnership landscape and potential recommendations useful for both public health agencies and the food industry, contributing to the development of more effective collaborative practices in ensuring food safety and security.

2. Methodology

2.1. Research Design

This study employs a systematic literature review to aggregate information on the collaboration between public health agencies and the food industry, identifying factors affecting these partnerships. Unlike other reviews, it includes scoping reviews and related literature to ensure a comprehensive understanding of success and failure factors. An extensive search was conducted using databases such as PubMed, Scopus, Web of Science, and Google Scholar, guided by a subject specialist and a librarian to include relevant keywords. The search was limited to English-language articles published after 2000. Predefined inclusion criteria focused on studies examining collaborative efforts aimed at enhancing preparedness, mitigating risks, or improving food safety and security, while exclusion criteria filtered out studies not involving both sectors or lacking empirical data. Two independent reviewers conducted the study selection, data extraction, and quality assessment processes, with disagreements resolved through discussion or a third reviewer. Data synthesis involved thematic analysis for qualitative data and descriptive statistics for quantitative data, with quality assessed using AMSTAR 2 and CASP tools.

3. Results of the Research

The literature search across multiple databases yielded a total of 1,247 potentially relevant studies. After removing duplicates and conducting the initial title and abstract screening, 286 studies were identified for full-text review. Of these, 68 studies met the inclusion criteria and were included in the final synthesis

The included studies covered a diverse range of collaborative efforts between public health agencies and the food industry, spanning various levels of analysis (local, regional, national, and international) and geographical contexts. The majority of the studies (42%) focused on collaborations aimed at enhancing food safety and risk mitigation, while others explored partnerships for improving food security (22%), supply chain resilience (18%), and emergency preparedness (18%) as shown in Figure 1.

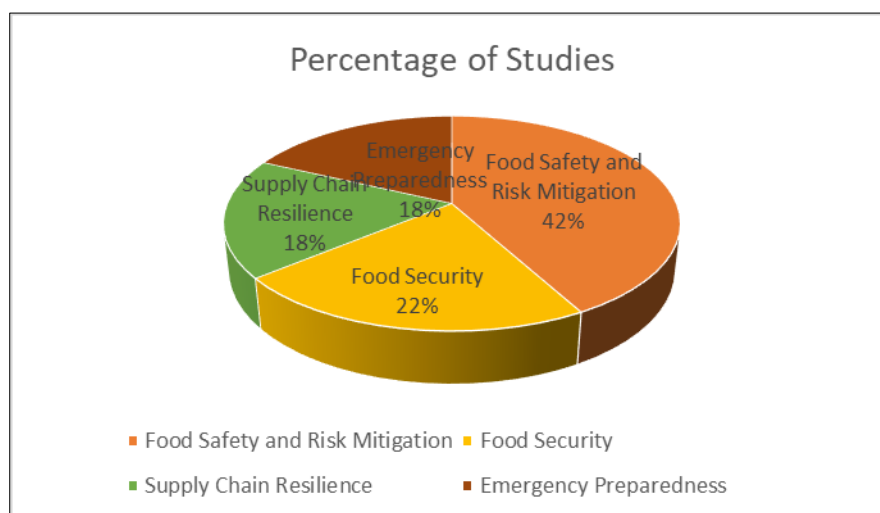


Figure 1 Distribution of Public Health-Food Industry Collaborative Studies

Table 1 Characteristics of Included Studies

Characteristic	Number of Studies (N=68)
Level of Collaboration	
Local/Regional	28
National	23
International	17
Focus Area	
- Food Safety and Risk Mitigation	29
- Food Security	15
- Supply Chain Resilience	12
- Emergency Preparedness	12
Study Design	
- Systematic Review	41
- Scoping Review	17
- Narrative Review	10

The systematic reviews and meta-analyses included in this study revealed varying degrees of effectiveness for collaborative efforts in achieving their intended outcomes. Several studies highlighted positive impacts on food safety indicators, such as reduced rates of foodborne illnesses [15], while others noted improvements in supply chain transparency and traceability [16,17]. However, the definitions of topical measures were often weak, and the results indicated a need for further investigation into the outcomes of these collaborations.

Qualitative data from the included studies provided insights into the factors affecting the effectiveness of collaborations between public health agencies and the food industry. Consistencies identified included robust communication systems, aligned goals and priorities, the building of trust, and an appropriate match of incentives, rewards, and resources [18,19]. Conversely, some studies highlighted issues such as cultural disparities, legal challenges, and conflicting self-interests among stakeholders [20,21].

