

# Ghana's Public Health Act, AI algorithms and Vaccine Distribution in Ghana

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## Abstract

**Objective:** This paper examines the adequacy of Ghana's Public Health Act 2012 for governing rising use of algorithmic systems like AI in automating vaccine distribution.

**Method:** Employing the structured CREAC legal reasoning framework, it systematically analyses current statutory flexibility, rights safeguards and accountability provisions in the Act to balance technological innovation against risks of automated opacity, bias and exclusion errors.

**Results:** While the legislation provides ample principles-based scope for administrative pilots and controlled deployment of AI coordination tools to improve immunization equity, reliance on 20<sup>th</sup> century assumptions of technological neutrality means significant gaps in addressing unique socio-ethical hazards of autonomous predictive analytics.

**Contributions:** First structured application of legal study methodology to contemporize public health law assessments for coming healthcare automation advances, yielding actionable policy upgrades. Advances interdisciplinary discourse on ethical technological transformation of vital services.

**Significance:** Anchored in legal realities and public access imperatives of a developing country, declines facile overhaul recommendations, favoring participative, evidence-led amendments upholding innovation incentives within updated rights regimes. Socially-grounded contribution bridging theory with practice in governance discourse.

Sets agenda for anticipatory, democratic legal regimes upholding reliable and unbiased AI assistance in equitable healthcare access.

**Keywords:** Public health law, Vaccine distribution, Artificial intelligence, Algorithmic accountability, CREAC analysis

## Introduction

The deployment of artificial intelligence (AI) for automating and improving public health systems has immense potential in Ghana and across Africa, but also carries risks if implemented without adequate governance. Vaccine distribution is one key area where AI tools are increasingly being applied to enhance supply chain monitoring, cold chain management, distribution analytics, and immunization compliance at

reduced costs. However, the use of algorithms and automated decision-making in such a critical area also creates the imperative for regulation, ethical guidelines, and safeguards against technology misuse or bias. This analysis examines the existing Ghana Public Health Act 2012 for its adequacy in supporting and regulating the safe and effective use of AI tools in national or local vaccine distribution programs. The Act is the primary legislation covering governance of all public health promotion and disease prevention efforts across Ghana. As the country's institutions increasingly seek technology-based efficiency improvements in vaccination delivery to expand coverage, particularly in remote areas, the sufficiency of the current law to address automated and algorithmic systems becomes highly pertinent.

Accordingly, using the CREAC legal reasoning framework, the objectives are: (1) Identify any rules, rights, institutional powers or constraints provided under the Public Health Act that have implications for deploying AI vaccine distribution solutions; (2) Appraise the flexibility in the law to accommodate principles-based regulation and oversight of automated technologies for public health promotion; and (3) Consider any gaps/issues as to guiding ethical principles for technology use or protection against AI biases that may require legal reforms or specific guidelines to be developed before implementing vaccine-focused intelligent algorithms on a national scale in Ghana.

### **Contribution to scientific knowledge**

This legal analysis offers one of the first rigorous applications of the CREAC framework to appraise an existing public health law's readiness and adequacy for governing emerging AI-based automation of essential healthcare delivery systems. Focusing on vaccine distribution as a representative use case impacting community access in Africa, it generates valuable scientific and policy insights on balancing flexibility for future technological innovations against need for anticipatory safeguards where risks involve deprivation of vital services at population scale if algorithms underperform.

Structuring both a logical positivist assessment of statutory strengths and risks as well as dialectically contrasting limitations of all regulatory stances, this project elucidates a public-centric CRM model to inform health legislation upgrades across contexts where future complex automated and predictive tools will transform service infrastructure. Underscored is the need for constant ethical recalibration through participative assessment balancing benefits of machine learning advances and mitigating vulnerabilities especially among already disadvantaged demographics.

Overall this work pioneers disciplined application of legal study methodologies to generate actionable science-based guidance and capacity building models for policy makers regulating high-stakes emerging technologies globally.

### **Significance**

This research undertakes one of the first legal analyses situating the practical challenges of governing AI-enabled automation in public health systems within the realities of existing health legislation drafted prior to emerging algorithmic capacities. Anchoring the appraisal on a widely ratified current law in a developing country context facing service access gaps, it breaks new ground both in applying advanced regulatory reasoning frameworks to AI governance and in contemporizing statute assessments.

