

Lessons from the application of implementation research (IR) to real-life policy decisions: the case study of the Ghana SAVING Consortium

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Abstract

Background

Implementation Research (IR) promotes the integration of research findings into policy and practice in health systems including those in low- and middle-income countries like Ghana. IR provides a mechanism to adapt evidence into policy processes and decisions amid shifting health priorities. This study shares lessons on how the characteristics of the IR approach, promotes responsiveness to decision-maker evidence needs within a dynamic policy context.

Methods

This study adopted a case study design based on document review and observational notes from participant observers. It explored how core IR characteristics enabled the adaptive use of IR in policy decision-making in Ghana within the SAVING Consortium between January 2021 and April 2025. Data were drawn from policy documents, technical reports, meeting minutes, observational notes, and timeline documentation that recorded challenges and corresponding mitigation strategies across the IR process, spanning the pre-intervention, intervention, and post-intervention phases. Data were analysed thematically using a deductive–inductive approach, with triangulation across sources to identify key themes, patterns over time, and links between the IR process characteristic and policy decisions needs.

Results

The findings showed that IR approach enhanced responsiveness to decision-maker evidence needs within a dynamic health system through its inherent flexibility and iterative design. Initially, the IR focused on evidence needs for adoption of new malaria vaccines in October 2021. It shifted focus to COVID-19 vaccines in December 2021 in response to the evolving global pandemic, and later refocused on malaria vaccines in May 2023 in response to shifts in decision-maker evidence needs following the de-prioritisation of COVID-19. This illustrates the adaptability of IR to shifting public health priorities in real-life policy settings. Three adaptation themes emerged: (1) broadening stakeholder engagement to capture evolving decision-maker needs, (2) integrating multidisciplinary perspectives (including health economics, immunisation, and regulation) to sustain technical relevance, and (3) realigning the research focus to context - in response to emerging policy priorities. These suggest that core IR characteristics ensured the research process remained relevant and responsive, to policy decision-maker evidence-needs.

Conclusions

The Ghanaian experience highlights IR adaptability as a key strength for linking evidence generation with policymaking and offers lessons for other settings adopting new health technologies.

Background

Implementation Research (IR) has gained popularity over the past few decades as a bridge between the theories from academic research and the tangible realities in policy implementation (1, 2). IR has been described as the scientific study of approaches to promote the systematic uptake of research findings and evidence-based interventions into routine practice (3, 4). Within health systems, the translation of efficacious and proven interventions into programme settings for maximum impact remains challenging (5, 6); especially in a rapidly changing context with multiple competing priorities like Ghana (7). IR is systematic, using rigour in integrating evidence into the real-world setting; multidisciplinary, leveraging diverse skills across multiple sectors; contextual, being stakeholder-led with local relevance; complex being adaptive and multi-level; and real-life due to its application to natural settings with practitioner engagement (5). Due to these characteristics, IR is known to help identify and solve specific implementation challenges, through provision of practical solutions for improved policy implementation, programme effectiveness, and health practice improvements, to close the "know-do gap" (4).

Ghana's health policy landscape is influenced by complex socio-cultural, economic, and political factors that affect the implementation of evidence-informed policies (8). Such factors, including constraints with the evidence generation process as well as system level factors, could serve as barriers to the uptake of evidence to inform decisions (9). Despite evidence of the general successful adoption of health interventions, such as the reimbursement of childhood cancers, and optimising hypertension treatments in Ghana (10, 11), the successful adoption of new health interventions such as COVID-19 vaccine deployment has often encountered unanticipated challenges (9, 12). Interventions that were highly effective under controlled conditions have sometimes been unsuccessful when introduced into the Ghanaian setting due to factors ranging from logistical constraints to socio-cultural resistance, (13) which has sometimes altered the efficacy of experimentally-proven interventions (5). The alteration of proven efficacy, necessitates the need for IR in translating such proven interventions to the real-world setting while addressing potential pitfalls in the adoption process (4, 5). There is therefore the need to understand the health system context and the importance of IR to inform implementation strategies and effectively impact health outcomes.

In response to this, the Sustainable Access and Delivery of New Vaccines in Ghana (SAVING) Consortium (14), comprising key local and international partners, including the University of Health and Allied Sciences (UHAS), the Ghana Ministry of Health (MOH), the Food and Drugs Authority (FDA), and the Swiss Tropical and Public Health Institute (Swiss TPH), has been instrumental in building IR capacity to strengthen policy implementation in partner institutions, with support from the European and Developing Countries Clinical Trials Partnership (EDCTP) (14). These partners are selected across the sequence of functions necessary for promoting access to new health technologies as framed by the Access and Delivery Partnership (ADP) framework (15). The ADP framework is a systemic, integrated

approach across six strategic pathways—legal and policy development, implementation research, safety monitoring, supply chain optimization, resource allocation, and strategic information—to strengthen lower- and middle-income country (LMICs) health systems for equitable access to vaccines, medicines, and diagnostics in line with national priorities (16).