4. Discussions of The Findings

4.1. Cross-Sector Collaboration

Cross-sector collaboration involving entities from the health, social, education, and housing sectors can significantly benefit health and health-motivating factors [22]. Anderson et al. (2015) [23] emphasize that prevention and control activities rooted in community capacity principles and coalition-building with cross-sector collaboration can effectively reduce health disparities among minority populations. However, the efficiency of these partnerships presents a mixed picture. While some findings highlight positive outcomes, others suggest only marginal or no improvements in health status [24].

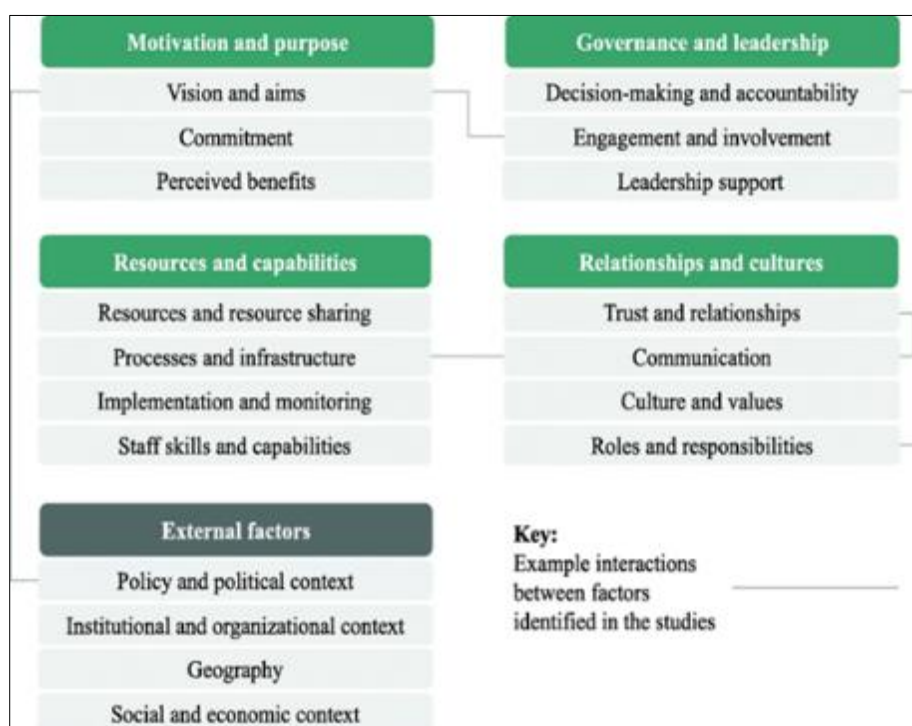


Figure 2 Factors that impact the functioning of collaboration and illustrative examples of its interconnections. (Alderwick et. al., 2021)

Ndumbe-Eyoh and Moffat (2013) [22] have highlighted that various stakeholder linkages can facilitate service improvements by enhancing the availability of services to vulnerable groups. Other studies, like Lewin et al. (2015) [25], reinforce this view by highlighting the benefits of these partnerships in enhancing service availability and quality. However, Mason et al. (2015) [26] caution that some integrated funding arrangements between health organizations and social services may inadvertently reduce access for some clients due to the influence of financial incentives. The impact of cross-sector collaborations remains inconclusive, with only a limited amount of literature available on resource utilization and spending. Hayes et al. (2013) [24] note that many interventions initiated by these collaborations require more resources, while Cameron et al. (2014) [27] found mixed results regarding cost effects, with some collaborations reducing costs and others increasing them for certain partners.

The diversity of players involved in cross-sector collaborations, including healthcare delivery, educational sectors, and NGOs, brings both advantages and disadvantages. According to Cooper et al. (2016) [28], this diversity can lead to more effective approaches to complex health issues by leveraging the strengths and resources of each sector. However, it also necessitates navigating different organizational environments, values, and practices, which can hinder cooperation and

project execution, as noted by Dowling et al. (2004) [29]. Consequently, developing effective communication structures, objectives, and expectations is essential for the success of these collaborations.

4.2. Integrated Health and Social Care

Research on the effects of partnerships between health and social care organizations to enhance integrated care has produced mixed and inconsistent results. Cameron et al. (2014) [27] and Liljas et al. (2019)[30] found varied evidence regarding health outcomes, service utilization, and quality of care. Additionally, Mason et al. (2015)[26] highlighted that most studies assessing health effects, such as quality of life and mortality, reported no significant difference compared to usual care.

