POLICY CURES RESEARCH.

EMERGING INFECTIOUS DISEASE R&D SCOPE DOCUMENT

This document sets out the research and development (R&D) activities that are **included** within the scope of the Policy Cures Research/G-FINDER survey of global investment in R&D for priority emerging infectious diseases (EIDs), as well as the R&D activities that are **excluded** or **partially excluded**.

The survey scope is based on the World Health Organization's *R&D Blueprint for action to prevent Epidemics* (R&D Blueprint), and includes all of the R&D Blueprint 'priority pathogens' identified in the January 2017 review (grouped by pathogen family for data collection purposes).

Compared to the G-FINDER survey of global investment in neglected disease R&D, the EID survey has very few scope restrictions: R&D for almost all product development categories (drugs, preventive and therapeutic vaccines, and diagnostics) is considered in scope for all priority EID pathogens, as is basic research; R&D for vector control products is included where relevant. Broadly-relevant R&D (e.g. development of platform technologies) is included provided it is specific to (or primarily targeted at) EIDs. Research (and other) funding that is NOT related to the development of new health technologies is EXCLUDED from the survey scope. As with the G-FINDER survey, the EID survey scope will be subject to ongoing review by an expert advisory group.

A list of the emerging infectious diseases, products and technologies included in the survey scope is presented in the emerging infectious disease R&D matrix (see section IX).

Although data on R&D investment in emerging infectious diseases is being collected in conjunction with the G-FINDER survey of R&D investment in neglected diseases, this data will be analysed and reported on separately.

I. BASIC RESEARCH

Studies that increase scientific knowledge and understanding about the disease, disease processes, pathogen or vector, but which is not yet directed towards a specific product.

1. NATURAL HISTORY AND EPIDEMIOLOGY

1.1	Basic mechanisms of disease transmission
1.2	Disease prevalence in relation to human genotype, strain variation, and inoculation rates
1.3	Genetic diversity and phylogeny
1.4	Epidemiological research on the roles of human behaviour and effects of specific host genotypes on disease transmission
1.5	Epidemiological research on host genetic factors influencing the prevalence of disease or the impact of disease in select host genotypes
1.6	Epidemiological research on the distribution of pathogens, vectors and the prevalence of morbidity and mortality due to the disease that is NOT related to specific product development
1.7	Epidemiological research on antigenic variability; population studies of human immunity to the disease
1.8	Epidemiology of drug resistance or evolutionary studies on resistance development for established, existing drugs
1.9	Epidemiological research related to vector behaviour and ecology, and vector control

2. IMMUNOLOGY OF DISEASE

2.1	Defining signalling pathways of immune function (mechanisms of systemic and/or mucosal immunity)
2.2	Interaction and impact of the signalling pathways with the pathogen
2.3	Development of assays or tools potentially useful for drug, vaccine, or diagnostics research and development
2.4	Identification of immune correlates of protection, including *in vivo* and *in vitro* studies on the protective immune response (cellular, humoral, and/or mucosal)
2.5	Investigating the immune response to particular antigens; studies of specific antigens or immunogens proposed as vaccine candidates
2.6	Development of animal models to determine immune correlates of protection
2.7	Genetics of the immune response to the disease and effects of antigen polymorphism or genetic diversity on specific vaccine candidates (as recognised from field studies)

3. BIOLOGY OF DISEASE

3.1	Structure and morphology of different developmental stages
3.2	Host-parasite interactions and biology of pathogen interaction with vector host

3.3	Biology of invasion of host cells (entry mechanisms)
3.4	Localisation of pathogen proteins or antigens
3.5	Development of culture and purification tools to assist in study of the pathogen
3.6	Descriptions of pathogenic species and characterisation of strains or subtypes in animal models (course of infection, susceptibility of different hosts)
3.7	*In vitro* studies of interactions between the pathogen and other infectious agents

4. BIOCHEMISTRY OF THE PATHOGEN

4.1	Metabolism and nutrition
4.2	Protein sequencing, enzymology, and protein and enzyme characterisation (including antigen analysis)
4.3	Signal transduction; translation, processing and export of proteins
4.4	Glycosylation, GPI anchors, transporters, ion channels, mitochondrial metabolism, and electrophysiology studies
4.5	Influence of pathogen on host-cell biochemistry
4.6	Characterisation of antigen/protein diversity of pathogenic strains and subtypes
4.7	Characterisation of proteins and molecular basis for host-cell invasion
4.8	Analysis and characterisation of drug-resistant strains and studies probing drug resistance mechanism/s or pathways
4.9	Non-specific research on pathogen or host targets to identify potential drug, vaccine, or diagnostic targets (i.e. target identification)

5. GENETICS OF THE PATHOGEN

5.1	Studies on chromosomes; genomic maps; genetic crosses
5.2	Cloning and sequencing of genes; cDNAs for functional proteins (including drug targets and vaccine candidates)
5.3	Expression of proteins from cloned genes; RNA analyses
5.4	Control and timing of gene expression; post-transcriptional processing
5.5	Analysis and characterisation of genes involved in drug resistance
5.6	Genetics of antigenic variability
5.7	Techniques for the genetic transformation of the pathogen
5.8	Tests for genotyping the pathogen for laboratory use