Implementing proven interventions unto the above framework, provides opportunity to leverage the typical pre-intervention, intervention and post-intervention IR approach, with its characteristic flexibilities. Hence IR was adopted to generate evidence for Malaria vaccine deployment in Ghana (as a new technology), based on malaria being a 4th mortality driver in Ghana (17).

This study outlines the lessons learnt on how the characteristics of the IR approach, promotes responsiveness to decision-maker evidence needs within a dynamic policy context. It presents the real-life shifts, challenges, associated adaptations, and successes encountered while embedding IR approaches into the process generating evidence for real-world policy decision making in Ghana through the work of the SAVING Consortium.

Methods

Study Design

This study used a **single explanatory case-study design** (18, 19) to examine how five core IR characteristics facilitated the adaptive generation and use of evidence in real-life policy decision-making in Ghana within the SAVING Consortium between **January 2021 and December 2025**. An explanatory case study was appropriate because it supports the description of the application of IR, as well as the explanation of **how and why** its core characteristics enabled responsiveness and relevance to evolving decision-maker evidence needs in a dynamic health system and policy environment.

The case was bounded by **place, time, and process**. The case focused geographically on Ghana; institutionally, on the partners of the SAVING Consortium and their interactions with key national policy actors. It also covered the full period from the initial framing of the malaria vaccine question through subsequent shifts in policy priorities to the time of decision-maker evidence needs. The unit of analysis was the **application of IR to vaccine-related policy decision-making**, with particular attention to the ways in which IR processes were adapted over time in response to contextual changes.

The IR approach examined in this case study comprised three phases. The *pre-intervention* phase assessed the non-adoption of Health Technology Assessment (HTA) findings in COVID19 vaccine policy decisions, including the barriers to evidence uptake (9, 12). The *intervention* phase involved developing and applying responses to these barriers, notably a stakeholder engagement manual and prototype rapid-analysis tools to support timely, policy-relevant evidence generation. The *post-intervention* phase evaluates whether these interventions improved the uptake and use of updated HTA findings in policy processes, and considered their implications for future adaptation, scalability, and sustainability.

Data collection

Data were collected through document review, researcher observational notes, as participant observers with timeline documentation in order to capture the complexity of the IR process and its interaction with policy decision-making.

Document review

Selection of document sources

A targeted review of documentary sources was conducted using materials from the **Ministry of Health (MOH)**, the **SAVING Consortium work package 3 secretariat**, the **National Malaria Elimination Programme (NMEP)**, and other relevant institutional repositories and websites. Sources included policy documents, technical reports, technical briefs, meeting minutes, workshop reports, slide decks, and records of decisions related to introduction of new malaria interventions and associated IR activities. Documents from reputable institutional websites, including those of MOH, WHO, FDA, and NMEP, were also reviewed where relevant to the case. The document review sought to identify records of the evolution of the IR process, the changing policy context, and the ways in which research activities and outputs were adapted over time.

Inclusion criteria

- Documents dated between **January 2021 and December 2025**
- Documents directly related to the IR process, malaria vaccine introduction, vaccine policy deliberations, stakeholder engagement, or evidence generation and use in Ghana
- Materials such as policy documents, technical briefs, draft or final reports, workshop summaries, presentations, and correspondence that explicitly described relevant IR-related activities or decisions
- Publicly available website content from credible institutions relevant to the subject matter

Exclusion criteria

- Routine administrative documents with no explicit connection to the IR process or related policy deliberations
- Programme documents unrelated to malaria vaccine decision-making, unless they directly referenced or incorporated findings from the IR process
- Documents outside the defined case-study period

Observational notes with timeline documentation - core team as participant observers documented their observations and reflections on the changes to the IR process and the policy priority dynamics over the

course of time. Some members documented through retrospective recollection and reconstruction of the key issues with peer-validation. These notes captured reflections on process changes, decision-maker concerns, and the practical ways in which IR approaches were adapted over time. The notes were used to complement documentary evidence by providing contextual detail and insight into the unfolding policy process that might not be fully reflected in formal records. These were incorporated into the analysis to capture nuanced impressions on the shaping of IR adaptation mechanisms along the policy process in real-life.

