Policy Evaluation Metrics Framework

from

ROADMAP FOR IMPEMENTING BIOSECURITY AND BIODEFENSE POLICY IN THE UNITED STATES

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Evaluation Metrics Framework

Figure 1 is the evaluation metrics framework for analyzing implementation of biosecurity and biodefense policies. This framework involves two parts, one focused on activity-based measures and one focused on outcome-based measures. In general, the two parts of this framework would be analyzed sequentially.

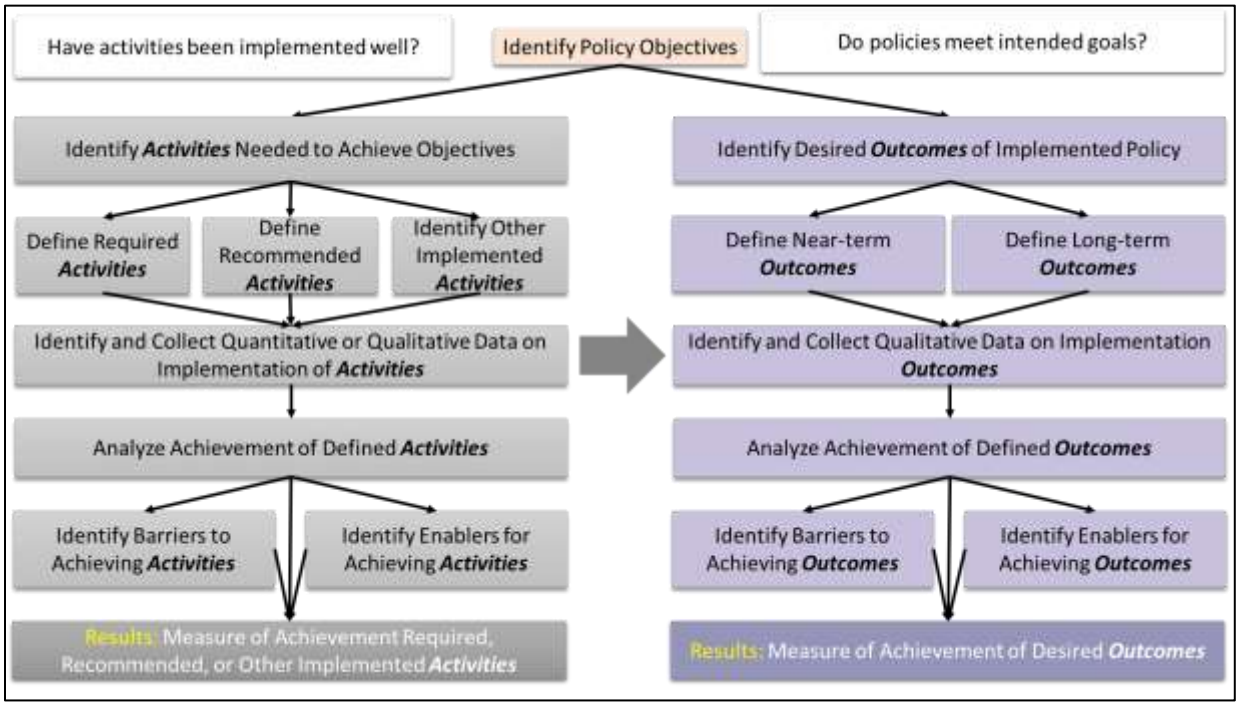

Figure 1. Evaluation Metrics Framework. This framework includes two parts: 1) quantifiable or semi-quantifiable, activity-based evaluation; and 2) qualitative, outcome-based evaluation. The specific measures used are based on required, recommended, and voluntarily implementing activities and the policy goals.

The process involved in assessing the successful achievement of activities undertaken to implement policies includes:

1) Identification of required, recommended, and voluntary activities undertaken to achieve the objectives of a given policy.
2) Identification of quantitative and qualitative data needed to assess the successful completion of the activities.
3) Solicitation and analysis of the data using any of the methodologies described in literature.
4) Identification of barriers preventing successful completion of the activities.
5) Identification of enablers aiding the successful completion of the activities.