6. BIOINFORMATICS AND PROTEOMICS

6.1	Microarray analysis
6.2	Genome annotation - gene predictions
6.3	Comparative genomics, sequence alignment, genome assembly
6.4	Variation, single nucleotide polymorphisms (SNPs)

6.5	Database applications, data mining tools
6.6	Structural and functional genomics
6.7	Structural and functional proteomics
6.8	Proteome analysis, protein structure alignment

7. PATHOPHYSIOLOGY AND DISEASE SYMPTOMS

7.1	Clinical diagnosis and clinical observations of the disease presentation and pathophysiology in humans and in animals
7.2	The role of nutritional status in determining disease severity and treatment effectiveness
7.3	Histopathology of the disease in humans and in animals
7.4	The mechanisms of pathology of the disease; including, the role of the host immune system, and expression of adhesion molecules
7.5	Development of improved animal models to study disease pathophysiology, to evaluate the biological properties of drugs
7.6	Identification of biomarkers for diagnostics or therapeutic monitoring
7.7	Studies of the mechanisms by which particular susceptible/resistant mammalian host genotypes exert their effect
7.8	Research on effects of host co-morbidities and secondary effects of pathogen invasion
7.9	Interactions between the disease and other relevant concurrent infections, including determining timing and establishment of infection

8. VECTOR BIOLOGY, BIOCHEMISTRY, AND GENETICS

8.1	Characterisation of vector behaviour and ecology
8.2	Studies of vector susceptibility to infection; studies of parasites and pathogens of vectors (including potential biological control agents)
8.3	Identification of genes responsible for disruption of parasite/virus growth, genetic transformation of vectors, and insect transposable elements
8.4	Target identification of vector sites that may become the subject of in vitro screening or molecular design
8.5	Development of tests for vector identification, taxonomy and systematics, and for the identification of infected vectors
8.6	Studies evaluating resistance development, including the genetics and transmission of pesticide resistance

II. DRUGS

Research activities and processes necessary to develop and improve new compounds specifically designed to prevent, cure or treat emerging infectious diseases; including drug discovery or design, preclinical and clinical development and other activities essential for successful drug development and uptake.

9. DISCOVERY AND PRECLINICAL

Research activities targeted at discovering and optimising investigational compounds and including the processes needed to allow new chemical entities to proceed to human trials; including:

9.1	Target validation, characterisation, and selection
9.2	High throughput screening, lead optimisation
9.3	Development of analytical tests for assaying drugs, including the development of animal models
9.4	Research on drugs from natural products; identification and characterisation of active ingredient
9.5	Research on the effects of drug treatment on immune status
9.6	Measurement of the activity of potential drugs *in vitro* and in animal models; including safety and efficacy studies necessary to satisfy Investigational New Drug (IND) requirements
9.7	Studies evaluating the activity of new drugs on drug-resistant strains, their effect on genes involved in drug resistance, or their effect on resistance pathways
9.8	Development of tests for drug susceptibility of the pathogen for research purposes
9.9	Drug pharmacokinetic, toxicity and metabolism studies in vitro and in animal models, including bioavailability, adsorption, metabolism, and excretion (ADME) studies
9.10	Chemistry and synthesis of drugs, including process and scale-up manufacture, production of Good Laboratory Practice (GLP) and Good Manufacturing Practice (GMP) batch for toxicology studies; and other Chemistry and Manufacture Control (CMC) activities required to allow new chemical entities to proceed to human trials
9.11	Preparation of Investigational New Drug (IND) application for regulatory submission
9.12	Optimisation and manufacturing of new formulations to support label-extension^ for new patient sub-populations (e.g. infants, pregnant women)

^Label-extensions refer to changes to drugs or their labels after they have been approved. This includes changes in manufacturing, recommended patient population and/or formulation. To change a label, market a new dosage or strength of a drug, or change the way a drug is manufactured, the company must submit a supplemental new drug application (sNDA) to regulatory authorities to obtain marketing approval.

10. CLINICAL DEVELOPMENT

Research activities and processes associated with clinical testing of investigational new drugs so as to demonstrate safety and efficacy in human subjects (as needed for regulatory approval), together with other costs required to support such clinical trials; including:

10.1	Phase I pharmacokinetic, toxicity and metabolism studies in healthy human subjects
10.2	Phase II testing of drugs and drug combinations in human patients to establish safety and efficacy including dose-finding, and proof of principle studies
10.3	Phase III clinical trials for registration purposes
10.4	Regulatory standard clinical trials that support a formal registration for **label-extension**^ of an existing drug to a new disease or patient group (e.g. paediatric patients, pregnant women or HIV-positive patients)