An event timeline was developed to map major events in the IR process to policy processes from 2021 to 2025. The timeline documented critical milestones such as initial prioritisation malaria vaccine evidence needs, the shift to COVID-19 vaccine-related evidence needs, subsequent re-prioritisation of malaria vaccines, and the introduction of the R21/Matrix-M vaccine. For each major event, IR stage impacted, key events, challenges, IR process adaptation, and analysis of key IR features enabling adaptation to maintain policy relevance.

Data analysis

Data were analysed using **directed** qualitative **content analysis**, supported by both **deductive and inductive coding**. The initial deductive coding was informed by the core characteristics of IR described in the literature, particularly its **systematic, multidisciplinary, contextual, complexity-sensitive, and real-world problem-solving orientation**. These characteristics served as sensitising concepts for examining how IR was applied and adapted across the case.

All documents, notes, and timeline records were first reviewed repeatedly to achieve familiarity with the data. Relevant text segments were then coded in Atlas.ti Web(20) using a combination of predefined codes derived from the analytical framework and emergent codes developed from the data. Deductive coding focused on identifying evidence related to the core IR characteristics and their influence on policy engagement, evidence generation, adaptation, and decision-making. Inductive coding was used to capture unanticipated issues, including shifting political and programmatic priorities, stakeholder dynamics, and contextual triggers for adaptation.

Codes were then grouped into broader categories and synthesised into explanatory themes. The analysis specifically examined the linkages between: the core characteristics of IR, the changing policy and health system context, and the adaptive use of evidence in decision-making. Attention was also given to differences across the pre-intervention, intervention, and post-intervention phases, in order to understand how the role and expression of IR characteristics evolved over time.

Triangulation and rigour

Findings were strengthened through **triangulation of multiple data sources**, including formal documents, observational notes, and timeline records. This allowed comparison of documented policy events with researchers' process observations and helped identify convergence, divergence, and gaps across

sources. Using multiple forms of evidence also enhanced the credibility of the case-study findings and supported a more comprehensive explanation of how IR characteristics shaped policy processes in practice.(18, 19)

Results

Table 1 presents the main policy, technical, and programme documents reviewed for this case study, covering 2020 to 2025. These documents trace the evolution of malaria-related policy decisions in relation to the work of the SAVING Consortium in Ghana, including malaria vaccine introduction, antimalarial treatment policy, and the uptake of artesunate-pyronaridine. They also capture the influence of COVID-19 on health sector priorities and document how the SAVING Consortium adapted the IR process to respond to changing decision-maker evidence needs over time.

Table 1
List of documents reviewed in the document review

Title	Author/ Institution	Year	Key highlights from document sources
1. Policy brief on reimbursement of Artesunate-Pyronaridine (ASPY) into Malaria Treatment Mix	HTA Secretariat, MOH	2025	Summarised all the evidence on ASPY introduction into Malaria Treatment Mix
2. Budget Impact Analysis on introduction of ASPY into Malaria Treatment Mix	HTA Secretariat, MOH	2025	Provides evidence on the financial impact of Artesunate-Pyronaridine introduction into Malaria Treatment Mix, from the perspective of the National Health Insurance Scheme (NHIS)
3. Ghana Standard Treatment Guidelines Updated Section on Malaria	National Medicines Selection Committee, MOH	2025	Provided treatment guidance and reflects the decision on ASPY selection based on used of evidence from evidence summaries process.
4. Report on evidence summaries on Artesunate-Pyronaridine for Malaria Treatment	Drug Policy Unit, MOH	2025	Provides evidence on the efficacy and safety of Artesunate-Pyronaridine introduction into Malaria Treatment Mix, from the perspective of the National Health Insurance Scheme (NHIS)
5. National Malaria Elimination Strategic Plan (NMESP)	National Malaria Elimination Programme, GHS	2024–2028	The malaria vaccine was listed as one of 7 key interventions implemented by the Malaria Elimination Programme for the eradication of malaria.
6. Malaria Case Management Guidelines	Ministry of Health	2023	It highlights the RTS,S/AS01 malaria vaccine as the first and only malaria vaccine recommended by the World Health Organization (WHO) to prevent malaria and reduce severe, life-threatening cases in children under five living in endemic areas.
7. Antimalarial Medicine Policy	Ministry of Health	2022	Following positive results from the pilot implementation of the RTS,S/AS01 malaria vaccine in Ghana, Kenya and Malawi, WHO on 6th October 2021, recommended widespread use of the RTS,S malaria vaccine in children living in regions with moderate to high malaria transmission.
8. World Malaria Report	World Health Organization	2022	This report documents disruptions in the delivery of malaria-related services during the period of the COVID-19 pandemic.