However, studies have documented some positive impacts. Cameron et al. (2014) [27] discovered that collaborations resulting in intermediate care could reduce inappropriate admissions to institutional care. Additionally, Baxter et al. (2018) [31] reported improvements in patient satisfaction and perceived quality of care associated with integrated care interventions. However, the evidence on resource use and spending remains inconclusive. Both Cameron et al. (2014) [27] and Baxter et al. (2018) [31] found inconsistent evidence regarding costs, while Mason et al. (2015) [26] noted that most integrated funding initiatives showed mixed or unclear effects on hospital costs and utilization.

The integration of health and social care services holds promise for providing a more comprehensive and coordinated approach to meeting the needs of individuals, particularly those with complex or multiple conditions (Baxter et al., 2018) [31]. By breaking down silos and fostering collaboration between healthcare providers and social service agencies, these initiatives aim to address the social determinants of health and promote a holistic understanding of well-being [26]. However, achieving true integration requires overcoming structural barriers, aligning incentives, and developing robust data-sharing protocols that respect privacy concerns while enabling seamless communication and care coordination.

4.3. Mental Health Collaborations

Hospitals, community-based organizations, and consumer organizations can form partnerships in mental health collaborations, acknowledging the complexity of mental health issues and the need for a variety of services beyond clinical care. These collaborations can provide a range of services, including early intervention, treatment, primary and secondary prevention, and tertiary intervention and recovery [32]. However, for these collaborations to be effective, it is essential to address issues of stigma, cultural sensitivity, and trust among all stakeholders.

Studies by Lopez-Carmen et al. (2018) [33] and Cooper et al. (2016) [28] have examined collaborations focused on improving mental health outcomes and services. Lopez-Carmen et al. (2018) [33] identified some studies reporting positive outcomes among indigenous children and their families receiving collaborative interventions, although the evidence base was limited. Cooper et al. (2016) [28] found mixed evidence regarding access to mental health services for children and young people, with some studies suggesting more equitable access and others reporting reductions in access. However, these studies did not show positive outcomes across all programs.

While there is limited literature specifically on the overall impact of such collaborations, the studies by Lopez-Carmen et al. (2018) [33] suggest potential benefits in terms of individual outcomes and service use for certain populations. These findings highlight the importance of addressing the unique needs and challenges of different groups to maximize the effectiveness of mental health collaborations.

4.4. Public Health Collaborations

Previous reviews [25,34] have highlighted collaborations between public health agencies and other sectors in addressing vector-borne diseases, chronic illnesses, and obesity. Lewin et al. (2019) [25] noted that many studies emphasized the benefits of these partnerships, particularly in terms of improved health behaviors and reduced disease incidence in the prevention and control of vector-borne diseases.

Ndumbe-Eyoh and Moffat (2013) [22], and Bagnall et al. (2019) [34] also reported positive impacts on health and health behaviors resulting from public health partnerships; however, they noted that the quality of evidence was low or very low. Ndumbe-Eyoh and Moffat (2013) [22] pointed out that evidence on the equity impacts of these collaborations was limited. Additionally, Lewin et al. (2019) [25] and Bagnall et al. (2019) [34] found little to no data on the cost impacts of public health collaborations, emphasizing the need for more rigorous economic evaluations in this area.

Public health collaborations also bring together government agencies, healthcare providers, community organizations, and other relevant stakeholders to address population-level health issues [32]. These collaborations can tackle a wide range of challenges, including disease prevention, health promotion, and emergency preparedness [22]. By pooling resources and expertise, these collaborations can develop comprehensive strategies, implement large-scale interventions, and disseminate public health information more effectively. However, maintaining these collaborations over time can be challenging, as they often involve multiple jurisdictions, competing priorities, and the need for sustained funding and political support.



Figure 5 The Expanded Health System building blocks, adapted from Sacks, et al (Global, 2018)

4.5. Clear Communication and Information Sharing

Effective communication and timely information sharing are critically important for the success of collaborative efforts [15,20]. When public health agencies and industry partners establish robust communication channels based on mutual trust and understanding, they can better coordinate preparedness planning, response efforts, and risk mitigation activities [35]. However, organizational differences, such as varying data management protocols and resource availability, can impede the flow of information [36]. Strategies like joint training sessions, open data platforms, and designated liaison roles can help overcome these challenges by fostering familiarity and promoting transparent dialogue between sectors [16]. Continuous engagement, rather than isolated interactions, reinforces commitment to collaboration and drives more impactful outcomes [18].