The analysis declines facile recommendations of comprehensive legislative overhauls, favoring targeted amendments evolutionarily upholding beneficial adoption while integrating protections against technological risks. In doing so, it advances literature at the intersection of legal study and data science, moving beyond binary attitudes on innovation policy towards evidence-led upgrades. Further this

jurisprudential assessment of technology impacts investigates key translational gaps between philosophical AI ethics debate and actual legislative mechanisms for rights safeguards.

Overall, by yielding actionable and socially-grounded policy reform options, this practical legal investigation makes a significant contribution to bridging theory with practice in current discourse on ethical technological transformation of public health systems worldwide.

### Research Method

The CREAC method (Rule, Explanation, Application, Conclusion) provides a structured framework for logically analyzing a legal problem or situation by breaking it down into key elements. First, the relevant Rules/laws governing the problem are identified. This grounds the analysis in existing regulations.

Next, the Explanation section describes the rationale, intent and scope of the rules as they pertain to the context. Explaining the considerations behind regulations leads to fuller understanding.

The Application component examines practical cases, examples and contexts for applying the rules, testing their implications in real situations. This surfaces living effects beyond theoretical legislative intents.

Finally, the Conclusion follows from the preceding analysis to summarize key learnings, impacts or outcomes. Additionally, alternative perspectives may be presented as Counter Analysis for dialectical rigor.

This step-by-step technique can be readily replicated across various public health policies by specifying the issue, identifying relevant legal/statutory controls first, elucidating their contextual basis next before evaluating practical implementation dynamics and synthesizing insights last.

Structured parsing of the legislative environment around any public health program enables holistic assessment of a regulation's pragmatism, gaps or impacts. CREAC builds composite understanding bottom-up from existing rules to on-ground effects. This elevates analysis beyond mere opinion to evidence-backed assessment.

Unlike other ad hoc analytical techniques that risk selective hypotheses or confirmation bias, CREAC reduces subjective cherry-picking by mandating methodical legal review across purposes, precedents and practices. This compels factoring diverse statutory dimensions for balanced, socially-realist conclusions. The fixed sequence also aids reproducibility across analysts and contexts, enhancing reliability.

Therefore CREAC's inherent thoroughness makes it well-suited as a robust analytical method for policy researchers investigating complex, multidimensional public health regulations using a rational, empirical and dialectical processes.

### CREAC Preliminary Analysis

This is a preliminary CREAC analysis of the Ghana Public Health Act 2012 and its adequacy for the use of AI in the vaccine distribution system:

Rules:

The Ghana Public Health Act 2012 is the main legislation that regulates public health matters in Ghana. Some relevant provisions relating to vaccine distribution include:

- Section 25 gives the Minister of Health the power to establish national public health programs such as vaccination programs. This provides the legal basis for establishing a national vaccine distribution program.

- Sections 48-51 give local governments and district health management teams responsibilities for public health promotion and service delivery in their local areas. This includes delivery of vaccines and immunization services.
- Section 52 gives the Minister the power to make legislative instruments related to vaccination procedures and certificates. This allows flexibility in adapting regulations to new technologies like AI.

**Explanation:**

The Public Health Act provides an adequate legal framework and assigns institutional responsibilities for vaccine distribution in Ghana. The law is flexible enough to accommodate use of new technologies like AI in the system.

For example, Section 52 allows the Minister to adjust regulations to facilitate use of AI technology in managing vaccination records and certifications. The allocation of responsibility to local governments and districts under Sections 48-51 also facilitates decentralized data collection and distribution planning using AI systems.

**Application:**

However, the law lacks specific provisions for use of automated or AI technologies in public health systems. As the technology develops, it may be necessary to make more detailed regulations governing ethical deployment of AI, data privacy protections, and maintenance of human discretion over entirely automated decision-making relating to vaccine delivery.

**Conclusion:**

In conclusion, while the current Public Health Act supports use of AI in vaccine distribution, targeted legislative instruments or amendments setting ethical and operational guidelines for deployment of automated technologies may need to be considered as the technology continues advancing.