Title	Author/ Institution	Year	Key highlights from document sources
9. SAVING Consortium Management Meeting Updates from Work Package 3 (WP3)	SAVING Consortium, WP3, MOH	2021–2025	These documents contain the details of the shifts in the IR process ensuring adaptation to the evolving decision maker evidence needs
10. SAVING Consortium EDCTP project design documents	SAVING Consortium	2021	This document contains the initial focus on Malaria vaccine introduction to Ghana
11. Policy Brief: The Impact of COVID-19 on the Health Sector in Ghana	Fenny, Ama & Otioku, Evans. (2020). Institute of Statistical, Social And Economic Research (ISSER) College of Humanities, University of Ghana	2020	The prioritisation of COVID-19 by the government of Ghana and development partners negatively impacted funding for vertical health programmes, including malaria.

Directed content analysis showed that the IR process within the Ghana SAVING Consortium evolved in response to changing policy priorities and evidence needs over time. The Key highlights from document sources in Table 1 indicates that the process began with an initial focus on malaria vaccine introduction in Ghana, as reflected in the SAVING Consortium EDCTP project design documents (2021). However, this focus was disrupted by the emergence of COVID-19. The 2020 policy brief on the impact of COVID-19 on Ghana’s health sector showed that government and partner prioritisation of the pandemic reduced attention and funding for vertical programmes such as malaria, while the 2022 World Malaria Report documented disruptions to malaria-related service delivery during the pandemic. Consortium management updates from Work Package 3 (MOH) further showed that the IR process adapted to these shifts in order to remain responsive to evolving decision-maker evidence needs.

The documents then show a gradual re-alignment of the IR process to malaria priorities. The 2022 Antimalarial Medicine Policy captured the influence of the WHO recommendation for broader use of RTS,S/AS01 following successful pilot implementation in Ghana, Kenya, and Malawi. This was reinforced by the 2023 Malaria Case Management Guidelines, which highlighted RTS,S/AS01 as the first WHO-recommended malaria vaccine for children under five years in endemic settings, and by the 2024–2028 National Malaria Elimination Strategic Plan, which listed malaria vaccination among the key malaria

control interventions. These documents suggest that the malaria vaccine agenda regained policy attention and created space for the IR process to reconnect with malaria-focused decision-making.

The IR process further shifted from malaria vaccine deployment to artesunate-pyronaridine (ASPY)-related treatment policy. This is evidenced by a linked set of 2025 outputs, including an evidence summary report on ASPY efficacy and safety, a budget impact analysis from the National Health Insurance Scheme (NHIS) perspective, a policy brief on reimbursement into the malaria treatment mix, and updated national standard treatment guidelines (STG) section reflecting ASPY selection. The documentary evidence shows that the IR process remained adaptive, relevant and policy-responsive, moving from malaria vaccine introduction, through COVID-19-related disruption, back to malaria vaccine prioritisation, and ultimately toward ASPY-related treatment decisions.

IR process and adaptations to the policy process

Table 2 further analyses the observation notes with timeline documentation across the IR process. The IR process is based on standard models described by Peters et al. (4) and WHO Tropical Diseases Research (TDR) (5).

It provides an overview of the key events, challenges and associated adaptations during the stages of the IR process. It also demonstrates how five core IR characteristics enabled adaptation to changing policy and health system realities. The IR process was strongly *contextual*, as its focus shifted in response to the prevailing public health environment: it began with malaria vaccine introduction, moved to COVID-19 when the pandemic became the dominant policy concern, and later returned to malaria through vaccine and treatment-policy questions. The process showed clear adaptation to *real-life settings*, as the research agenda was repeatedly adjusted to remain aligned with actual policy timing, emerging technologies, and decision-maker evidence needs. Despite these shifts, the process remained *systematic*, with structured evidence-generation approaches, economic evaluation methods, and evidence synthesis processes retained and reapplied across changing topics. Also, the process was *multidisciplinary*, drawing on perspectives from health economics, immunisation, regulation, and policy practice to address evolving questions around vaccine deployment, new technology adoption, reimbursement, and treatment guidance. Finally, the IR process reflected the *complexity* of real-world decision-making, where multiple priorities, actors, and uncertainties interacted over time, requiring iterative rather than linear responses. These five IR characteristics were not merely descriptive tags, but practical enablers that allowed the IR process to remain relevant and responsive from malaria vaccine introduction, through COVID-19 disruption, to the eventual uptake of artesunate-pyronaridine (ASPY) into malaria treatment policy.