Additionally, effective mechanisms for sharing early warning information during emerging threats or outbreaks are vital. Regularly scheduled coordination calls and simulation exercises allow partners to practice rapid, transparent information exchange, which can be invaluable in real crises [18,36]. Establishing communication protocols in advance facilitates the seamless escalation of important information to decision-makers during time-critical incidents. The use of traditional and social media also enables timely alerts to reach a broader audience. However, these channels require clear guidelines regarding authorized spokespersons, the protection of sensitive industry data, and coordination to

ensure message consistency. Involving communication and public relations experts in planning sessions helps to anticipate information needs and manage potential miscommunication risks.

4.6. Aligned Goals and Shared Ownership

Effective collaborations require all partners to have aligned goals that prioritize food safety and public health over respective organizational priorities [20]. When collaborations are perceived as token interactions or driven purely by regulatory compliance, they often fail to achieve their objectives [36]. Partners must develop collective decision making through consensus building and shared responsibility to foster genuine cooperation [35]. External facilitation may help in the processes of goal alignment during the formation of the initial partnerships [18].

Moreover, goals are more likely to be sustained through leadership or funding changes if they are put down in formal charters or memorandums of understanding signed by all the partners [11,18]. These documents help to ensure that the partner's expectations and priorities are defined in tangible terms while also outlining the governance structures, resources, decision-making authority, and conflict resolution mechanisms. However, goals have to be revisited periodically and in unison to update them with new risks and capabilities that may be discovered during collaboration activities. The process of reviewing the partnership on a periodic basis based on impact evaluations ensures that partners are on the right track while at the same time fostering the culture of adapting to new needs.

4.7. Addressing Differing Operational Realities

The variations in organizational cultures and operating environments present continuous issues such as conflicting demands and dissimilar risk perceptions [16]. The risk assessment and risk management abilities of public health agencies and the food industry are different because of their roles [20]. It is therefore important that these divergences are managed in a positive way, for instance, by coming up with joint training to familiarize the partners with each other's worlds [15]. It is best to have these conversations at the beginning of the project and throughout the project to define responsibilities, expectations, and address issues as they arise [35]. Standardizing data also helps in reducing cultural and capacity barriers and the same applies to protocols [18].

Also, stakeholders need to look for synergies and cooperation that would enhance the overall capabilities of the system without replicating efforts [15,35]. For instance, industry data systems for tracking contaminated products may be useful to public health agencies, whereas government testing laboratory networks may be useful to food companies. These types of synergistic arrangements require compatible data standards and protocol harmonization. Mitigating proprietary concerns by means of such things as aggregated data use or secure access agreements assists in realizing potential value from cooperative use of specialized assets.

4.8. Strong Leadership and Sustained Commitment

Effective high-level leadership is pivotal in driving collaboration initiatives, while mid-level management must champion day-to-day collaboration efforts [36]. Designated collaboration champions and governance structures instill accountability while flexible planning allows adaptation to changing needs [16]. Collaboration functionality depends on consistent long-term investment by partner organizations rather than sporadic short-term commitments [20]. External stakeholders like consumer advocacy groups can reinforce collaboration importance and priorities during political or budgetary uncertainties [15]. With proactive efforts, collaborative partnerships are more likely to endure changing circumstances [35].

Sustainability planning from the outset, with committed further bridge funding sources identified, can safeguard against disruptions from leadership or policy changes [18,35]. Supplemental funding from other independent grants or industrial consortiums can offer operating funds in case of budget reductions for a participating organization. Contingency staffing arrangements also help maintain momentum for initiatives that outlive original leadership tenures. External advisory boards comprising respected representatives help raise collaboration visibility and attract advocacy support during transitions.

4.9. Challenges in collaborations between health and social care

Effective management of structural and governance interfaces between health and social care is a significant challenge in efforts to integrate these services. As Cameron et al. (2014) [27] pointed out, health and social care organizations often have different goals, funding structures, information technology systems, and professional cultures. To overcome these challenges, it is essential to appreciate each other's constraints and find ways to work around existing barriers in service provision [29]. This process includes developing legal contracts that address issues such as nondisclosure,

resource access, conflict of interest, and liability [12]. If these structural issues are not adequately addressed, collaborations may fail to achieve their goals or may not be sustainable in the long term.

Furthermore, Tello-García and Alers (2007) [37] noted that collaborations often do not sufficiently engage stakeholders and end-users of services. Effective partnerships need to actively involve patients, caregivers, community organizations, and staff who provide services to identify their needs, concerns, and experiences. Ensuring stakeholder engagement can be achieved through methods such as workshops, surveys, and community forums. The more client input is sought, the more client-centered the services and support provided will be. This approach not only enhances the relevance and effectiveness of integrated care but also fosters a sense of ownership and commitment among all stakeholders involved.