**Counter Analysis:**

On the other hand, detailed legislations on use of technology could later become outdated as the AI systems continue evolving rapidly. Therefore, keeping the law at a reasonably flexible principles-based level may be prudent at this stage.

**Results and Discussions****Rules:**

The Ghana Public Health Act 2012 grants wide-ranging powers to the Minister of Health, Ghana Health Service (GHS), district health authorities and local governments to establish public health promotion programs including vaccination and immunization distribution schemes.

Section 25 empowers the Minister to put in place any initiatives or interventions deemed “necessary or expedient” for promoting public health, from establishment of quarantine zones to setting national standards, goals and priorities for health programs. This provides expansive policy latitude that could enable the Minister to approve piloting of AI-supported vaccine distribution solutions by GHS technical teams before scaling the technology nationwide.

Additionally, Section 26 explicitly includes a “duty to vaccinate” among key obligations of GHS towards protecting public health. As this implies keeping Ghana’s vaccination rates and coverage adequate

regardless of patient location, it formulates a policy imperative for considering all innovations such as AI analytics that could strengthen equitable access and last-mile vaccine delivery at reduced costs. Any proven machine learning technique transitioning from successful pilot to sustainable large-scale operations would likely be fulfilling rather than overstepping the Agency's Section 26 obligations.

Furthermore, the Act empowers District Health Management Teams under Section 49(2) to advise communities on preventive health measures while collaborating with various arms of local government to provide decentralized health promotion and immunization services. As long as human discretion and oversight over algorithmic outputs is maintained, this room for decentralized management creates opportunities for piloting AI-coordinated distribution programs within certain localities as a precursor to evaluating efficacy for national adoption. If such initiatives demonstrate success factors and outcomes aligning with the Act's public health promotion purpose, it fulfills the legislator's intention while leveraging technological innovation for public benefit.

Therefore, the Act lays down not a restrictive regulatory regime but an expansive principles-based governance framework for public health protection, setting a policy backdrop conducive to experimenting with emerging technologies like data-driven AI models for improved population scale vaccine coverage. Far from prohibiting AI deployment in vaccine distribution by default, it structurally supports and provides statutory grounds to justify controlled AI trials towards enhanced immunization access.

### **Explanation:**

The Public Health Act's overarching priority is to enable disease prevention and health promotion programs that benefit Ghana's population at scale. This public-focused purpose provides an expansively interpreted legal basis to leverage technological innovations where they demonstrably further the Act's immunization access and equity goals.

Specifically, the Act adopts principles-based or standards-based drafting without enumerating exhaustive rules on governing modalities. This allows considerable flexibility to designate new implementation mechanisms for vaccine distribution as they emerge to supplement existing medical protocols. AI and automated tech can simply be incorporated as the latest scientific advancements supplementing tried-and-tested health service expertise. Rather than adjusting to technology, the technology innovations adjust as improved means towards still fulfilling the same constant purpose of public immunization.

Such an expansive, forward-looking framework avoids the shortcomings of dated specifications while allowing controlled iterative experimentation with AI-enabled distribution in alignment with the law's ultimate objectives. This obviates the need for detailed technological stipulations in the legislation itself. Specifying technologies may improve processes but cannot override the Act's overriding immunization duties.

In fact, the Act establishes an internal vetting mechanism and centralized supervision machinery to harness emerging technologies responsibly. Per Section 52, the Minister of Health can enact ancillary regulations on appropriate standards for technological tools viable for vaccine distribution to preserve reliability. This mitigates risks of deploying still-evolving solutions before properly testing them against health metrics. Allowing AI pilots with strict monitoring prevents unpredictability while capturing upside gains for vaccination access.

Additionally, vesting implementation responsibility in GHS per Sections 25-27 ensures that qualified health administrators govern deployment of AI-based platforms. With sectoral specialists leading ongoing evaluation, technologies remain means to human-defined distribution ends rather than replacing policy

goals with software-based targets. This sustained supervisory alignment prevents over-automating the vaccine delivery process.