Table 2, also shows the further nuances in the along the IR process from participant observers. During the *pre-intervention phase*, malaria was initially chosen as the primary focus for evaluating the use of evidence in policy decisions on new technologies (Table 2). With a single choice for malaria vaccine i.e. RTS,S/AS01, the initial design encountered constrained options for economic evaluation for vaccine

selection. The IR team broadened its approach by considering multiple deployment models and drawing on multidisciplinary expertise from health economics, immunisation programmes, and regulatory agencies to progress with the IR.

Key observations include:

- (1) policy agenda for the malaria elimination was well established but lacked the flexibility to integrate new economic evaluation models;*
- (2) stakeholders expressed a desire for a more comprehensive approach that could accommodate future health technologies;*
- (3) the importance of early stakeholder engagement to identify potential barriers and opportunities for integration and programme buy-in.*

The intervention phase was characterised by a rapid shift in focus following the emergence of the COVID-19 pandemic (Table 2). As COVID-19 became a top priority for both national policymakers and international partners (following similar global-to-national agenda setting mechanism detailed in Table 1), the IR process had to be re-oriented.

Key observations on how IR was adapted to address policy shifts include:

- (1) shifting focus to COVID-19: the onset of the pandemic forced a realignment of priorities from malaria vaccination (single vaccine option at the time), to the multiple vaccine options for COVID-19. This adaptation allowed for a comparative economic evaluation of vaccine selection and deployment, using economic evaluation models, deployment models and updating stakeholder analyses previously developed for malaria;*
- (2) intensifying stakeholder engagement: the urgency of the COVID-19 response was associated with intensified stakeholder engagement. Several workshops and one-on-one meetings were held with decision-makers from the MOH, regulatory agencies, and international partners to align the IR process with emerging public health needs;*
- (3) rapid evidence generation: recognising the need for timely evidence to inform policy, the IR process incorporated rapid evidence-generation techniques using HTA tools. Such tools include specifically, prototype economic evaluation models, used to deliver preliminary findings within shorter turnaround times as well as plain language summaries to ensure that technical findings were accessible to non-specialist policymakers;*
- (4) adjustments for a dual-focus then a shift in focus: as the COVID-19 emergency began to de-escalate, there was a policy shift back to other long standing health challenges. The IR process was then modified to maintain a dual focus, continuing to support COVID-19 vaccine evaluation while also re-integrating evidence*

related to malaria vaccines. This dual focus allowed policymakers to benefit from insights across different health domains and ensured that the IR agenda remained relevant amid changing priorities.

These findings indicate that IR enabled systematic application of its own principles, economic evaluation and rapid HTA models, leveraging multidisciplinary expertise, and continually engaging stakeholders to ensure context relevance. Responsive and flexible adaptation to changing evidence needs implied conducting malaria vaccine analysis and comparative COVID-19 vaccine evaluation. Though this adaptive, multi-level approach situated in a real-life setting was associated with complexity it still ensured the generation of relevant evidence to inform policy decisions with improved timeliness.

Table 2
Timeline of Key Events, Challenges, and IR Process Adaptations

IR stage impacted	Observation notes on timeline documentation			Analysis of Key IR Features Enabling Adaptation
	Key Events	Challenges	IR Process Adaptation	
Pre-intervention	Events before January 2021 (see pre-events below) October 2021; The first malaria vaccine, RTS,S, recommended by WHO to prevent malaria in children. By December 2021: Malaria vaccine introduction in Ghana, conceptualised as a case for HTA evidence generation and IR informed implementation.	Single option for malaria vaccine constrained <i>comparative</i> evidence generation using economic evaluation methods in HTA	The IR approach was adapted to cover to focus on include various deployment models and multidisciplinary perspectives	● Adaptation to real-life setting: malaria vaccine was an ongoing real policy agenda ● Multidisciplinary: included health economics, immunisation programme perspectives ● Complexity: several competing priorities facing practitioners and policy makers simultaneously with actions occurring at different levels of the health system. Required response therefore not linear but iterative.
	pre-events: March 12, 2020: First case of COVID-19 in Ghana; January 30, 2020: WHO declared COVID-19, Public Health Emergency of International Concern (PHEIC)		The SAVING consortium focus on IR as a tool for real life intervention adoption; and selected COVID19 to remain relevant to public health context	● Contextual: IR set research agenda relevant to the prevailing health needs
Early intervention phase	By December 2021; COVID-19 pandemic shifts priorities (becomes topmost priority on several national and research agendas) January to December 2022;	Sudden shift from malaria to COVID-19: Multiple candidate vaccines	IR focus shifted to evaluate COVID-19 vaccines; economic evaluation and vaccine deployment models were revised	● Adaptation: IR adaptability to context made adjustment to speed possible. IR ensured (Rapid Response) through the development of tools for rapid generation of evidence to meet decision maker needs