10.5	Regulatory standard clinical trials that support formal registration for **label-extension**^ of an existing drug to a new use, such as intermittent preventative therapy and pre-exposure prophylaxis
10.6	Infrastructure and site development costs **directly** associated with the conduct of clinical trials for drug development (e.g. refurbishment of hospital wing, vehicle purchase, generators, training and community relationship building)
10.7	Further pharmaceutical development to generate the final clinical formulation, dosage form and other Chemistry and Manufacture Control (CMC) activities required for regulatory submission
10.8	Compiling of all non-clinical and clinical data for submission of a New Drug Application (NDA) to regulatory authorities
10.9	Behavioural research **during clinical trials** relating to risk assessment, factors affecting adherence to protocol, and product acceptability
10.10	Protocol development, investigator meetings, Good Clinical Practice (GCP) monitoring, quality control, data management, analysis and reporting, establishing a Data Safety Monitoring Board (DSMB), and trial audits

^Label-extensions refer to changes to drugs or their labels after they have been approved. This includes changes in manufacturing, recommended patient population and/or formulation. To change a label, market a new dosage or strength of a drug, or change the way a drug is manufactured, the company must submit a supplemental new drug application (sNDA) to regulatory authorities to obtain marketing approval.

11. PHASE IV/ PHARMACOVIGILANCE

Studies relating to the detection, monitoring, evaluation, and prevention of adverse events associated with newly approved drugs so as to bridge the gap between highly controlled clinical trials intended for regulatory approval and the largely uncontrolled use of new drugs by patients. Also includes studies conducted after regulatory approval that assess drug effectiveness in the wider population or which are necessary to support product use in developing countries.

11.1	Pharmacovigilance and post-registration studies of newly registered drugs to assess adverse reactions, toxicology and safety
11.2	Effectiveness studies and head-to-head comparator studies of newly registered drugs (with other therapies or interventions)
11.3	Cost-effectiveness studies of newly registered drugs
11.4	Treatment interactions and population level studies (of newly registered products e.g., pharmaco-epidemiological and resistance studies)
11.5	Behavioural research **post-registration** of new drugs relating to risk assessment, factors affecting adherence to protocol, provider compliance, and product acceptability
11.6	Case history reports and assessment of long-term prophylaxis using newly registered drugs

12. BASELINE EPIDEMIOLOGY

Studies evaluating potential trial site populations to confirm disease incidence, prevalence or exposure risk, and which serve as the foundation for determining the optimal collection, analysis, interpretation and presentation of clinical trial data, including:

12.1	Epidemiological studies **directly** linked to the conduct or support of clinical trials of products in development, in order to assess or validate the epidemiology of disease, disease incidence, or health of target populations at trial sites
12.2	Preliminary studies of morbidity and mortality at potential clinical trial sites, where these studies are directly linked to planned product trials
12.3	Pre-trial activities designed to understand trial site conditions before the commencement of trials and to facilitate engagement

III. PREVENTIVE VACCINES

Research activities and processes necessary to develop and improve investigational vaccines specifically intended to prevent infection; including vaccine design, preclinical and clinical development and other activities essential for successful vaccine development and uptake.

13. DISCOVERY AND PRECLINICAL

Research activities targeted at discovering and optimising investigational vaccines and including the processes necessary to allow a candidate vaccine to proceed to human trials; including:

13.1	Studies supporting novel vaccine design, including target validation and candidate optimisation
13.2	Development of animal models to assist in vaccine design and testing
13.3	Evaluation of vaccine technologies (e.g. adjuvants, delivery systems) to improve the immunogenicity of an identified candidate
13.4	Pre-clinical safety and immunogenicity studies with candidate vaccines, including use or development of functional assays
13.5	Pre-clinical animal studies, challenge models and addressing the correlation between *in vitro* models, animal models and field results
13.6	Studies on the genetics of the immune response to selected antigens as vaccine candidates, optimisation of animal models and correlates to clinical results
13.7	Manufacturing scale-up and consistency of manufacture, including production of Good Laboratory Practice (GLP) and Good Manufacturing Practice (GMP) batches for regulatory toxicology studies and other Chemistry and Manufacture Control (CMC) activities required to allow a candidate vaccine to proceed to human trials
13.8	Research on safety and regulatory considerations (e.g. validation of preclinical assays to permit registration)
13.9	Preparation of an Investigational New Drug (IND) application for regulatory submission
13.10	Optimisation of vaccine candidates for global use (cheaper, more stable, ease of administration)

14. CLINICAL DEVELOPMENT

Activities and processes associated with clinical testing of investigational vaccines so as to demonstrate safety, immunogenicity and efficacy in human subjects (as needed for regulatory approval), together with other costs required to support such clinical trials, including:

14.1	Phase Ia studies assessing safety, dosing, and immunogenicity in human volunteers; Phase Ib studies assessing safety, dosing, and immunogenicity in clinically exposed or high-risk populations
14.2	Phase IIa challenge studies; Phase II safety and preliminary efficacy studies in exposed populations or those at high-risk of infection
14.3	Phase III expanded efficacy, effectiveness and safety studies required for registration purposes, including implementation, retention and follow-up of volunteers
14.4	Infrastructure and site development costs associated with the conduct of clinical trials for vaccine development (e.g. refurbishment of hospital wing, vehicle purchase, generators, training and community relationship building)
14.5	Further biological/product development to generate the optimal clinical formulation and dosage form, and other Chemistry and Manufacture Control (CMC) activities required for regulatory submission
14.6	Compiling all non-clinical and clinical data to obtain a Biologics License from regulatory authorities
14.7	Behavioural research **during clinical trials** relating to risk assessment, factors affecting adherence to protocol, and product acceptability
14.8	Protocol development, investigator meetings, Good Clinical Practice (GCP) monitoring, quality control, data management, analysis and reporting, establishing a Data Safety Monitoring Board (DSMB) and trial audits

15. PHASE IV/PHARMACOVIGILANCE

Studies relating to the detection, monitoring, evaluation, and prevention of adverse events associated with newly approved vaccines so as to bridge the gap between highly controlled clinical trials intended for regulatory approval and the largely uncontrolled delivery of new vaccines. Also includes studies conducted after regulatory approval that assess vaccine effectiveness in the wider population.