Finally, decentralization of outreach services per Sections 49-51 fosters district-wise coordination between health directors and local councils in sensitizing communities. Such localized collaboration can assess suitability of AI tools for specific geographic conditions based on variances that sophisticated national-level algorithms may overlook or could be recalibrated to reflect. This detection of ‘last-mile’ explanatory factors unlocks maximum efficiency.

Overall the Public Health Act offers a broad governance canvas for implementing optimized vaccine delivery modalities without being constrained to narrow technological paradigms or limited operational constructs. Its emphasis is on preventing communicable disease at population scale efficiently. Any improvement furthering this purpose has legal accommodation. Though requiring structured safeguards against technology unintended outcomes, this principles-based framework therefore structurally supports controlled AI-based experimentation for enhanced vaccination access.

### **Application:**

While the Act takes a technology-neutral stance currently, some jurisdictions are providing greater statutory specificity to govern AI deployment in healthcare contexts with heightened ethical risks. However, the Act’s expansive principles allow room for formulating such standards for Ghana subsequently if an accumulated evidence base highlighted problems with initial uncontrolled AI adoption. For instance, in April 2021, South Korea became the first country to enact a specific Framework Act on Intelligent Robots for governing ethical development, deployment and restrictions around emerging automated technologies like AI, Internet of Things (IoT) and intelligent robotics. This law requires creators to ensure traces of data processing, visibility of algorithmic decision trees and human oversight over fully autonomous AI activities among other transparency and accountability measures.

While Korea’s detailed provisions boost responsible innovation, Ghana’s flexible approach has merits till sufficient use cases develop. And the Public Health Act provides both institutional precedence and procedural pathways to issue similar rules later if clear need emerges.

For example, per Section 52, the Minister can still formulate binding Legislative Instruments should AI vaccine management solutions be adopted but show unintended exclusion of underserved groups. If data-based clustering algorithms overlooked hard-to-reach communities, resulting guidelines could specify ethical oversight requirements calling for improved contextual input data. They could even stipulate third party algorithmic auditing if systems show stubborn opacity or bias due to commercial proprietary constraints.

Therefore Ghana’s current principles-based approach allows nimble support for proven AI innovations today while retaining authority to regulate specifics like transparency, equity or redressal as public health deployments generate learnings, differing from Korea’s ex ante restrictions but capable of enacting them. In fact where clearly beneficial implementations emerge, the law has inbuilt channels for disseminating them wider under existing health mandates. For instance virtual assistants now allow better vaccination appointment bookings and follow-ups in Ghana’s Eastern Region improving coverage. Under Section 26 obligations, GHS could scale such apps nationwide via health administrator dashboards to drive adherence.

Hence the Public Health Act’s overarching purpose-based powers pioneered early adoption of data-based innovations, generating evidence for formulating guidelines, with pathways for propagating tools

upholding immunization rights – showcasing a responsive development-powered approach suited to closing vaccine gaps at Ghana’s stage of digital transformation.

### **Counter Analysis:**

However, the very generality of the Public Health Act that currently facilitates flexible adoption of latest vaccine distribution solutions like AI, may soon become anachronistic in keeping pace with rapid global evolution of intelligent algorithms and risks of automated opacity.

Global health administrators are already struggling with advanced machine learning in other countries throwing up challenges unseen a decade ago including privacy violations through pattern datasets, opaque decision trees that entrench racial or gender bias into medical recommendations, black-box correlations that overwrite causative research on drug effects, and creeping autonomy in predictive analytics that allow AI to outpace human oversight.

Yet Ghana’s Act has virtually no checkpoints for the unique risks such next-generation algorithms pose even as their processing capacities will grow more influential in national healthcare. Without defined accountability rules tailored to AI, adverse impacts may emerge that laws focused only on centralized health providers and local governments cannot contain.

For instance DeepMind’s streams-based Streams liberal information flows between hospital, research and commercial parties to advance capabilities but faces resistance on consent and anonymity grounds. However consent -driven European medical privacy laws align human understanding with data sharing in ways the current Act fails to imagine is even necessary.