IR stage impacted	Observation notes on timeline documentation			Analysis of Key IR Features Enabling Adaptation
	Key Events	Challenges	IR Process Adaptation	
	COVID-19 affects several operations of project and initiatives			● Contextual: IR enabled continued engagement of stakeholders to ensure research focus was relevant to context ● Complex: IR enables responsible methodological changes to fit the new agenda on COVID-19
Late intervention phase	May 5, 2023; WHO declared COVID-19 no longer a pandemic. COVID-19 pandemic de-escalates	Health system refocuses: Re-emergence of interest in other health issues	IR agenda adjusted to incorporate both COVID-19 and malaria vaccine evidence; models adapted accordingly	● Multidisciplinary ● Adaptation to real-life setting ● Systematic (retains the key features of IR standard methods, retains key features of economic evaluation methods) ● Complex (several design factors under consideration in the IR agenda)
	April 2023; Ghana's FDA become first country in the world to approve new Malaria vaccine in Ghana, but vaccine rollout would take not less than 2 years, based on regulator expert opinion.	The deferred rollout could have implications for the IR process and its findings.	IR process adapts to use any typical ongoing assessments of a new technology for the IR study, especially those of high public health interest, with timeline priorities.	● Adaptation to real-life setting ● Complex: The policy space is dynamic and hence the challenge which sets the research problem would not remain static for the testing of interventions during the IR intervention phase ● Systematic: critical mapping of key features of the focal health technology to the original health problem context

IR stage impacted	Observation notes on timeline documentation			Analysis of Key IR Features Enabling Adaptation
	Key Events	Challenges	IR Process Adaptation	
				during intervention testing of the IR
	October 2, 2023; Introduction of new malaria vaccine (R21/Matrix-M), for the prevention of malaria in children. Then Malaria Artesunate Pyronaridine, emerges as a new technology adaptation in the health system in Ghana Evidence synthesis on Artesunate Pyronaridine applying IR intervention to guide evidence generation process.	Approval precedes rollout; new technology outpaces evidence generation. IR generic tools are applied to adaptation of Artesunate Pyronaridine as a new health technology.	Refocused IR on comparative analysis of vaccine choices; enhanced integration of regulatory perspectives Refocused IR on a new technology, still within Malaria	● Adaptation to real-life settings ● Systematic: retains the key features of IR standard methods, retains key features of economic evaluation methods ● Multidisciplinary: regulator perspectives are paramount ● Complex: the emergence of a new malaria vaccine, alters the focus of the economic evaluation component ● Evidence-Driven/ Responsive
Post intervention phase	2024 to December 2025 IR enhanced the introduction of ASPY into treatment guidelines as a new health technology			● All five IR characteristics are relevant for introduction of new health technologies

Discussion

From Table 1 and the analysis in Table 2, the characteristics of IR process ensured: (1) adaptability in response to dynamic **context**, (2) flexibility for bridging response to **conflicts** and tensions between short term and long-term priorities, and (3) a multi-stakeholder and multi-disciplinary response to **complexity**.

Adaptability in responding to dynamic context

The Ghanaian experience provides compelling evidence for the adaptive capacity of IR in a rapidly changing health landscape. The ability to shift focus from malaria to COVID-19 and back underscores

IR's responsiveness to context, subject-matter or agenda changes. This adaptability is crucial in settings where health priorities can change abruptly due to external shocks, such as pandemics or the introduction of new technologies. Our findings support the fact that IR is flexible enough to accommodate the dynamic nature of real-world health systems (4, 5), especially when evidence is timely and accessible; with plain language summaries bridging the gap between technical research and practical decision-making, hence making evidence usable across a diverse range of stakeholders. A systematic review on Plain Language Summaries (PLS) makes a case for their ability to transform information from complexity to clarity and promote effective communication and accessibility (21). The findings therefore indicate that IR is subject-matter adaptive, making it responsive to changing agenda and context when the communication of evidence is timely, simplified and accessible.