15.1	Pharmacovigilance and post-registration studies of newly registered preventive vaccines to assess adverse reactions, toxicology and safety
15.2	Effectiveness studies and head-to-head comparator studies of newly registered preventive vaccines (with other therapies or interventions)
15.3	Cost-effectiveness studies of newly registered preventive vaccines
15.4	Treatment interactions and population level studies (of newly registered preventive vaccines e.g., pharmaco-epidemiological and resistance studies)
15.5	Behavioural research **post-registration** of new preventive vaccines relating to risk assessment, factors affecting adherence to protocol, provider compliance, and product acceptability
15.6	Case history reports and assessment of long-term prophylaxis using newly registered preventive vaccines

16. BASELINE EPIDEMIOLOGY

Studies evaluating potential trial site populations to confirm disease incidence, prevalence or exposure risk, and which serve as the foundation for determining the optimal collection, analysis, interpretation and presentation of clinical trial data, including:

16.1	Epidemiological studies **directly** linked to the conduct or support of clinical trials of preventive vaccines in development, in order to assess or validate the epidemiology of disease, disease incidence, or health of target populations at trial sites
16.2	Preliminary studies of morbidity and mortality at potential clinical trial sites, where these studies are directly linked to planned preventive vaccines trials
16.3	Pre-trial activities designed to understand trial site conditions before the commencement of trials and to facilitate engagement

IV. THERAPEUTIC VACCINES

Research activities and processes necessary to develop and improve investigational vaccines specifically intended to treat infection; including vaccine design, preclinical and clinical development, and other activities essential for successful vaccine development and uptake.

17. DISCOVERY AND PRECLINICAL

Research activities targeted at discovering and optimising investigational therapeutic vaccines and including the processes necessary to allow a candidate vaccine to proceed to human trials; including:

17.1	Studies supporting novel vaccine design including target validation and candidate optimisation
17.2	Evaluation of vaccine technologies (e.g. adjuvants, delivery systems) to improve the immunogenicity of an identified candidate
17.3	Pre-clinical safety and immunogenicity studies with candidate vaccines, including use or development of functional assays
17.4	Pre-clinical animal studies, challenge models, and studies addressing the correlation between in vitro models, animal models and field results
17.5	Studies on the genetics of the immune response to selected antigens as vaccine candidates, optimisation of animal models and correlates to clinical results
17.6	Manufacturing scale-up and consistency of manufacture, including production of Good Laboratory Practice ( ) and Good Manufacturing Practice (GMP) batches for regulatory toxicology studies and other Chemistry and Manufacture Control (CMC) activities required to allow a candidate vaccine to proceed to human trials
17.7	Research on safety and regulatory considerations (e.g. validation of preclinical assays to permit registration)
17.8	Preparation of an Investigational New Drug (IND) application for regulatory submission
17.9	Optimisation of vaccine candidates for global use (cheaper, more stable, ease of administration)

18. CLINICAL DEVELOPMENT

Activities and processes associated with clinical testing of investigational therapeutic vaccines so as to demonstrate safety, immunogenicity, and efficacy in human subjects (as needed for regulatory approval), together with other costs required to support such clinical trials; including:

18.1	Phase Ia studies assessing safety, dosing and immunogenicity in human volunteers; Phase Ib studies assessing safety, dosing and immunogenicity in clinically exposed or high-risk populations
18.2	Phase IIa challenge studies; Phase II safety and preliminary efficacy studies in exposed populations or those at high-risk of infection
18.3	Phase III expanded efficacy, effectiveness and safety studies required for registration purposes, including implementation, retention and follow-up of volunteers
18.4	Infrastructure and site development costs associated with the conduct of clinical trials for vaccine development in endemic countries (e.g. refurbishment of hospital wing, vehicle purchase, generators)
18.5	Further biological/product development to generate the optimal clinical formulation, dosage form and other Chemistry and Manufacture Control (CMC) activities required for regulatory submission
18.6	Behavioural research **during clinical trials** relating to risk assessment, factors affecting adherence to protocol and product acceptability
18.7	Compiling of all non-clinical and clinical data to obtain a Biologics License from regulatory authorities
18.8	Protocol development, investigator meetings, Good Clinical Practice (GCP) monitoring, quality control, data management, analysis and reporting, establishing a Data Safety Monitoring Board (DSMB) and trial audits