The result of this process is a quantitative or semi-quantitative measure of the successful implementation of the specified and unspecified activities undertaken to meet policy objectives.

The process involved in assessing the successful achievement of policy goals includes:

1) Articulation of desired objectives based on policy and programmatic goals.
2) Identification of outcomes that may be observed in the near-term compared to those observed over a longer period of time.
3) Identification of qualitative data needed to assess achievement of desired outcomes. (The types of data needed to assess outcomes may not be publicly available, but may be obtainable by law enforcement, regulatory agency, or members of the intelligence community. Alternative, data may be related to the persistence of repeat, institutionalized, or diversified activities. Examples of different types of data needs are included in the use cases in Appendix 2.)
4) Solicitation and analysis of the data.
5) Identification of barriers preventing successful achievement of activities.
6) Identification of enables aiding the successful completion of activities.

The components and process of this framework were applied to three existing policies in the broader biosecurity and biodefense policy arena to understand how well the framework can be generalized to a variety of different types of policies. The use cases chosen include a voluntary or semi-voluntary policy (the NIH Guidelines for Recombinant and Synthetic Nucleic Acids), statutory or regulatory policy (the Biological Weapons Anti-terrorism Act of 1989), and a capability-building policy (the Public Health Emergency Medical Countermeasure Enterprise). These use cases, which are included in Appendix 2, highlight the generalizability of the evaluation metrics framework shown in Figure 1.

Evaluation Metrics Use Cases

Application of the Evaluation Metrics Framework developed for this project to three use cases is presented in this appendix. The use cases included in this appendix are:

- NIH Guidelines for Recombinant and Synthetic Nucleic Acids, which is a voluntary guidance that is contractually required for all research institutions that receive U.S. government funding
- Biological Weapons Anti-Terrorism Act, which is a legally-binding criminal statute
- Public Health Medical Countermeasures Enterprise (PHEMCE), which is a U.S. government-wide biodefense program

These use cases illustrate how the framework can be applied and enabled the authors to revise the initial framework to ensure its relevance to different types of policies.

Policy	**NIH Guidelines on Recombinant and Synthetic Nucleic Acids**
Policy Goals	Reduce the potential safety risks that may result from research involving genetic engineering Reduce the potential safety risks that may result from research involving use of synthesized DNA
Policy Objectives	Implement a system for reviewing and overseeing genetic engineering research Establish a process for identifying, analyzing, and mitigating potential safety risks genetic engineering research

Policy Type	Policy Guidance, contractually required in grant awards	
	Activities	**Sample Evaluation Questions**

Required Activities	• Institutional biosafety committee at research institutions receiving federal funding that:
	  ○ Reviews and oversees genetic engineering research
	  ○ Recommends conditions under which genetic engineering research can be conducted safely
	  ○ Recommends alternative approaches for high-risk research
	  ○ Approve or reject genetic engineering based on the biosafety risks posed
	  ○ Report outcomes of reviews to the National Institutes of Health Recombinant DNA Advisory Committee (RAC)
	  ○ Has required diversity of expertise
	  ○ Is trained to review and oversee recombinant and synthetic nucleic acid research
	  ○ Participates in review of human subjects research, if appropriate
	  ○ Ensures PI compliance with the Guidelines
	  ○ Determine health surveillance needs of researchers
	• PI responsibility:
	  ○ Submit registration documentation to the IBC for research that must be reviewed
	  ○ Submit information about certification of new host-vector systems
	  ○ Seek approval of NIH conduct covered experiments and request exemptions
	  ○ Seek determination from NIH about containment requirements, especially if not included in the Guidelines
	  ○ Seek approval by IBC for clinical trials added after the research has been registered with NIH
		<u>Institutional Questions</u>
		• Has the institution established an institutional biosafety that:
		  ○ Has knowledgeable scientists, institutional biosafety administrators, and public representatives serving?
		  ○ Has a biosafety officer, who is involved in the IBC review and oversight process?
		  ○ Keeps well-documented records of the meetings and reports to NIH on time and as required?
		  ○ Meets on a regular schedule?
		• How often are committee members trained?
		• How often are the training materials updated with new policy-relevant information and scientific advances?
		• What is the turn-around time for the reviews?
		• How many protocols are evaluated each year?
		• How many protocols have received recommendations for experimental alteration based on biosafety risks?
		• How often have study principal investigators been involved in discussing the risks, experimental conditions, and alternative approaches?
		• How many protocols are rejected each year?
		• How many protocols are approved each year?
		• How many times has the IBC consulted with non-member, subject matter experts each year?
		• How often does the IBC allow members of the public to observe the reviews?
		• Do IBC member recuse themselves from review of their own research or research from which they could benefit?
		• How many protocols receive detailed review each year?
		• Does the institution have plans for addressing accidents or violations?
		• How often is research conducted at the institution reviewed to ensure compliance?