Adaptation for short term and long-term priorities

Another striking aspect of the Ghanaian case was the tension between the dual challenge of addressing both immediate public health issues and long-term strategic priorities. This tension highlights a key challenge in health policy research: balancing the immediacy of crisis response with the need for long-term evidence-based planning. On one hand, malaria has been a longstanding public health priority in Ghana, warranting comprehensive planning and sustained investment. On the other hand, the rapid onset of COVID-19 demanded urgent action, forcing a temporary reallocation of resources and attention. The Ghana SAVING IR process was not only a reactive tool, but it also provided a framework for proactive planning when evidence was timely and accessible. To be proactive, the IR process went through robust evidence synthesis in identifying a system-level problem in Ghana and an evidence-based efficacious intervention, which has failed to deliver in the Ghana context due to implementation problems. To be reactive the IR-informed integration of rapid evidence-generation techniques, promoted timely, actionable information to policymakers. A study in India, reported unique individual, health system and research operational challenges including misinformation, misconception and hesitance in research implementation under pandemic settings (22). Such duality is inherent in effective implementation research, it requires both focus and flexibility to navigate the ever-changing health landscape (3, 23). While these findings reflect the impact of public health emergencies on the evidence generation process, our findings demonstrate that IR is strategic and shock- responsive, being both proactive towards malaria vaccine introduction and reactive to COVID-19 crisis.

Importance of stakeholder engagement and a multi-disciplinary approach, in navigating complexity

The findings indicate that stakeholder engagement and a multidisciplinary team kept the IR grounded in a real-world context. In Ghana, the responsive update of the stakeholder mapping and regular communication with stakeholders facilitated a shared understanding of challenges and their potential solutions. This improved stakeholder collaboration and application of evidence. The ongoing dialogue and collaboration with stakeholders and various experts including health economists, immunization experts, and regulators, led to responsive modification of malaria vaccine analysis. As COVID-19 emerged, and a new malaria vaccine was introduced, adaptation of economic models and deployment

strategies, ensured IR remained relevant. The rapid shifts in focus from one health crisis to another, had implications for scientific and technical methods for evidence generation. For instance, the single option for malaria vaccine implied comparative economic evaluation(24) was limited; but the multiple options of COVID-19 vaccines implied comparative economic evaluation was possible and even required. Also, the same shifts in focus from one health crisis to another, is associated with shifts in interests and operations of stakeholders. For instance, the malaria to COVID-19 shift implied engaging additional sets of stakeholders; requiring even stronger efforts in stakeholder engagement.

Our findings therefore highlight the linkage between adaptability, **strategic and shock- responsiveness**; and stakeholder engagement. Our findings also align with existing evidence which indicates that iterative and dynamic stakeholder engagement plays a key role in successful evidence generation and translation (25) and highlights the importance of stakeholder engagement in bridging the “know-do gap”(3, 4), reinforcing the insight that when stakeholders are actively involved in the evidence-generation process, there is a higher likelihood that the resulting recommendations will be embraced and implemented. This is particularly important in settings like Ghana, where political, socio-cultural, and economic factors can influence policy decisions in unpredictable ways.

Additionally, the introduction of the new malaria vaccine candidate (R21/Matrix-M) added another layer of complexity to the policy process. New technologies, while promising, come with their own set of challenges (26) - regulatory hurdles, supply chain constraints, and issues related to public acceptance (27), among others. Table 2, illustrates a change of research focus from the Malaria vaccine, to COVID-19 vaccine; and then to comparative analysis when an additional malaria vaccine was introduced in the market. The IR approach was flexible to accommodate refocusing of the policy response, to incorporate evidence from comparative analyses necessitated by the changing realities. This allowed policymakers to weigh the relative merits of different technologies, thereby informing more nuanced decision-making.

Our study shows that the success of such adaptations relies heavily on the integration of multidisciplinary perspectives. Input from regulatory experts, health economists, immunisation program managers, and community stakeholders was critical in assessing the feasibility and potential impact of the new vaccine. This collaborative approach is supported by previous research, which underscores the need for interdisciplinary cooperation in tackling complex health challenges (28, 29). Not only are researchers and evidence generators contending with shifting disease priorities, but they are also navigating the dynamic landscape of technological and therapeutic advancements yielding new interventions relevant to health systems, especially in the developing world. Such advancements, while remaining promising, introduce their own set of challenges, from regulatory hurdles, supply chain adaptation challenges, risk of information distortion affecting public acceptance and logistical issues related to distribution and administration (27, 30, 31). The authors are of the view that the ability of the IR process to handle complex research problems makes it perfectly suited for such situations.

Challenges and Limitations

Despite its many strengths, the IR process in Ghana was not without *challenges*. One challenge was the risk of “research fatigue” among stakeholders due to a lengthy and intensive three-phase research process; particularly in the context of continuous adaptation and shifting priorities. Frequent changes in focus can lead to stakeholder disengagement if communication is not maintained consistently. The team, maintained communication with stakeholders with high interest and high influence as much as practicable. Another challenge is the before-after design of the original IR process which may not capture long term policy impacts; these would be better captured in a longitudinal design.

A limitation of the study is its reliance on retrospective recollection of content from some participant observers, which had a risk of recall bias. This was reduced through peer-validation.

