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Preface

Developing national capacity for health research is critical. There are many areas of health research namely biomedical, clinical, public health or health system. Health research needs to be rooted in and responsive to national needs. Health Research Priorities document assist researchers and policymakers in effectively targeting research that has the greatest potential clinical and public health benefit. Therefore, Health Research Priorities setting exercises were organised and coordinated by National Institutes of Health (NIH), Ministry of Health, Malaysia for 12th Malaysian Plan. We proposed a few methods for Health Research Priorities setting that allow informed choices on different approaches and outlines eight areas of health research. We hope that this will serve as a guideline and generic assistance for planning health research budget and processes. The methods explain what need to be identified and clarified in order to establish the context for which priorities are set; the methods offer discussions on stakeholder participation and information gathering, and emphasise the importance of well-planned research identification, implementation, evaluation, and transparency for health research uptake.

We also need to ensure that health research is responsive to national needs, gets synthesised, summarised and packaged in ways that policymakers and civil society representatives can use, and that policymakers have sufficient capacity to access and apply the research findings.

We hope that this document can be utilised at multiple levels either at national and sub-national and by multiple stakeholders such as national health leaders, researchers, funding agencies and development agencies, as well as civil society stakeholders to achieve the goal of enhanced utilisation for health research. While health research implementation and evaluation require consideration and coordinated action to enhance uptake, we also hope that this document helps in a broader context of health research coordination to inform funding and policy-making in a sustainable manner. Moreover, this document can serve as a guidance to inform national-level research priorities. Also, the generic framework offered by this document provides a useful template for future collection of more detailed information on good practices in health research prioritisation.

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Foreword

In the past, the health research agenda had been primarily researcher-driven with minimal input from the stakeholders, particularly from the policymakers and patients. These perpetual conflicts of interests within the research community cause a detrimental effect in particular to the direction of health research funding. These issues effectually lead to the failure to address the real needs of the stakeholders, considerably of the patients. In dealing with these challenges, the health research priority-setting processes may assist researchers and policymakers in efficiently targeting researches that have the maximum potential to benefit public health. A diverse range of methods is available for deployment to prioritize research customised to the various healthcare contexts, populations, environments, and resources available in which the priority setting initiated.

There are many approaches to health research priorities, but there is no general agreement on what might constitute the best practice. Regardless of the lack of international consensus for the best method for research priority setting, the process must be fair, equitable, and legitimate. It demands credible evidence to identify, address and integrate into a myriad of perspectives and values held by relevant stakeholders. Prioritisation allows the researchers and policymakers to channel resources as well as donor investments in health to the areas of the highest priority. It covers health equity and emphasises the importance of connecting research, action, and policy. Prioritisation also enables the government to be responsive to the needs of the population's most vulnerable groups, for example, women, children, the elderly, and the poor.

The Ministry of Health is committed to high-quality research priority-setting activities to target research with the greatest public health values, hence the need for agreement on what constitutes quality or good practise in this field. Therefore, we sought the experts in the 12MP-HRP core team for Health Research Priority Setting for 12th Malaysia Plan (12MP-HRP) that consists of officers from various research backgrounds under the NIH, Ministry of Health to extensively review all available literature to determine the gaps and challenges. With the assistance of Technical Working Groups, the 12MP-HRP core team has successfully produced this comprehensive 12MP-HRP document and the Ministry of Health wishes to congratulate the team for the astounding effort.

Notwithstanding the global pandemic due to the outbreak of COVID-19, it is important to identify the research areas that we must prioritise. I hope that this document will provide the direction to strengthen health research in Malaysia. Under the 12th Malaysia Plan (12MP), it is also hoped that health research will improve the population health, enhance the quality of healthcare services, and improving access to healthcare.

Therefore, we sought the experts from the 12MP-HRP core team to identify the Health Research Priorities under 12th Malaysia Plan which consists of officers from various research backgrounds in the NIH, Ministry of Health to extensively review all available literatures to determine the gaps and challenges. With the assistance of Technical Working Groups, the 12MP-HRP core team has successfully produced this comprehensive 12MP-HRP document and the Ministry of Health wishes to congratulate the team for the astounding effort.

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Director General of Health
Ministry of Health, Malaysia

Foreword

Setting priorities for health research is essential to make the best use of investments, which is especially relevant in resource-poor environments. Therefore, it is important for research priority setting to be conducted at all levels of health systems, jurisdictions, and health areas. Research priority setting can be a tool to improve the management of an organisation and support better decision making. As there is no single pathway or approach to setting research priorities, the current method is designed for use in many different settings and contexts to serve a different range of activities that involve identifying, prioritizing, and achieving consensus on the research areas or questions of importance to stakeholders, programme managers and clinicians. Furthermore, prioritisation is required to meet the current demand for enhanced harmonisation of health research, especially when combined with financial flow analyses for health research and the burden of disease studies. Prioritisation helps ensure the most effective use of resources (such as research capacity, time and funds) for optimal health impact.

The 12MP-HRP focused on eight national problems: 1) Health System; 2) Communicable Diseases; 3) Non-Communicable Diseases; 4) Older People; 5) Mental Health; 6) Environmental and Disaster Risks; 7) Nutrition, Food Safety and Quality; 8) Oral Health. All of these national problems were identified based on a four-step identification process, adapted from a few well-established methodologies. These national problems will be the main health research focus in the 12MP (2021-2025). We highlighted on cross-cutting research where the research can be conducted at nearly any stage of a national problem.