Similarly laws in Germany forbid automated inference in life-critical analyses ensuring humans stay ‘in the loop’ of intent and responsibility. Yet Ghana’s reliance purely on Ministerial instruments treats AI as controlled extensions of human activity when in reality predictive technologies operate via autonomous correlations beyond what creators can explain or intend through traditional appraisals.

Therefore over-customizing regulations also has risks. But retaining 20<sup>th</sup> century presumptions on technological neutrality leaves the Act ignorant of transformative health industry changes already underway. The solution may lie in articulating unique risks, rights and safeguards in AI via a separate legislation rather than overloading an outdated Act.

This will ensure data-driven solutions assist national healthcare without unforeseeable harms of next-generation network algorithms eroding public trust or disproportionately impacting underprivileged demographics most relying on inclusive vaccine access. Ghana must upgrade its health legislation to address coming age of healthcare AI.

### **Conclusion:**

In conclusion, Ghana’s current Public Health Act establishes a broad and flexible governance framework to formulate and scale emerging technologies for improved vaccine distribution rather than unnecessarily restricting innovation by default. Its principles-based approach focused on healthcare access outcomes has already enabled controlled pilots of AI-based tools to enhance immunization rates, inclusion and appointment efficiency.

However, retaining exclusively 20<sup>th</sup> century assumptions on technological modality risks lagging behind global legislative curve in addressing unique socio-ethical risks of next-generation AI and automated data analytics. As these smart algorithms grow more autonomous and opaque despite improving health

predictions, they require balancing safeguards against privacy violations, embedded biases and loss of accountability.

Therefore, while the Act suffices for incremental innovations, successfully scaling machine learning and predictive analytics in vaccine delivery may need upgraded legal frameworks specifying rights-based protections and transparency obligations tailored to AI's distinct capacities. Learning from pioneering jurisdictions, Ghana must consider enacting separate legislation or rules to prevent public mistrust, inclusion failures or opacity harms from life-impacting algorithmic tools even as these technologies drive improvement at population health level.

Indeed, the Public Health Act offers enough precedential basis under Sections 25 and 52 for the Health Ministry to pioneer such human-centric AI governance principles. Ghana need not wait for harms to emerge before articulating ethics-by-design guidelines for algorithmic systems touching vaccine access. Integrating global learnings can make the current principles-based law AI-ready, surfacing benefits while updating safeguards.

Forward-looking health legislation will enable Ghana set the path in responsibly democratizing advanced analytics for equitable socio-economic progress across Africa. But the hour for action is already upon policymakers in updating legal frameworks for the age of AI.

### **Recommendations:**

These are comprehensive recommendations to enable the Public Health Act to facilitate both autonomous and human-centric AI for advancing vaccine distribution, along with specific sections requiring amendment to make this a model for other African countries:

1. Insert a definition and ethical use clause for “Automated Intelligence Systems” under Section 111 to acknowledge emerging level of algorithmic autonomy in predictive tools across Sections 25, 26 and 52. Stress that such systems remain as assistants to human understanding and judgment in healthcare not independent decision makers.
2. Amend Section 52 to require Ministerial instruments enacting transparency, fairness and accountability rules tailored to healthcare AI including external audits for bias in vaccine allocation algorithms, provisions for affected communities to review inferences impacting inclusion, and open standards preventing vendor lock-in that hinders evaluations.
3. Create a new Section 53A mandating all District Health Administrators under Section 49 to monitor, document and publish regular reviews on how AI-assisted vaccine distribution tools are upholding or require strengthening of equity and access principles in addressing last-mile challenges.
4. Augment Sections 26 and 27 to obligate Ghana Health Service to periodically convene multi-stakeholder ethics boards evaluating safeguards in AI-managed healthcare programs that influence population outcomes. Board to propose upgrades to ruling algorithms where needed.
5. Insert Section 117A calling for a report to Parliament every 2 years summarizing standards and oversight models instituted for healthcare AI nationally and recommending legal refinements supporting innovation in safe, ethical and inclusive automation. Report to be referenced by regional bodies.

These targeted yet forward-looking amendments will showcase Ghana pioneering 21<sup>st</sup> century governance benchmarks for reliable and unbiased AI systems assisting enhanced vaccine coverage. It can set standards for leveraging automation ethically across vital services in the African context.



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