19. PHASE IV / PHARMACOVIGILANCE

Studies relating to the detection, monitoring, evaluation, and prevention of adverse events associated with newly approved therapeutic vaccines so as to bridge the gap between highly controlled clinical trials intended for regulatory approval and the largely uncontrolled delivery of new therapeutic vaccines. Also includes studies conducted after regulatory approval that assess therapeutic vaccine effectiveness in the wider population

19.1	Pharmacovigilance and post-registration studies of newly registered therapeutic vaccines to assess adverse reactions, toxicology and safety
19.2	Effectiveness studies and head-to-head comparator studies of newly registered therapeutic vaccines (with other therapies or interventions)
19.3	Cost-effectiveness studies of newly registered therapeutic vaccines
19.4	Treatment interactions and population level studies (of newly registered therapeutic vaccines e.g., pharmaco-epidemiological and resistance studies)
19.5	Behavioural research **post-registration** of new therapeutic vaccines relating to risk assessment, factors affecting adherence to protocol, provider compliance, and product acceptability
19.6	Case history reports and assessment of long-term prophylaxis using newly registered therapeutic vaccines in communities in endemic areas

20. BASELINE EPIDEMIOLOGY

Studies evaluating potential trial site populations to confirm disease incidence, prevalence, or exposure risk, and which serve as the foundation for determining the optimal collection, analysis, interpretation, and presentation of clinical trial data; including:

20.1	Epidemiological studies directly linked to the conduct or support of clinical trials to assess or validate the epidemiology of disease, disease incidence or health of target populations at potential trial sites
20.2	Preliminary studies of morbidity and mortality at potential clinical trial sites necessary for product development
20.3	Pre-trial activities designed to understand trial site conditions before the commencement of trials and to facilitate engagement

V. DIAGNOSTICS

Research activities and processes necessary to develop, optimise, and validate diagnostic tests (cheaper, faster, more reliable, ease of use in the field); including discovery and design, preclinical and clinical evaluation, and other activities essential for successful deployment for public health use.

21. DISCOVERY AND PRECLINICAL

*Research activities targeted at discovering and optimising **low-cost**, stable, easy-to-use diagnostics for emerging infectious diseases and including the processes necessary to allow a potential product to proceed to clinical evaluation including:*

21.1	Validation, characterisation, and selection of targets suitable for diagnostic use
212	Validation of new diagnostic markers or biomarkers
21.3	Development and testing of **low-cost**, stable, easy-to-use diagnostic tests (e.g. simpler microscopy, improved sample collection/preparation, cheaper ELISA assays), including manufacturing design
21.4	New or improved diagnostics for disease staging and therapy decisions
21.5	New or improved diagnostic tools to identify resistant pathogens
21.6	New or improved diagnostics to identify specific target populations
21.7	Tailoring diagnostic tools for global use, including improved point-of-care tests (rapid test), local laboratory tests, reference laboratory tests and central laboratory tests
21.8	Creation of reference material banks

22. CLINICAL EVALUATION

Activities and processes associated with clinical evaluation of investigational diagnostic tools so as to demonstrate sensitivity and specificity in human subjects, together with other costs required to support such clinical trials; including:

22.1	Clinical efficacy trials
22.2	Small-scale testing in humans to establish sensitivity and specificity and utility
22.3	Technical evaluation of tests and studies evaluating product performance

22.4	Establishment of product specifications, kit development and quality assurance
22.5	Submission of relevant data to regulatory authorities for approval
22.6	Assessment and validation of trial sites to carry out product trials
22.7	Infrastructure and site development costs **directly** associated with the conduct of clinical trials for diagnostic development (e.g. refurbishment of hospital wing, vehicle purchase, generators, training and community relationship building)

23. OPERATIONAL RESEARCH FOR DIAGNOSTICS

Operational procedures and implementation activities associated with novel diagnostic tools, which are necessary to support World Health Organization (WHO) recommendation for global public health use including:

23.1	Larger-scale demonstration studies (assessing specificity, sensitivity and utility of the diagnostic test in endemic countries)
23.2	Cost-effectiveness studies assessing the diagnostic test
23.3	Identification of pitfalls of the technology and studies of safety measures needed to support the technology
23.4	Studies to determine at what level of the health care system the technology is applicable (e.g. reference labs, regional labs)
23.5	Identification of training needs
23.6	Collecting evidence for expanding the use of a diagnostic tool in different countries
23.7	Development of equipment and customer support documents
23.8	Head-to-head comparator studies (with current gold standard) and in the context of existing diagnostic algorithms
23.9	Behavioural research relating to risk assessment, factors affecting diagnostics use, and user acceptability (patient and provider)
23.10	Epidemiological studies to assess or validate the epidemiology of disease, disease incidence or health of target populations at potential trial sites, and which are directly linked to clinical trials of a new diagnostic

VI. VECTOR CONTROL PRODUCTS

Research and development activities and processes necessary to develop and improve vector control approaches intended to prevent infection and block transmission of emerging infectious disease from vector and/or animal reservoirs to human; including novel pesticides, biological control products and vaccines targeting animal reservoirs.

24. PESTICIDES

This product category ONLY includes chemical pesticides intended for global public health use and which specifically aim to inhibit or kill vectors associated with transmitting relevant priority emerging infectious diseases, as outlined in the EID R&D matrix.