The 12MP-HRP core team from the National Institutes of Health (NIH) has worked hard to review and identify all the available literature and assessed the evidences using published methods to provide a comprehensive range of national problems and research areas. Additionally, we also have the Technical Working Group (TWG) to assist the 12MP-HRP core team in determining the prioritisation of research areas through serial discussions and meetings. I hope this document will serve as a reference for research development and to maximise the utilisation of funding needed for health research in Malaysia.

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Foreword

Priority setting is a major issue in health research, and no health system, particularly in developing countries, can afford to pay for every research project. Therefore, since 8MP we continue to coordinate and lead the national main areas of health research priorities. As the gap between the need for health research and the amount of money available to fund the research grows, difficult decisions must be made. A logical and transparent appeal to establish priorities guides the policymakers in their selection of health interventions and maximises social welfare.

The 12MP for healthcare is aimed to improve the health of the population, enhance the quality of healthcare services, and improve access to healthcare. Therefore, the development of the Health Research Priorities for 12MP (12MP-HRP) aims to address the critical gaps in information and evidence in health research in Malaysia. The 12MP-HRP core team has worked hard since 2019 to develop this document by reviewing thousands of health research literature and developing a well-established method to identify the research gaps. Scoring of each identified research area was done by the Technical Working Groups (TWGs) and stakeholders from various institutions and universities. Finally, after calculating the scores and ranking the research areas this comprehensive document was eventually produced.

I applaud the best effort carried by the 12MP-HRP core team and all TWG members. I hope this document will serve as a guide to all researchers and policymakers to determine the most important research to be prioritised for Malaysian healthcare.

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List of abbreviation

11MP	11th Malaysia Plan
12MP	12th Malaysia Plan
AI	Artificial Intelligence
AIDS	Acquired Immunodeficiency Syndrome
ASFR	Age-Specific Fertility Rates
ASIS	Asset and Services Information System
BMI	Body Mass Index
BSH	*Bantuan Sara Hidup*
CAMMS	Computerized Asset Maintenance & Management System
CASIS	Concept-Aware Social Image Search
C/E	Consultation & Examination
COMBI	Communication for Behavioural Impact
COVID-19	Coronavirus disease 2019
CPI	Customer Price Index
CPG	Critical Practice Guidelines
CSR	Corporate Social Responsibility
CT	Computerized Tomography
CVA	Cerebrovascular Accident
CVD	Cardiovascular Disease
DES	Dietary Energy Supply
DM	Diabetes Mellitus
DOSM	Department of Statistic Malaysia
DTA	Diagnostic Test Accuracy
EGMs	Evidence Gap Maps
EMR	Electronic Medical Records
EnPHC	Enhanced Primary Health Care
ETL	Extract-Transform-Load
FBS	Food Balance Sheet
FOP	Front of Pack
FPP	Full Paying Programme
GDM	Gestational Diabetes Mellitus
GIS	Geographic Information Systems
GNT	Global Nutrition Target
GUM	Growing Up Milk
HIES	Household Income and Expenditure Survey

HIS	Health Information System
HIV	Human Immunodeficiency Virus
HCL	Healthier Choice Logo
HCW	Healthcare Worker
HHR	Health Human Resource
HPT	Hyperparathyroidism
HRG	High-risk Group
HRH	Human Resources for Health
HRM	Human Resource Management
HRMS	Human Resources Management System
HRP	Health Research Priorities
ICT	Information and Communications Technology
ID	Study Identification
IDD	Iodine Deficiency Disorder
ILI	Influenza-like illness
IQ	Intelligence Quotient
IRMS	Information and Records Management Society
IT	Information Technology
IYC	Infant and Young Child
JLA	James Lind Alliance
KAP	Knowledge, Attitude and Practice
KOSPEN	*Komuniti Sihat Pembina Negara*
KPWKM	Ministry of Women, Family and Community Department
MDG	Millennium Development Goal
MIH	Molar-Incisor Hypomineralisation
MNT	Medical Nutrition Therapy
MoH	Ministry of Health
MREC	Medical Research and Ethics Committee
MRI	Magnetic Resonance Imaging
MSM	Men Sex with Men
MyFCD	Malaysian Food Composition Database
NCDs	Non-Communicable Diseases
NGO	Non-Governmental Organisation
NIH	National Institutes of Health
NHMS	National Health and Morbidity Survey
NMRR	National Medical Research Register
NPANM	National Plan of Action for Nutrition of Malaysia
NRP	Nutrition Research Priorities

NSP	National Strategic Plan
NTD	Neural Tube Defect
OOP	Out-of-pocket
PCC	Person-Centred Care
PDAs	Patient Decision Aids
PE	Pulmonary Embolism
PHC	Primary Health Care
POCT	Point of Care Test
PrEP	Pre-Exposure Prophylaxis
PWDS	Person With Disabilities
QAP	Quality Assurance Program
RAAS	Renin-angiotensin-aldosterone system
RTA	Road Traffic Accidents
R&D	Research and Development
SARI	Severe Acute Respiratory Infection
SDG	Sustainable Development Goals
SDM	Shared Decision Making
SGA	Small for Gestational Age
SOP	Standard Operating Procedure
SOCSO	Social Security Organisation
SPIKPA	Foreign Worker Health Insurance Coverage Schemes
SSB	Sugar Sweetened Beverages
SSS	Malaysian Healthy Plate
TB	Tuberculosis
T&CM	Traditional and Complementary Medicine
UHC	Universal Health Coverage
UI	Urinary Incontinence
USI	Universal Salt Iodization
VHF	Viral Haemorrhagic Fever
VTE	Venous Thromboembolism
WC	Waist Circumference
WGS	Whole-genome Sequencing
WHO	World Health Organisation
WHR	Waist-Hip Ratio
WHtR	Waist-Height Ratio
WRA	Women of Reproductive Age

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Health Research Priorities for the 12th Malaysia Plan (2021 – 2025)

EXECUTIVE SUMMARY

Health research priorities in Malaysia should reflect the unique characteristics, needs and goals of the health sector in Malaysia. The primary goal of our health sector is to improve the health and quality of life of the people of Malaysia. This in turn, would enhance national productivity and competitiveness, with positive impacts on economic development.