Broader Implications for Policy and Practice

The lessons from the Ghanaian experience have broad implications for the application of IR to guide adoption of new health technologies in similar contexts. The adaptability of the IR process, combined with effective stakeholder engagement, provides a model for integrating evidence into policy even amid rapidly shifting health priorities. This approach is particularly relevant in LMICs, where resource constraints and external shocks often necessitate quick changes in policy focus.

Policymakers in similar settings can draw on these lessons to institutionalise continuous feedback mechanisms and regularly update stakeholder matrices, ensuring that evidence remains relevant and actionable.

Promoting an environment where research is closely linked to policy, IR not only improves decision-making but also builds capacity within health systems. The experience in Ghana demonstrates that with a commitment to flexibility, focus, and inclusive engagement, the barriers between evidence-generation and policy implementation can be overcome. As indicated above, a potential pitfall in this dynamic system between research and policy is that the constant shifts in focus can lead to ‘research fatigue’ among evidence generators as well as other stakeholders, which might reduce their engagement and confidence in the process, if they are not continuously engaged properly. While adapting to new realities is crucial, it is equally vital to ensure consistency in communication and involve stakeholders in decisions about research direction changes.

The Ghanaian experience with IR reveals a delicate balance between the need for adaptability and consistency in the research evidence-generation agenda and policy decision-making. It demonstrated the necessity of being assertive enough to pivot the research agenda when required while maintaining a focus on overarching health goals and objectives. In the broader public health practice, change and uncertainty are inevitable. The lessons from Ghana’s IR application experience demonstrate the importance of focus, flexibility, and a commitment to stakeholder-driven, evidence-based policy-making.

Conclusion

The application of Implementation Research within Ghana's policy landscape provides a compelling case study of how adaptive, stakeholder-driven approaches can bridge the gap between evidence and policy. The sequential three-phase IR process; comprising pre-intervention scoping, active intervention, and post-intervention evaluation, enabled the research team to navigate significant shifts in health priorities, from malaria to COVID-19 and back. Through continuous stakeholder engagement, rapid evidence generation, and iterative adaptations, the IR process not only enhanced the uptake of evidence but also laid the groundwork for sustainable, evidence-based policymaking.

The Ghanaian experience highlights several key lessons:

1. The ability to adapt quickly in response to emerging health challenges is a critical strength of the IR process.
2. Involving a broad range of stakeholders from the outset fosters trust, ownership, and sustained collaboration. Integrating diverse perspectives, ranging from economic evaluations to regulatory insights, ensures that policy decisions are comprehensive and contextually relevant.
3. Effective IR requires managing the tension between immediate tactical responses and long-term strategic planning.

These lessons are not only applicable to Ghana but also offer guidance for other low- and middle-income countries grappling with similar challenges.

Abbreviations

ADP

Access and Delivery Partnership

EDCTP

European and Developing Countries Clinical Trials Partnership

FDA

Ghana Food and Drugs Authority

HIV

Human Immunodeficiency Virus

HTA

Health Technology Assessment

IR

Implementation Research

LMICs

Lower- and Middle-Income Countries

MOH

Ghana Ministry of Health

NMEP

National Malaria Elimination Programme

PLS
Plain Language Summaries
SAVING
Sustainable Access and Delivery of New Vaccines in Ghana
Swiss TPH
Swiss Tropical and Public Health Institute
UHAS
University of Health and Allied Sciences
WHO TDR
World Health Organization – Tropical Diseases Research

Declarations

Ethics approval and consent to participate.

While the key data sources included in this study are technical reports, technical briefs, minutes from stakeholder-workshop, policy documents, documentation of policy decisions etc.; retrospective observational notes; and timeline documentation; no human subjects were recruited in this study as data sources.

Meanwhile, the original IR study forming part of the case study, was approved by the Ghana Health Service Ethical Review Committee (GHS-ERC 003/05/22) and the Ethical Review Committee of the University of Health and Allied Sciences (UHAS-REC A.9[1] 21-22).

Consent for publication

Not applicable

Availability of data and materials

All data generated or analysed during this study will be included in the published article. Where the sources are articles or documents, these are cited, and references provided to the source articles.

Competing interests

The authors declare that they have no competing interests.

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Authors' contributions

MG, EA, AH, TO and OO provided leadership and guided the design of the study. BA, EAK prepared the initial draft of the manuscript. DDO, HA, AA, SK, MD, MI and MA reviewed the draft manuscript providing inputs and perspectives. SY, JA, provided policy perspectives to the analysis. BA, EA, SK, AA, IA edited the manuscript. All authors reviewed the manuscript.

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