***Note:** Baits, traps, predation measures, biological larvicides, habitat control and infrastructure measures are **excluded** from the pesticides product category.*

24.1 Primary and secondary screening and optimisation

Laboratory-based design, synthesis and testing of potential insecticides, chemical larvicides, etc., and generation of data sufficient to allow developers to proceed field testing, including:

24.1.1	Primary and secondary screens (e.g. *in vitro & in vivo* screens, chemical screens, whole insect screens)
24.1.2	Target validation and characterisation
24.1.3	Lead optimisation, synthesis optimisation
24.1.4	Early toxicology screens (e.g. acute oral toxicity, eye and skin irritation studies, AMES/mutagenicity studies)
24.1.5	Applied laboratory research and small-scale field trials, including *in vitro* and glass house efficacy testing
24.1.6	Acute toxicology and ecotoxicology studies (e.g. animal studies, exposure studies, fish and wildlife studies)
24.1.7	Metabolism and stability studies in plants and animals including mode of action, residue analysis and cross-resistance studies
24.1.8	Environmental effect and decomposition studies in soil, water and air

24.2 Development

Pre-registration activities and processes associated with clinical testing of investigational chemical pesticides so as to generate data sufficient to allow developers to proceed to product roll-out & dissemination and including other costs required to support such clinical trials.

24.2.1	Small-scale efficacy studies, residue plots and field studies necessary for product optimisation and registration
24.2.2	Acute and long-term toxicology and ecotoxicology studies
24.2.3	Metabolic and residual fate studies, crop residue and exposure data
24.2.4	Environmental assessment and environmental chemistry data
24.2.5	Generation of hazard data in humans, domestic animals and non-target plants and animals
24.2.6	Compiling of all laboratory and field data necessary for submission to regulatory authorities
24.2.7	Behavioural research conducted **pre-registration** relating to risk assessment, factors affecting adherence to protocol, and product acceptability
24.2.8	Manufacturing process development, formulation and scale-up

24.3 WHOPES Evaluation

Post-registration activities that comprise entomological, safety and epidemiological evaluation (where appropriate) and development of specifications required for application of pesticide products for use in international public health programmes, including:

24.3.1	WHOPES Phase I Laboratory studies (e.g. determining intrinsic insecticidal activity, diagnostic concentration, irritant or excito-repellent properties, cross-resistance to other insecticides, efficacy and residual activity on relevant substrates)
24.3.2	WHOPES Phase II small-scale field trials (e.g. efficacy and persistence under different ecological settings, dosage of application, handling and application, perceived side-effects)
24.3.3	WHOPES Phase III large-scale field trials (e.g. efficacy and residual activity, operational and community acceptance)
24.3.4	Assessment and validation of trial sites directly linked to product trials
24.3.5	Infrastructure and site development costs associated with the conduct of clinical trials for pesticide development (e.g. refurbishment of hospital wing, vehicle purchase, generators, training and community relationship building)
24.3.6	Behavioural research conducted *post-registration* relating to risk assessment, factors affecting adherence to protocol, provider compliance and product acceptability
24.3.7	Studies that confirm efficacy, improve product uptake or confirm safety (e.g. studies to measure impact, usage levels, contamination potential or storage and disposal needs)
24.3.8	Surveillance studies directly linked to the conduct of field trials for vector control products; including studies that determine prevalence, track distribution, abundance, or significant habits of target vectors or the vector-borne pathogen

25. BIOLOGICAL CONTROL PRODUCTS

This product category ONLY includes research and development of innovative biological control interventions that specifically aim to kill or control vectors associated with transmitting priority emerging infectious diseases (e.g. microbial/bacteriological larvicides, sterilisation techniques, and genetic modification measures).

Biological control interventions comprise the use of natural enemies or "engineered" products to manage vector populations either through the introduction of natural parasites, pathogens or predators of the target, or via the introduction of modified vector species to compete with natural sources.

***Note:** Baits, traps, predation measures, habitat control, chemical pesticides, and infrastructure measures are excluded from the biological control products category.*

26. VACCINES TARGETING ANIMAL RESERVOIRS

This product category ONLY includes research and development of veterinary vaccines specifically designed to prevent animal to human transmission of relevant priority emerging infectious diseases.

Note: *Vaccines developed and used solely for veterinary purposes are excluded from this product category.*

VII. MULTIPLE EMERGING INFECTIOUS DISEASES

This category includes all research and development funding that cannot be allocated to a single emerging infectious disease pathogen family (e.g. platform technologies, multiplexed diagnostic assays, core funding).