The purpose of identifying health research priorities is to facilitate research that provides relevant and targeted information to support the primary goal of the health sector. The resultant research outputs should improve the health status and the delivery of health care in Malaysia. From a social perspective, health research primarily aims to bring social benefits via a variety of means, including, for instance, evaluation of health-related epidemiological data in the Malaysian-setting, and industry-driven development of innovative technology with commercial value. Only some research in health technology might have a direct commercial value, but their development should be anchored primarily on the potential health benefits they will bring to Malaysians.

In this document, the selection of priority areas for health research was guided by information/evidence requirements related to two fundamental principles. First, the core principles in the 12th Malaysia Plan (12MP), and second is the continuing need to promote wellness and to reduce the burden of current and emerging diseases among Malaysians.

The Role of the Health Sector

The 12MP is a five-year road map (2021-2025) of developmental strategies for achieving the national aspirations. It is also based on Universal Health Coverage (UHC) which emphasised on the concept that all people and communities can use the promotive, preventive, curative, rehabilitative and palliative health services they need, of sufficient quality to be effective, while also ensuring that the use of these services does not impose financial burden[1]. To enable the concept of health-for-all a reality, skilled health workers need to provide quality, people-centred care and policymakers will be committed to invest in UHC. UHC aims to provide individuals and communities an access to high quality health services so that they can take care of their own health and the health of their families. UHC should be based on strong, people-centred primary health care (PHC). Good health systems are rooted in the communities they serve. They not only focus on preventing and treating diseases and illnesses, but also on helping to improve well-being and quality of life. This is also in line with the Sustainable Development Goals (SDGs) Agenda 2030, also known as the Global Goals, which were adopted as a universal call to action to end poverty, protect the planet and ensure that all people enjoy peace and prosperity by 2030[2]. It contains 17 integrated goals which are collectively identified as zero hunger, good health and well-being, gender equality, clean water and sanitation, affordable and clean energy, reduced inequalities, sustainable cities and communities, responsible consumption and production and climate action.

The thrust of these strategies is to promote wellness rather than merely dealing with illnesses; and to transform health care delivery to meet the needs and growing aspirations of the nation and yet be affordable to individuals and society.

Priorities for Health Research

Research that addresses critical gaps in information and evidence to support these strategies will be considered as priority research. However, while promoting wellness, the health sector has to continue dealing with illnesses. In order to improve health status, the burden of disease among Malaysians should continue to be an integral guide to the development of national research priorities. Burden of disease refers to death, disability and hardship of various kinds that result from illnesses. The latest National Health and Morbidity Survey (NHMS) 2019 found a high prevalence of non-communicable diseases (NCDs) among the Malaysian population, such as diabetes; 18.3%, hypertension; 30.0%, hypercholesterolemia; 38.1%, overweight; 30.4%, obese; 19.7%, and depression; 2.3%[3].

Malaysian Health at Glance 2018 reported that, for communicable diseases, the rate of dengue fever increased by 30.7% over the six-year period between 2011 and 2016, with a nearly 20% increase in the incidence of tuberculosis (TB) between 2010 and 2016. On the other hand, there have been encouraging decreases in the incidence of Human Immunodeficiency Virus (HIV) (16.8% decrease since 2010) and malaria (84% decrease since 1998)[4].

For most conditions mentioned above, considerable knowledge exist on effective interventions with established practice guidelines developed locally and globally. However, research is needed on how best to apply such interventions in the Malaysian

context. The overarching goals of the 12MP encompass three dimensions, namely economic empowerment, environmental sustainability and social re-engineering[5]. Additionally, the 12MP envisaged health development and research to be guided on four main areas as below:

1. Health technology and health system (Digital and Artificial Intelligence (AI), human resources and financial)
2. Improving national health
3. Environmental health & disaster risks
4. Nutrition, food safety & quality

Transparency and Inclusiveness in the Selection of Research Priorities

In the past, the choice of research areas often has been guided mainly by the personal interest of researchers or of managers of research funding agencies. These interests might not be aligned to the information needs that are considered as priorities by the end-users, namely, clinicians, health care managers, policymakers and consumers of health care in the country. This has resulted in many research findings "ending up on the shelf" and wasteful use of research funds. In order to address this gap between research and the use of research results, the Ministry of Health (MOH) has developed a process for selecting health research priorities.

We have identified the health research priorities through a widely inclusive collaborative and transparent approach. First, in a comprehensive scoping exercise, research priority areas were identified by reviewing existing national and international health literature to determine critical gaps in evidence or knowledge in the priority areas. The process involved a wide range of questions of importance to patients and clinicians. It was between what researchers want to study and the practical information that is needed day-to-day by patients and health professionals. The process involved searching published and unpublished studies to match with the national register and identification of gaps. All stakeholders provided suggestions, knowledge, perceptions, and judgments on the following aspects:

- The magnitude or severity of a problem in the priority area
- The economic importance
- The expected impact of research, and
- The feasibility of research to be completed within the next 5 years

The health research priorities that emerged from this process are summarized in Table 1.