4.10. Factors impacting effective public-private partnerships

According to studies by Garcia Martinez et al. (2007) [15] and Ugurluoglu et al. (2020) [38], there are a few key factors that influence whether public-private partnerships in food systems and related areas will be effective. Trust between partners is vital, and it is important to have balanced relationships with shared risks and benefits. Goals and expectations must be jointly defined and there needs to be flexibility to adjust operations based on lessons learned. Partners should also have complementary and mutually supporting competencies. Ensuring transparent communication and establishing formal mechanisms for participatory decision-making can help maintain accountability. Addressing these success factors early on can maximize the chances of public-private partnerships achieving their intended outcomes.

Additionally, Narrod et al. (2009) [18] found that partnerships are more sustainable when economic incentives are aligned for each partner. This may require the creation of new market relationships to increase sales and revenues. For instance, the producer-exporter cooperation enables farmers to have various domestic and international buyers. When all the partners gain financially, then they are more likely to continue with the partnership in the long run.

4.11. Strategies for overcoming barriers to integrated healthcare

As identified in the research by Baxter et al. (2018) [31], there are several factors that can hinder the integration of healthcare services including payment systems that do not encourage coordination, different incentives between organizations, problems with information sharing because of privacy laws, and different professional identities that are not unified. However, the studies also described the measures that can be taken to mitigate these barriers. These are cross-professional education to promote interprofessional cultures, service integration to support information exchange, use of mixed payment systems, building integrated information technology systems, and supporting care coordinators to work across sectors [30,39,40]. The research indicates that with active attempts to implement such integration approaches, healthcare systems can improve the delivery of care to patients with multiple conditions [49, 50].

In addition, Narrod et al. (2009) [18] also found that economic incentives should be properly coordinated for each partner in order to sustain the partnership. This may involve developing new market outlets to enhance the sales and revenues. For example, the producer-exporter cooperation allows farmers to obtain various domestic and international buyers. If all the partners are to gain financially, then they are more likely to stick together for the long haul.

5. Conclusion

In conclusion, the literature highlights a variety of challenges and opportunities when it comes to healthcare systems collaborating and integrating their services both internally and in partnership with other community organizations. The research has shown there are structural, cultural, economic and practical barriers that must be addressed for partnerships and integrated care models to be effective long-term. Key success factors include overcoming governance differences, aligning incentives, building trust between partners, and meaningfully engaging stakeholders. While strategies like multidisciplinary training programs, co-located services, blended payments and digital infrastructure can help overcome some barriers, more work is still needed. Sustained efforts are required to change entrenched organizational and professional dynamics that have hindered collaboration historically. Ongoing evaluation and refinement of new care models is also important to understand what approaches are most beneficial to clients and how systems can continue improving.

Recommendations for Future Research

There are some promising areas for future research that could further advance progress on healthcare system integration and partnerships.

- Conducting more qualitative studies exploring client and caregiver perspectives on integrated care approaches. Gathering feedback on challenges experienced, areas for improvement and priorities for future modeling would help shape person-centered models. In-depth interviews and focus groups are some methods that can provide insightful feedback.
- Leveraging implementation science methodology for the continued evaluation of specific partnership and care coordination programs that have been established. Areas of focus for evaluation could include analyzing cost-offsets and health outcomes associated with integrated supports, as well as identifying best practices for multi-disciplinary team collaboration, communication and care planning.
- Researching blended payment models and how funding coordination across systems and sectors can be sustainably achieved. This type of mixed-method economic analysis combining cost modeling with qualitative interviews of decision-makers could provide guidance on payment reform to incentivize integrated care.
- Exploring the role of digital health technologies in supporting partnerships between health and other community services. Mixed-methods studies combining surveys, interviews and record reviews could examine issues like information sharing barriers, technology adoption challenges among smaller organizations, and the value of telehealth in facilitating coordination.
- Conducting comparative case studies of different regions/nations to identify lessons on best structural designs for accountable care networks, primary care/social service alliances and public-private community partnerships around determinants of health. Factors like governance structures, data practices, scope of integrated services and community engagement strategies could be analyzed.
- Applying equity and cultural safety lenses to partnership and integration research to ensure models are responsive to diverse patient populations and address long-standing barriers to equitable access. Intersectional approaches accounting for factors like gender, socioeconomic, Indigeneity, language and migration status are needed.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

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