	○ Communicate with IBC throughout the entire research effort ○ Maintain and promote safe laboratory practices • Institution Responsibilities: ○ Allow members of the public to observe IBC discussions ○ Adopt emergency plans for spills ○ Establish procedures for safe conduct of recombinant or synthetic nucleic acid research ○ Comply with shipping requirements ○ Have a biological safety officer ○ Inspect laboratories to ensure appropriate safety measures are being used ○ Review research conducted at institutions to ensure compliance with Guidelines ○ Report violations of the Guidelines, accidents, or problems • federal advisory committee (RAC): ○ Review proposed studies that may present significant biosafety risk ○ Provide recommendations to the research institution and NIH about mitigation of biosafety risks of genetic engineering research ○ Provide recommendations to the research institution and NIH about mitigation of ethical, legal and biosafety risks of human gene transfer studies ○ Provide training in laboratory safety to IBC members ○ Convene Gene Therapy Policy Conferences	• How many research activities that have not undergone review are identified each year? • Do procedures exist for seeking research approval and determination of containment from the NIH? • How many laboratory staff are aware of the safety risks of their research? <u>NIH Questions</u> • RAC ○ How many protocols has the RAC reviewed? ○ What recommendations has the RAC made for addressing risks? ○ How often does the RAC convene to review protocols? ○ How many IBC members have received training by the NIH? ○ How often do the Gene Therapy Policy Conferences occur? ○ How many people attend the Gene Therapy Policy Conferences? • What methods has the NIH used to certify or decertify new host-vector systems?
Recommended Activities	• The RAC evaluates emerging biotechnologies and recommends modifications to the guidance to address new biosafety risks posed by emerging biotechnologies	• How often does the RAC convene to discuss emerging biosafety considerations of biotechnologies? • How often does the RAC engage with scientists, technologists, and other stakeholders when it evaluates emerging technologies? • What information does the RAC review when analyzing emerging technologies?

		• What types of biosafety risks have been identified by emerging biotechnology? • What suggestions have been made to address these risks?
Other Activities	• Institutions promulgate adherence to Guidelines even if research is not covered	• Does the institution have a process for interacting with researchers who are not immediately covered by the Guidelines? • How many institutions that are not required to comply with the Guidelines, nonetheless have established procedures for adhering to the Guidelines?
	Outcomes	**Sample Evaluation Questions**
Near-Term Outcomes	• Institutions have the requisite guidance and resources to evaluate the biosafety risks of unfamiliar research methodologies. • Institutions and researchers work together to identify, analyze, and mitigate risk. • Best practices in biosafety risk identification, analysis, and mitigation are shared to institutions, researchers, and RAC members, which promotes consistency of review. • Institutional review procedures that meet the intent of the Guidelines.	• Across institutions, how uniformly do institutions review and adjudicate concerns? • How well do the reviews of protocols by institutions and the RAC align? • What processes exist to share best practices in review and oversight of genetic engineering research? • Are institutional review committees involving principal investigators in the review, analysis, and identification of risk mitigation strategies? • Have challenges in review and oversight of research involving genetic engineering been identified and addressed? • Have institutions and the RAC established common practices in evaluating research involving emerging biotechnologies and new research stakeholders? • Are scientists of all levels aware of best practices for their research?
Long-term Outcomes	• Biosafety risks of research are anticipated and reduced consistently across institutions and the RAC.	• Has the frequency of accidental or unintended exposures or releases decreased since the guidance was issued? • Have risks of purposeful release of engineered or synthesized organisms (e.g., gene drives in mosquitoes and synthetic organisms for remediation or environmental clean-up) been anticipated and addressed? • What tangible benefits have resulted from implementation of the policy?