The research priorities identified through this process will guide the use of the MOH Research Grant. The rationale for identification of each priority area is elaborated in the tables provided in subsequent chapters. Potential researchers were encouraged to construct the rationale in line with the health priorities identified to shape their research proposals. This would facilitate the subsequent application of their research results. Researchers are also encouraged to improve the focus of their study by identifying the specificity of information or evidence that is required to improve health care or behaviour and empowerment of the Malaysian community.

Table 1: Indicative areas for priority research in the health sector during the process of development of the 12th Malaysia Plan (2021-2025)*		
Research domain	Research areas	Indicative Priorities for research
Improving the quality of and accessibility to health system	Healthcare financing	Affordability
		Costing
		Efficiency
		Financing
	Human resources (human and facilities)	Quality of training & competency
		Provider behaviour
		Specialist manpower needs & roles
		Human Resource Management (HRM) workforce lifespan
		Primary care needs/ health coverage
		Health system research
		Brain drain
		Foreign contract doctors
		Robotics in Healthcare
		Healthcare facilities
	Innovation and technology in health	Health information management
		Biobank
		Quality of information systems and digital health
		Big data
		Advanced medical printing
	Service delivery	Service contracting
		Health regulation
		Health planning
		Organisational structure
		Person-centred care (PCC)
	Public-public integration	Formulation of sectorial strategies, as well as specific technical policies
	Public-private integration	Private Sector/ Non-Governmental Organisation (NGO) involvement
	Equity	Equity analysis for SDG and UHC in Malaysia
		Distribution and utilization of resources
		Healthcare access and responsiveness
	Health literacy, community empowerment and mobilization	Enhanced health literacy
		Strengthen coordination, monitoring and evaluation of community participation and mobilisation programmes
		Strengthen supportive environment to empower individuals, families and community

Research domain	Research areas	Indicative Priorities for research
Communicable Diseases	Pandemic Preparedness	Building research capacity, preparing for outbreak research, fostering collaborations and networks and enhancing communication and knowledge translation
	Coronavirus Disease 2019 (COVID-19)	Cost effectiveness, adaptation behaviours and strategies to change (new normal) for people at risk groups i.e. people with other co-morbid, older people, children, people with special needs and indigenous group
		Preventive, treatment and control measures (vaccine development)
	Pneumonia/ILI/SARI	Cost effectiveness, preventive and control measures, treatment outcome
	Dengue, Mycobacterial Diseases, Hepatitis, HIV/AIDS, Melioidosis, Malaria	Cost effectiveness, behaviour and preventive measure (including vaccine and latest treatment), drug resistant, treatment outcomes and cure
	Antimicrobial resistance	Epidemiology and epigenetic of antimicrobial resistance
	Vaccine preventable bacterial disease i.e. Measles, Diphtheria, Pertussis, Rabies, Pneumococcal	Cost effectiveness, behaviour and risk factor
		Vaccine uptake and vaccine refusal
	Boosting host immune responses to vaccines	Nutritional interventions (supplements e.g. vitamin D, E, probiotics), exercise
	Leptospirosis	Prevention and control (vector control), Diagnosis
	Viral Haemorrhagic Fever	Cost effectiveness, behaviour and preventive measure (including vaccine and latest treatment), drug resistant, treatment outcomes and cure
	None-dengue Arthropod borne viruses	Cost effectiveness, behaviour and preventive measure (including vaccine and latest treatment), drug resistant, treatment outcomes and cure
Research domain	Research areas	Indicative Priorities for research
Non-communicable Diseases	Endocrine and Metabolic diseases	Diabetes Mellitus (DM) Genetic factors, behaviour, delivery and monitoring of care Screening uptake and strategies Economic impact Evaluation of intervention strategies

Research domain	Research areas	Indicative Priorities for research
	Cardiovascular diseases (CVD)	Hypertension, Hyperlipidaemia & Cerebrovascular accident (CVA): Economic & social cost, behaviour and prevention, treatment and control measures
	Neurodegenerative diseases	Biomarkers for diagnosis, newer drugs and impact of bioactive compounds, healthy life-style and development of theses condition
	Cancer	Cell based therapy, cost effectiveness, prevention, treatment outcomes and control measures
		Genetic factors for prognosis and treatment, genomic, transcriptomic, proteomic, delivery and monitoring of care, advanced technologies and epidemiological studies
		Nutritional and health life-style intervention, public health, traditional and complementary medicine (T&CM) intervention
	Maternal health issue	Postnatal morbidity, anaemia and abortion
	Tobacco	Tobacco and e-cigarette
		Smoking
Research domain	**Research areas**	**Indicative Priorities for research**
Older People	Improving quality of care for older adults	Identifying problems in clinically complex or non-independent older adult
		Benefits and burden of aggressive disease in older people
		Gaps in care for vulnerable ageing population such as older persons with limited literacy or in prison
		Healthy ageing
		Population ageing on the economy, health prevention behaviour patterns and health access among the older people
	Older people health issues	Mental health such as Dementia, depression, schizophrenia and Alzheimer
		Other chronic diseases such as DM, Hyperparathyroidism (HPT), CVD and other communicable disease
		Geriatric Syndrome (incontinence, dementia, depression, falls, frailty) among older people
	Caring society and capacity building of society	Support, specific care, living environment
		Mobility, nutrition, disability and frailty