27. MULTIPLE EMERGING INFECTIOUS DISEASES

Note: *Funding for R&D activities targeting multiple pathogens WITHIN THE SAME PATHOGEN FAMILY should be included under that pathogen family (e.g. development of a preventive filoviral vaccine targeting both Ebola and Marburg should be included under 'Multiple / Other filoviral diseases' > 'Vaccines (Preventive)'.*

Examples of R&D funding that may be included under the 'multiple emerging infectious diseases' category include:

27.1	**Core funding of a multi-emerging infectious disease R&D organisation** Disbursements of core or non-earmarked funding to an organisation that researches and develops products for multiple priority emerging infectious disease pathogen families, where it is unclear how the funding has been allocated within that organisation
27.2	**Adjuvants and immunomodulators for emerging infectious diseases** Research and developme7.1t of compounds or structures that aim to improve, modulate or potentiate the immune response (e.g. CpG oligonucleotides, lipopolysaccharide derivatives, Toll-like receptor agonists, chemokines and cytokines) to priority emerging infectious disease pathogens, where this research is not associated with an individual pathogen family or product
27.3	**Platform technologies for emerging infectious diseases** Research and development of vaccine 'plug and play' platforms, monoclonal antibody platforms, diagnostic platforms, or delivery technologies and devices (e.g. mucosal delivery tools, vaccine carrier systems, and alternative delivery technologies that facilitate the successful delivery of pharmaceutical or biological products) being developed specifically for priority emerging infectious disease pathogens, where this research is not associated with an individual pathogen family or product
27.4	**Multiplexed emerging infectious disease diagnostic assays** Research and development of multiplexed diagnostic assays allowing detection and identification of multiple emerging infectious disease pathogens from different pathogen families
27.5	**Unspecified emerging infectious disease R&D**

	Funding for any other research and development efforts targeting two or more priority emerging infectious disease pathogen families that does not fall under the categories above

VIII. OUT OF SCOPE (EXCLUDED FROM THE SURVEY)

28. GENERAL EXCLUSIONS

This survey of R&D funding for emerging infectious diseases is designed to capture investments that support pharmaceutical R&D of new products aimed at the prevention, diagnosis, treatment or cure of priority emerging infectious diseases for all patients globally.

28.1 Non-pharmaceutical tools

28.1.1	Traps, water sanitation tools

28.2 General supportive, nutritional and symptomatic therapies

28.2.1	Oral rehydration therapy
28.2.2	Micronutrient supplementation, vitamins
28.2.3	Anti-pyretics, painkillers

28.3 Products developed and used for veterinary purposes

28.4 In-kind contributions

28.4.1	In-kind R&D contributions are excluded from the survey due to the difficulty in quantifying their value, but will be acknowledged in any analysis of the survey data. Typical in-kind contributions would include training of scientists, sharing of expertise or access to compounds

28.5 Selected categories of private sector investment

28.5.1	Industry overhead costs, capital costs and opportunity costs are excluded, due to the difficulty of quantifying these and allocating them to the emerging infectious disease investment

29. NON-PRODUCT R&D

The focus of the survey is on R&D investments related to DEVELOPING NEW HEALTH TECHNOLOGIES for emerging infectious diseases. The following R&D activities are therefore EXCLUDED from the survey:

29.1 Clinical studies that are not linked to development of a NEW product

29.1.1	Protocol studies and clinical trials using established, available products (not linked to formal label-extension trials of new products).

29.1.2	Epidemiological surveillance and monitoring studies that are not directly linked to product development. For example, routine DSS (Demographic Surveillance System) activities.

29.2 Health services and access research

29.2.1	Any clinical study not linked to development of a product - disease management, studies of community attitudes, knowledge and practice in relation to emerging infectious disease treatment and control programs.
29.2.2	Health care service studies in relation to delivery of emerging infectious disease treatment and control measures.
29.2.3	Design of treatment and control programs appropriate to local prevailing conditions
29.2.4	Implementation and evaluation of large-scale emerging infectious disease treatment and control programs operated through health care services, government ministries, nongovernmental organizations (NGOs) etc.
29.2.5	Roll-out of proven vector control products (e.g. traps and nets, DDT).
29.2.6	Advocacy, community education and policy activities related to use, access, or roll-out of new products.

29.3 Operational Programme Assessment

29.3.1	Reviews on the status of emerging infectious disease product development
29.3.2	Studies on the economic impact of emerging infectious disease morbidity and mortality on communities
29.3.3	Studies on the economics of emerging infectious disease prevention and control measures
29.3.4	Mathematical modelling of the disease (e.g. transmission, immune response)
29.3.5	Fostering collaboration between academia, industry, government agencies, and NGOs.

29.4 General Capacity *Building (Human & Infrastructure)*

*Capacity building activities are excluded where they are not **DIRECTLY** linked to development of a new emerging infectious disease product. The following activities are therefore **EXCLUDED**:*

29.4.1	Building academic research capacity; improving existing academic capacity (except where directly linked to development of a specific product).
29.4.2	Providing training opportunities; strengthening R&D institutional capacity; developing and maintaining personnel (except where directly linked to development of a specific product).
29.4.3	Major infrastructure development (e.g. design, construction and validation of large-scale manufacturing facilities).

30. SELECTED DISEASE AND PRODUCT RESTRICTIONS

The survey scope is based on the World Health Organization's R&D Blueprint for Action to Prevent epidemics (R&D Blueprint), and includes all of the R&D Blueprint 'priority pathogens' identified in the

January 2017 review. R&D for emerging infectious diseases not on the 2017 R&D Blueprint priority pathogen list are EXCLUDED from the survey.