Policy	Biological Weapons Anti-Terrorism Act	
Policy Goals	Implement the Biological Weapons Convention Protect the United States against biological terrorism	
Policy Objectives	Punish individuals who develop, possess, produce, stockpile, transfer, acquire, retain, or possess pathogens, toxins, or delivery systems for use as weapons Punish individuals who knowingly assists an organization or foreign government to develop, possess, produce, stockpile, transfer, acquire, retain, or possess pathogens, toxins, or delivery systems for use as weapons	
Policy Type	Criminal statute	
	Activities	**Sample Evaluation Questions**
Required Activities	• The Federal Bureau of Investigation has an established process for prosecuting individuals who develop, possess, or use pathogens as weapons • The FBI seizes pathogens, toxins, or delivery systems not intended for peaceful or prophylactic purposes • Federal law enforcement has a process for destroying or disposing of seized pathogens, toxins, or delivery systems	• Does the FBI have standard operating procedures for assessing whether an event is covered by the statute? • How often have suspects been prosecuted under this law? • How often have suspects been falsely prosecuted under this law? • How many FBI agents know about this statute? • How many local police know about this law? • Does FBI have standard operating procedures for interacting with local partners?
Recommended Activities		
Other Activities		
	Outcomes	**Sample Evaluation Questions**
Near-Term Outcomes	• Uniform operating procedures for assessing events for its relevance to the statute • Established partnerships and open lines of communication with local police, FBI, emergency response personnel • Common definition of 'biological threat' • Seizure and destruction of confiscated pathogens, toxins, and delivery systems not intended for peaceful or prophylactic purposes	• Are operating procedures implemented uniformly by local and federal law enforcement? • Do communication platforms or systems exist to promote information-sharing? • Do platforms or forums exist to promote sharing difficulties in assessing potential events? • Do local and federal law enforcement have the same understanding of biological threat? • Does federal law enforcement have the same threshold for evaluating relevance of and applying the statute? • Do local and federal stakeholders conduct table top exercises?
Long-term Outcomes	• Prevent biological weapons attacks in the United States • Prevent malicious individuals from possessing biological agents	• How many potential incidents have been prevented because of this statute? • What evidence exists to suggest long-term outcome is achieved?