Research domain	Research areas	Indicative Priorities for research
Mental Health	Addiction	Substance abuse i.e. Illicit drugs such as methamphetamine, opioids, Alcohol abuse
		Behavioural i.e. gaming/gambling disorder, mental-health problems related to digital era such cyberbully, internet addiction, pornographic addiction
	Depression, suicide and other psychiatric disorder	Prevention (identification of vulnerable groups for early intervention), interventional strategies and training
	Violence (Adult)	Physical, emotional and sexual violence (18 years above)
		Violence & abuse - SDG and UHC in Malaysia
	Physical injuries	Intentional and unintentional injuries including road traffic accidents (RTA) and self-harm
Research domain	Research areas	Indicative Priorities for research
Environmental & Disaster Risks	Environmental health and safety	Climate change and health
		Occupational Health
		Waste management
		Toxic chemicals
		Urbanization
		Air pollution
	Disaster and health risks in man-made disasters (industrial)	Disaster preparedness and response in man-made disaster
		Health effect of disaster to population and responder
Research domain	Research areas	Indicative Priorities for research
Nutrition, food safety & quality	Maternal and young child nutrition	Maternal nutrition/nutritional status and its outcome to mothers, infants and young children
		The impact of infant and young child (IYC) nutritional status on growth and development
		Evaluation of current strategies/ programmes/policies for mothers
	National food and nutrition situation	Regular national surveys for monitoring global and national nutrition indicators
		Evaluation on the existing national nutrition programmes of Ministry of Health (MOH)
		Determination of the factors/ causes affecting food and nutrition security status

Research domain	Research areas	Indicative Priorities for research
	Life course approach to food intake and dietary practices	Effects of personal and environmental factors on food intake
		Effects of food intake and dietary practices on physical, mental and social well-being
		Identification/ development of effective strategies/ interventions to improve diet quantity and quality
		Improvement in methods/ tools/ instruments for assessment of food intake
	Nutritional deficiencies and excesses	Association between macronutrient status with health outcomes
		Development of studies to determine macronutrient and micronutrient status of all age groups
	Overweight and Obesity	Relationship between Waist Circumference (WC), waist-hip ratio (WHR), waist-height ratio (WHtR) and body mass index (BMI) on NCDs
		Development and evaluation of obesity prevention and intervention programmes
		Identification of new methods to define obesity
	Diet-Related Non-Communicable Diseases	Consolidation of aetiological data of diet-related NCDs risk and control
		Consolidation of interventional data related to prevention and control of diet-related NCDs
		Evaluation of nutritional care delivery system for prevention and management of diet-related NCDs
	Nutrient and Non-nutrient Composition of Food	Analysis of macro and micronutrients in foods
		Addition of ethnic foods items
		Analysis of phytochemicals in foods
		Improvement of analytical methods and related methodologies
	Food safety status and health risks	Evidence based food safety information to prevent foodborne illness and protect public health
	Food safety culture	Behavioural study
	Food Fraud	Food Integrity, fraud and traceability
	Food safety system	Sustainability of food safety system
	New advance technology	Advance analytical tools for food safety measure

Research domain	Research areas	Indicative Priorities for research
Oral Health	Oral health condition	Dental carries, periodontal condition, soft and hard tissue lesions, Molar-Incisor Hypomineralization (MIH), facial and dental trauma, oral health problem related-to occupational and handicapping dento-facial anomalies
	Access to dental services	Reduction of oral health inequalities at a community or population level
	Oral cancer	Early detection and diagnosis of oral cancer
	Digital technologies	3D or 4D modelling
		Electronic Dental Record

*The research grant of the MOH will focus on these priority areas. Other institutions that fund health research is also encouraged to focus on these priority areas.

CHAPTER 1: INTRODUCTION

Setting priorities for health research is essential to maximize the impact of investments in research. Health Research Priorities (HRP) processes assist researchers and policymakers in effectively targeting research with the greatest potential public health benefit[6]. In general, the primary objective of health research priorities is to improve the health status of the population and to improve the quality and delivery of health care that is affordable and accessible. To achieve this, research outputs should be relevant to the requirements of the health system and be valued by potential users including policymakers, health care managers, clinical practitioners and consumers. Health research might not have a direct marketable commercial value. However, it should have a high social value.

While there is international consensus on the need for priority setting, there is no consensus on a single best methodology. Several different approaches have been used to set priorities, all of which have a common emphasis of being transparent and inclusive. Researchers as well as potential users of research outputs are involved in the process. Malaysia has recognized the need for priority setting in health research and has taken a leading role in applying various methods at a national level. In this latest priority setting exercise, it is based on the most important long-term overarching goals identified in the 12MP, builds on the experience gained in previous years. The priorities provide guidance for the allocation of research grants from the funds allocated to the MOH.

Health Research Priorities for the 12th Malaysia Plan (12MP)

The fundamental principles and development policies are based on the 12MP encompassing three dimensions, namely economic empowerment, environmental sustainability and social re-engineering. The principles, objectives and strategies outlined in the 12MP is one the foundation for selecting health research priorities. Therefore, HRP guided by 12MP and Evidence Gap Maps (EGMs)[7] defines eight strategies for this purpose, namely;

1. Improving population health outcomes
2. Strengthening health services
3. Environmental health and food safety & quality
4. Sustainable healthcare financing
5. Healthcare resources (human and facilities)
6. Innovation and technology in health
7. Public-private integration
8. Health literacy, community empowerment & mobilisation

In the wake of the COVID-19 pandemic, we made some adjustments in our methodologies and classification of HRP under the proposed 12MP. We made an overall division of research areas into Communicable Disease and NCDs, from which research gaps in specific areas would be identified. Table 2 illustrates the principles in determining **priority research** in the health sector based on the research gaps identified in the following two broad areas of Population Health and Health System[8], and Table 3 enumerates specific research focusses to be targeted in these two areas based on the priorities identified.