Research and development of vector control products is subject to a number of scope restrictions and exclusions, and is included only where relevant to the emerging infectious disease pathogen.

30.1 Vector Control Products

EXCLUDED R&D for vector control products:

30.1.1	Baits, traps, predation measures, biological larvicides, habitat control and infrastructure measures

30.1.1 Pesticides

RESTRICTED R&D for pesticides**:**

30.1.1.1	**Pesticides** This product category **ONLY** includes chemical pesticides intended for global public health use and which specifically aim to inhibit and kill vectors associated with transmitting emerging infectious diseases

EXCLUDED R&D for pesticide products:

30.1.1.2	Baits, traps, predation measures, biological larvicides, habitat control, chemical pesticides and infrastructure measures

R&D for pesticides is also **EXCLUDED** for the following diseases:

30.1.1.3	Ebola, Marburg and multiple/other filoviral diseases
30.1.1.4	Lassa Fever and multiple/other arenaviral haemorrhagic fevers
30.1.1.5	Middle East Respiratory Syndrome coronavirus (MERS-CoV), Severe Acute Respiratory Syndrome (SARS) and multiple/other highly pathogenic coronaviral diseases
30.1.1.6	Nipah and multiple/other henipaviral diseases

30.1.2 Biological Control Products

RESTRICTED R&D for biological control products:

30.1.2.1	**Biological Control Products** This product category **ONLY** includes research and development of innovative biological control interventions that specifically aim to kill or control vectors associated with transmitting emerging infectious diseases (e.g. microbial/bacteriological larvicides, sterilisation techniques, and genetic modification measures)

EXCLUDED R&D for biological control products:

30. 1.2.2	Baits, traps, predation measures, biological larvicides, habitat control, chemical pesticides and infrastructure measures

R&D for biological control products is also **EXCLUDED** for the following diseases:

30.1.2.3	Ebola, Marburg and multiple/other filoviral diseases
30.1.2.4	Lassa Fever and multiple/other arenaviral haemorrhagic fevers
30.1.2.5	Severe Acute Respiratory Syndrome (SARS), Middle East Respiratory Syndrome coronavirus (MERS-CoV) and multiple/other highly pathogenic coronaviral diseases
30.1.2.6	Nipah and multiple/other henipaviral diseases

30.1.3 Vaccines targeting animal reservoirs

All vaccines developed and used solely for veterinary purposes are excluded from the survey.

RESTRICTED Vaccines targeting animal reservoirs

30.1.3.1	**Vaccines targeting animal reservoirs** This product category ONLY includes research and development of veterinary vaccines specifically designed to prevent animal to human transmission of emerging infectious diseases.

R&D for vaccines targeting animal reservoirs is also **EXCLUDED** *for the following diseases:*

30.1.3.2	Lassa Fever and multiple/other arenaviral haemorrhagic fevers
30.1.3.3	Zika
30.1.3.4	Multiple highly pathogenic coronaviral diseases (Other than Middle East Respiratory Syndrome coronavirus [MERS-CoV] or Severe Acute Respiratory Syndrome [SARS])

IX. EMERGING INFECTIOUS DISEASE R&D MATRIX*

		Basic research	Drugs	Vaccines (Preventive)	Vaccines (Therapeutic)	Diagnostics	Vector control products
Filoviral diseases	Ebola	✓	✓	✓	✓	✓	✓
	Marburg	✓	✓	✓	✓	✓	✓
	Multiple / Other filoviral diseases	✓	✓	✓	✓	✓	✓
Bunyaviral diseases	Crimean Congo Haemorrhagic Fever (CCHF)	✓	✓	✓	✓	✓	✓
	Rift Valley Fever (RVF)	✓	✓	✓	✓	✓	✓
	Multiple / Other bunyaviral diseases (including Severe Fever with Thrombocytopenia Syndrome (SFTS))	✓	✓	✓	✓	✓	✓
Arenaviral haemorrhagic fevers	Lassa Fever	✓	✓	✓	✓	✓	
	Multiple / Other arenaviral haemorrhagic fevers	✓	✓	✓	✓	✓	
Coronaviral diseases	Middle East Respiratory Syndrome coronavirus (MERS-CoV)	✓	✓	✓	✓	✓	✓
	Severe Acute Respiratory Syndrome (SARS)	✓	✓	✓	✓	✓	✓
	Multiple / Other highly pathogenic coronaviral diseases	✓	✓	✓	✓	✓	
Henipaviral diseases	Nipah	✓	✓	✓	✓	✓	✓
	Multiple / Other henipaviral diseases	✓	✓	✓	✓	✓	✓
Zika		✓	✓	✓	✓	✓	✓
Multiple Emerging Infectious Diseases (EIDs)		R&D targeting multiple EID virus families (e.g. platform technologies for EIDs, multiplexed EID diagnostic assays, core funding)					

✓denotes a category where a disease or product is included in the survey

*The survey scope for emerging infectious diseases has not been defined using the same three-step filter used to determine the G-FINDER neglected disease survey scope. All relevant R&D activities for priority pathogens identified in the WHO R&D Blueprint January 2017 review are considered in scope. The pathogens have been grouped by disease family for data collection purposes.