Policy	Public Health Emergency Medical Countermeasure Enterprise	
Policy Goals	Improve the U.S. capability for medical countermeasure research, development, and acquisition	
Policy Objectives	Establish a coordinated system for research, development, and acquisition of medical countermeasures against material threat agents Define the roles and responsibility of federal, industry, and research stakeholders in the system Define the priorities for MCM against material threat agents	
Policy Type	Program strategy based on statutes	
	Activities	**Sample Evaluation Questions**
Required Activities	• Create and communicate clear regulatory pathways for MCM development • Promote dialogue with FDA • Identify scientific and regulatory challenges in MCM development • Develop operational plans for maintaining the MCM inventory • Develop operational plans for communicating guidance to end-users • Develop and provide training and education of MCM stakeholders • Develop and implement strategies for assessing and monitoring MCM safety and performance in an emergency • Set requirements to MCM research, development, acquisition • Support Development of MCM • Maintain and manage MCM stockpile • Facilitate deployment of MCM • Provide guidance and support for distribution, dispensing, and administration of MCM • Support research and development of MCM (NIH, DoD, ASPR) • Support advanced development of MCM (BARDA) • Develop a Regulatory Management Plan for MCM • Describe CBRN agents that present threats to the U.S. (DHS) • Evaluate progress of MCM research, development, procurement, and use	• Have lines of communication for regulatory issues been created? • How many academic stakeholders access these communication pathways each year? • How many industry stakeholders access these communication pathways each year? • How many U.S. government stakeholders access these communication pathways each year? • How many international stakeholders access these communication pathways each year? • How often does FDA speak to MCM developers? • How many unique MCM developers does FDA speak with each year? • What standard operating procedures exist for MCM inventory management? • Do these procedures withstand or adapt to changes in inventory needs? • What standard operating procedures exist for communicating needs with end-users? • How many end-users think they adequate and sufficient information to answer their questions? • What strategies have been developed to assess MCM safety in an emergency? • What strategies have been developed to monitor MCM performance in an emergency? • What educational materials exist for MCM stakeholders? • How many the trainings are required? • How many unique stakeholders take each training each year? • How often is training provided? • How often are training materials updated? • How are stakeholders notified about new or updated training materials?

	• Report available funds for procurement of MCM through the Special Reserve Fund	• How often are MCM priorities and requirements set? • Are interagency partners involved in MCM-priority and requirement setting? • Are requirements communicated to regulatory bodies? • Are requirements communicated to MCM developers? • What percentage of federally-funded MCM research and development is driven by specific product requirements? • What percentage of federally-funded MCM research and development results from exploratory efforts? • What percentage of privately-funded research and development is eligible for MCM advanced development and procurement? • Does the U.S. government provide guidance to local emergency response stakeholders about MCM distribution, dispensing, and administration? • Does the U.S. government provide technical and financial support for MCM distribution, dispensing, and administration in an emergency? • How often are policies for MCM distribution, dispensing, and administration reviewed and updated? • Are local emergency response stakeholders involved in the development of MCM distribution, dispensing, and administration plans? • What is the cost-breakdown of basic research funding for MCM and related research? • What is the cost-breakdown of advanced development funding for MCM? • Does the process for assessing MCM needs improve as new information or risks are identified? • How often do stakeholder agencies communicate and coordinate activities with each other? • How many times have agencies leveraged MCM research and development investments of other agencies? • How often do stakeholder agencies report on MCM research and development achievements?

		• How often do stakeholder agencies report on procurement and use of Special Reserve Fund?
Recommended Activities	• Cooperate with DoD research and development of MCM for force protection • Support research on regulatory science • Implement infectious disease risk assessments that require MCMs (HHS) • Assess economic consequences of terrorism threats (DHS) • Engage intelligence community to conduct terrorism risk assessments (DHS) • Evaluate cross-threat considerations for MCM development and use (ASPR, CDC) • Develop (CDC) and review (FDA) pre-Emergency Use Authorization (EUA) packages for qualified MCM	• To what degree has HHS and DoD cooperated on basic and applied research and development of candidate MCM? • Are there procedures in place to identify advantageous knowledge or technologies for MCM development from published literature? • How often are infectious disease risk assessments conducted? • How adaptive are the risk assessment inputs to new threat and risk information? • Do economic consequences get assessed? • How often is the intelligence community engaged in threat assessment? • How often are cross-threat considerations evaluated? • What procedures exist to address potential cross-threat issues? • How many pre-EUAs have been developed? • What criteria are used to determine the need for a pre-EUA? • How are pre-EUA packages communicated to MCM stakeholders?
Other Activities	• BARDA monitor emerging technologies for their potential application to MCM platform or product development • Research institutions work with private industry to conduct advanced development and manufacture MCM • CDC provide training to stakeholders about the MCM stockpiles • Conduct preparedness assessments to identify MCM needs • Evaluate suitability of current MCM to meet preparedness needs • Develop clinical practice guidelines for MCM use • Assess policy implications of MCM use • Develop procedures for communicating risk and	• How often does BARDA monitor and evaluate emerging technologies? • How often does BARDA monitor scientific literature for beneficial technologies? • How often does BARDA attend conferences to identify beneficial technologies? • What percentage of MCM companies are start-ups, emerging from the MCM market? • What percentage of large pharmaceutical or biotechnology companies are involved in MCM research and development? • What percentage of large companies have partnerships with academic or government scientists who conduct MCM research? • What percentage of start-up companies have partnerships with academic or government scientists who conduct MCM research?