Table 2: Definitions of research gaps

Missing information
Research/evidence/knowledge gaps • Missing or low or very-low-certainty evidence from a body of research on a particular topic that could otherwise potentially answer the questions of decision-makers (clinicians, other practitioner groups, administrators, policymakers).[9]
Synthesis/unidentified gaps • Absence of or the presence of low or very-low-certainty evidence from systematics reviews is available to contribute meaningfully to the evidence base in a particular area.[10,11] • Lack of up-to-date and conclusive systematic reviews with sufficiently high certainty of evidence that is mapped to a question on health care.[12]
Treatment uncertainty • Lack of up-to-date, reliable systematic reviews or research evidence that provide clear answers about the effects of health care interventions, and/or the presence of up-to-date systematic reviews which highlight the uncertainties.[13]
Absolute evidence gaps • Little or no direct evidence from primary studies is available.[10]
Knowledge gap (knowledge void gap) • Desired research findings do not exist.[14-16]
Practical knowledge gap (action-knowledge conflict gap) • Professional behaviour or practices deviate from research findings, contributed only by indirect outcomes, or are not covered by research.[14–16]
Inadequate information
Research/evidence/knowledge gaps • The evidence base inadequately addresses a key question.[17]
Empirical gap (evaluation void gap) • Research findings or propositions need to be evaluated or empirically verified.[14–16]

Population gap

- Research regarding a population that is not adequately represented or under-researched in the evidence base or prior research (e.g. sex, race/ethnicity/age).[18]

Insufficient information

Research/evidence/knowledge gaps

- Not much information is available and/or there is a lot of uncertainty about the accuracy of the existing estimates/evidence.[19]
- Additional research is needed, from policymakers perspectives, to address the evidence gap in the available primary research.[9]

Methodological gap (method and research design gap)

- A variation in research methods is required to generate new insights or to avoid distorted findings.[14-16]

Theoretical gap (theory-application void gap)

- Theory should be applied to certain research issues to generate new insights; theory is lacking, so a gap exists.[14-16]

Table 3: Priority research areas in the proposed Twelfth Malaysia Plan (12MP)

Priorities Area	Sub Priorities
Population Health	Communicable Diseases
	Non-Communicable Diseases
	Older People
	Mental Health
	Environmental & Disaster Risks
	Nutrition, Food Safety & Quality
	Oral Health
Health System	Healthcare Financing
	Healthcare Resources (human and facilities)
	Innovation and Technology in Health
	Service Delivery
	Public-public Integration
	Public-private Integration
	Equity
	Health Literacy, Community Empowerment & Mobilization

CHAPTER 2: METHOD

The research priority-setting process for the 12MP (2021-2025) was guided by a similar effort carried out for the 11th Malaysia Plan (11MP) (2015-2020), EGMs and methods adopted in research priority-setting exercises by the World Health Organisation (WHO). Emphasis centres on conducting comprehensive consultation with relevant stakeholders, setting explicit criteria, following systematic and transparent processes, developing close link with guideline developer and policymakers to identify their perceived priorities for setting priorities.

Leadership for the research priority setting was provided by the Director-General of Health Malaysia. The process began with the commissioning by the Deputy Director-General of Health (Research and Technical Support) of a task force, led by the Head of Sector for Evidence-Based in Healthcare, one of the sectors under the umbrella of the National Institutes of Health (NIH). The main task force for the HRP is the 12MP-HRP core team which consists of selected researchers with various skill levels and experience in developing health research priorities and knowledge synthesis from all institutes in NIH. A technical working group (TWG) which consist of experts from various fields namely health system, health delivery, biomedical and social science research, innovation, clinical, stakeholders and patient advocacy sectors was formed to assist 12MP-HRP core team.

The 12MP-HRP core team was tasked with providing and sharing knowledge about the different available methods for knowledge collation, appraisal and synthesis from the published and unpublished studies so that robust evidence and knowledge gaps could be identified, as well as the strengths and weaknesses of available evidence. The TWGs provided the expertise needed to formulate more specific research questions, themes, or opportunities within each priority area. The purpose of the TWG is to provide recommendations to the 12MP-HRP core team on priorities for health research in Malaysia.

In Malaysia, significant challenges remain in achieving optimum provision of preventive and curative health care to all segments of the population. This is the result of combination of factors, including insufficient human resources and suboptimal healthcare seeking behaviour. To date, mortality in Malaysia is still predominantly caused by ischaemic heart disease (15.0%) followed by pneumonia (12.2%), cerebrovascular diseases (8.0%), chronic lower respiratory disease (2.6%) and RTA (3.7%).[20] However, deaths due to communicable diseases such as dengue (244.07/100 000), TB (92/100000) and new emerging disease pandemic COVID-19 (0.6%) pose significant concerns to the care providers and the public.[21–23]

While there has been a significant increase in health research conducted in Malaysia in recent years, the research on the whole has not been translated adequately to practical recommendations that address the challenges in health care provision. For instance, some of the research undertaken has not contributed to health policy or practice guideline due to a mismatch between ideas from researchers and expectations from health care decision-makers. In some instances, the research agenda is driven by funders (including industry) and is thus not driven by and applicable to national or local problems. Furthermore, usability of findings tends to be hampered by limitations in quality of conduct, analysis and reporting of studies.

Thus, there is a need in the research field “to increase value and to reduce waste”, especially in resource-constrained settings.

Evidence-based approaches to address health problems are recognized as best practice. Evidence-based public health draws on the principles of evidence-based health care and is defined as the “integration of the best available evidence with the knowledge and considered judgments from stakeholders and experts to benefit the needs of a population”.

When allocating resources, policymakers and health-care practitioners need to consider the significance of the health problem; the quality of evidence on the effectiveness of a health intervention and its potential benefit-harm balance in the local perspective. The cost and cost–effectiveness must also be weighed up, along with personal values and preferences, feasibility, acceptability and equity. To achieve evidence-based decision-making, data from rigorous primary research and evidence syntheses relevant to the Malaysian context must expand and translation of evidence into policy and practice must be enhanced.

In this current priority-setting exercise, the 12MP-HRP core team conducted a search for the health research priorities adapted from EGMs principles through (i) identifying relevant and context-sensitive research priorities; (ii) conducting robust, internationally competitive research; and (iii) linking primary research with evidence synthesis, implementation research, policy and practice. The 12MP-HRP core team planned, coordinated and implemented the priority setting process in a series of steps.

EGMs present a new addition to the tools available to support evidence-informed policy making. EGMs are thematic evidence collections covering a range of issues such as health system and healthcare delivery, communicable and NCDs or maternal and child health. They present an overview of existing evidence from primary research, systematic reviews or impact evaluations in a sector or subsector, schematically representing the types of interventions evaluated and outcomes reported. Gap maps enable policymakers and practitioners to explore the findings and quality of the existing evidence and facilitate informed judgment and evidence-based decision making in international development policy and practice. The gap map also identifies key “gaps” where little or no evidence from previous research, based on information retrieved from the National Medical Research Register (NMRR) as well as mapped evidence provided by relevant scoping reviews and systematic reviews, with recommendations on the areas where future research should be focused. Thus, gap maps are a useful tool for developing a strategic approach to building the health research priorities in a particular area.

Developing research priorities

We followed a four-step participatory process adapted from EGMs, WHO, Cochrane Method for Prioritization, James Lind Alliance (JLA) and Delphi Method.[7,24-26] Representatives of the policy and practice community were involved throughout, as continuous interaction can help identify challenges in need of solutions and increase the chances of research findings being translated into policy.

Step 1: Developing area

A series of meetings were conducted among policymakers and all NIH Directors to identify domains that were considered in need of further research in the Malaysian context. The 12MP-HRP core team members searched for relevant input documents as well as identified and recruited members deemed suitable to deliberate on each of the domains. The domains were based on main objectives identified during the process of prioritisation exercise in tandem with the 12MP. Through discussion and face-to-face consultations and meeting with stakeholders, we developed a list of priority research areas. To do so, the 12MP-HRP core team members carried out a comprehensive scoping search exercise in the major health care databases, including Medline (PubMed), SCOPUS, OVID, EMBASE, Web of Science, Google scholar, CENTRAL and PROSPERO along with previously registered research with NMRR over the last 10 years.

The search aimed to assess potential priority research areas drawing on the international evidence-base as well as the expertise and interests of participating institutions and stakeholders. It was structured in four sections: (i) priority diseases, drawing on but not limited to the 10 most important diseases in Malaysia based on burden of disease ;(ii) the 10 most important risk factors in Malaysia also based on burden of disease; (iii) priority interventions against diseases and risk factors; and (iv) ongoing projects by research institutions and collaborating agencies. The search was conducted between April and June 2020. We have updated the search again throughout May 2021.

All inputs were incorporated into the final list, either as new research areas or as sub-sets of areas already available in the initial list. An initial shortlist of priority research areas derived from the search provided the starting point for discussion among 12MP-HRP core team members, stakeholders and all directors under NIH. With reference to existing checklists, stakeholders were asked to consider four criteria in prioritizing: (i) magnitude and importance of the health problem; (ii) research and other strengths of the respective area; (iii) requirements by the funder and related strategic advantages and/or disadvantages; and (iv) feasibility of achieving meaningful results given available resources and timelines.

Step 2: Searching for relevant studies and assessing inclusion

Through evidence mapping, we identified gaps in research areas in Malaysia. These evidence maps provided an overview of the existing evidence for the priority research areas from Step 1. Expanding on previous work, we developed methodological guidance comprising seven steps: developing a framework, formulating a clear question, defining criteria for inclusion of research, conducting systematic searches, selecting research for inclusion, extracting data and presenting results (Table 4). Depending on the nature of the question and resources, primary studies, systematic reviews, protocols, evidence synthesis and/or practice guidelines were also considered.

In Step 2, the research gaps were identified. The criteria used for identification of gaps were as follows:

- Cumulative volume of research in a particular area, namely, the extent of

research that have satisfactorily answered the research question
- Economic importance
- Local, regional and global Impact of the research output
- Feasibility of the research, including the possibility of multi-institutional and multi-national collaboration in expertise and funding provision

Table 4. Developing an evidence map in seven steps.[7,24,25]

No.	Step	Description	Example
1	Developing a framework	Describe broad research area and/ or use logic model to illustrate framework, using published logic model templates.	Comprehensive models of care for diabetes and hypertension.
2	Formulating a clear question	Formulate broad question using the PICO/ PEO format. ▪ For Intervention: Population, Intervention, Comparison, Outcome ▪ For Diagnosis: Population, Index test, compared standard, target disorder ▪ For Prognosis: Population, prognostic Indicator, Compared indicator, Outcome ▪ PEO mostly for qualitative study: Population, Exposure and Outcome	What are the effects of comprehensive service delivery models for management of chronic diseases (with a focus on diabetes and hypertension) in adults, across the whole spectrum of prevention, early diagnosis and treatment?
3	Defining criteria for inclusion of research area	Develop criteria related to population, intervention/indicator and study designs. Do not use criteria related to comparisons or outcomes.	Participants: for example, Adults (> 18 years), excluding pregnant women. Interventions: Any comprehensive model of service delivery or model of care, addressing prevention, early diagnosis or treatment of diabetes and/or hypertension; or a combination of these. Studies: systematic reviews, defined as those that had predetermined objectives, predetermined criteria for eligibility, searched at