	information to the public in a pandemic • Support construction of MCM development and manufacturing capabilities (BARDA) • Develop an Innovation Modeling Hub to provide analytic decision-support and access real-time modeling capabilities (ASPR)	• How often does CDC train stakeholders about the MCM stockpile? • How often are training materials reviewed and updated? • How do stakeholders learn about new or revised training materials? • How often are preparedness assessments conducted? • How adaptable are preparedness assessments to societal, demographic, and other population-based changes? • How often is the MCM stockpiled evaluated for suitability? • What methods or considerations are used to assess suitability of the MCM stockpiles? • For how many different products have clinical practice guidelines been developed? • How are these guidelines communicated to end-users? • What procedures are in place to communicate information to the public during emergencies? • Have centers of MCM development and manufacturing been designed? • Have centers of MCM development and manufacturing been established and/or constructed? • How many of these centers leverage existing consortia and research hubs? • Has an Innovation Modeling Hub been developed? • To what degree are past investments in modeling, biosurveillance, and decision-support leveraged for the Innovation Modeling Hub? • Which stakeholders access the Hub? • Do the results from modeling efforts inform preparedness assessments?
	Outcomes	**Sample Evaluation Questions**
Near-Term Outcomes	• An integrated process for identifying, developing, producing, and acquiring high-priority MCM • MCM platforms that enable rapid development and acquisition of MCM products • Processes that enable rapid scale-up and manufacturing of MCM in emergencies or outbreak conditions	• Does a single process for defining, identifying, developing, and acquiring high-priority been developed? • Are all stakeholders aware of this process? • To what extent have emerging technologies improved MCM platform and product development? • To what degree are regulators able to evaluate successfully new products, especially those based on new technologies?

	• Improved investments in MCM development and maintenance • Incorporation of new knowledge, technologies, and equipment in the development of MCM products and platforms • Policies on support of civilian use of MCMs in an emergency • International collaborations for developing MCMs	• To what degree are MCM producers willing to incorporate new approaches for MCM development and production? • Has the PHEMCE strategy and implementation plan provided sufficient guidance for MCM investments? • Do policies for supporting civilian use of MCM in an emergency exist? • Are stakeholders knowledgeable about these policies? • How many international collaborations for MCM development are initiated each year? • How many foreign governments have provided a market for developed MCMs? • How many foreign governments have provided a market for developed MCMs? • Has the risk from high priority threat agents decreased?

Long-term Outcomes	• Rapid development and deployment of MCM in an outbreak or emergency
	• Strong communication and coordination among enterprise stakeholders, including domestic and international stakeholders
	• Stockpile needed MCM
	• Seamless, sustained process for reviewing and approving MCM
	• Acquisition of MCM for at-risk individuals
	• Ongoing interagency coordination for development of MCM
	• Ready capability to develop and manufacture MCM
	• Capability to model threats to enable decision-support
		• How well-protected (medically) are U.S. citizens in an emergency?
		  ○ How quickly have MCMs been developed in an emergency?
		  ○ How quickly have MCMs been deployed in an emergency?
		  ○ Do MCM developers understand the process for development, review, and approval of MCM?
		  ○ What high-priority threat agents are at-risk individuals protected against?
		  ○ Do stakeholder agencies leverage each other's investments?
		  ○ Do stakeholder agencies leverage new scientific and technology advances?
		• Are stakeholder agencies able to evaluate information and assess uncertainty of incomplete information to enable decision-making in an emergency?