No.	Step	Description	Example
			least two data sources, of which one was an electronic database, and performed data extraction and risk of bias assessment. We also considered randomized controlled trials in case of finding a limited number of systematic reviews.
4	Conducting systematic searches	Pre-specify a search strategy focusing on population and intervention. Search for published and unpublished research articles under systematic review and heath research databases: Cochrane database (www.cochranelibrary.com) Health Evidence (www.healthevidence.org) Prospero (ongoing systematic reviews) (www.crd.york.ac.uk/PROSPERO) PubMed (www.ncbi.nlm.nih.gov/pubmed) Embase (www.elsevier.com/onlinetools/embase) Scopus (https://www.scopus.com) Web of Science (https://mjl.clarivate.com/) Google Scholar (https://scholar.google.com/) OVID (http://ovidsp.dc2.ovid.com/) NMRR (https://www.nmrr.gov.my) Medical Research and Ethics Committee (MREC) (http://nih.gov.my/web/mrec/) NHMS technical report 2016, 2017, 2018 and 2019 (http://iku.moh.gov.my/)	A combination of search terms related to delivery of health care, diabetes, hypertension and systematic reviews was used and the search string adapted to each database. Specific search strategies are reported for each database.

No.	Step	Description	Example
		All Public Universities with Medical Faculty Ethics Committee All Medical Libraries in Public Universities Clinicaltrial.gov (WHO ICTRP) (http://www.clinicaltrials.gov/) (http://www.who.int/ictrp/en/) Psych Info (ProQuest) (https://www.apa.org/pubs/databases/psycinfo) (www.proquest.com) OSH UPDATE + FIRE (https://www.sheilapantry.com/oshupdate.html)	
5	Selecting research area or inclusion	Select studies for inclusion by first screening titles and abstracts for potentially eligible studies. Conduct full text screening of potentially eligible studies.	One author screened all the titles and abstracts of the search outputs to discard the citations that were not relevant to the question. Both authors then performed a second round of screening to identify potentially eligible studies. Full text screening of seemingly relevant studies was done by two authors independently.
6	Extracting data	Pre-specify data extraction form, which should include citation details, characteristics of the systematic review, primary study or guideline, characteristics of the population, intervention and comparisons, primary and secondary outcomes and quantitative or qualitative results. Extract relevant data onto data extraction form.	One author extracted data of the included research articles onto a form containing: ■ Study Identification (ID) and citation ■ Included study designs ■ Geographical details ■ Number of included studies and participants ■ Characteristics of populations

No.	Step	Description	Example
			▪ Characteristics of interventions and comparisons ▪ Reported outcomes ▪ Main results
7	Presenting results	Present findings descriptively in table format and, where appropriate, through a visual mapping.	Evidence table or in narrative synthesis.

Subsequently, we identified gaps in the evidence base. Between May 2020 to June 2020, evidence maps were created by the 12MP-HRP core team.

Step 3: Coding and critical appraisal

We identified the area for health research from the evidence mapping. We engaged with the policymakers and stakeholders through emails and voice call to develop a checklist for priority areas. The list was developed between June and August 2020.

Step 4: Validation of research priority areas

Validation of the research priority areas is a fundamental element of this exercise. We invited the policymakers, stakeholders and experts in the field, to give feedback on the identified research priority areas. We conducted serial consultations with expert groups, including academics, government agencies, non-governmental organisations and funding bodies. The priority ranking criteria used in this document were as follows[27]:

1. Public health importance
2. Gaps in knowledge
3. Scientific feasibility
4. Economic impact
5. Curative versus preventative and critical need

The ranks for all the identified research priorities process were not only numerically, but also colour coded. The rationale of the colour coding is for easy visibility to identify the priorities. The colour rankings start with red being the highest, followed by orange, yellow, green and finally blue. The color purple are a separate classification of auto-priority focus areas that has been pre-identified by the stakeholder. The range of ranking are equally divided by consensus decision of each TWG, some colour codes are widened or narrowed based on the technical inputs given by each TWG group.

IDENTIFIED RESEARCH PRIORITIES

Priority research areas

The databases search was completed by the 12MP-HRP core team members. Together, the 12MP-HRP core team, TWGs, stakeholders and decision makers identified infectious diseases and NCDs as the two most important problems with different profiles of priorities. We selected areas on COVID-19, pneumonia/ Influenza-like illness (ILI)/ Severe Acute Respiratory Infection (SARI), Dengue, TB, Hepatitis, HIV/AIDS, Malaria, and vaccine preventable diseases under communicable diseases; endocrine and metabolic diseases, CVD and cancer under NCDs; RTA and injuries, maternal and child health, environmental and disaster risks and nutrition, food safety and quality (Figure 1). Overall, we listed high-fasting plasma glucose, atherosclerosis, hyperlipidaemia, obesity, physical inactivity and sedentary life style, smoking, stunting growth, malnutrition and food intake and water pollution as priority risk factors (Figure 1). We prioritised population-level (i.e., primary prevention, secondary prevention, health system and health policy interventions) over individual-level interventions (i.e., individual-level health care and tertiary prevention). We came to a consensus that all research activities required a population and/or health system perspective and that each research activity would need to be taken forward jointly by partner institutions.

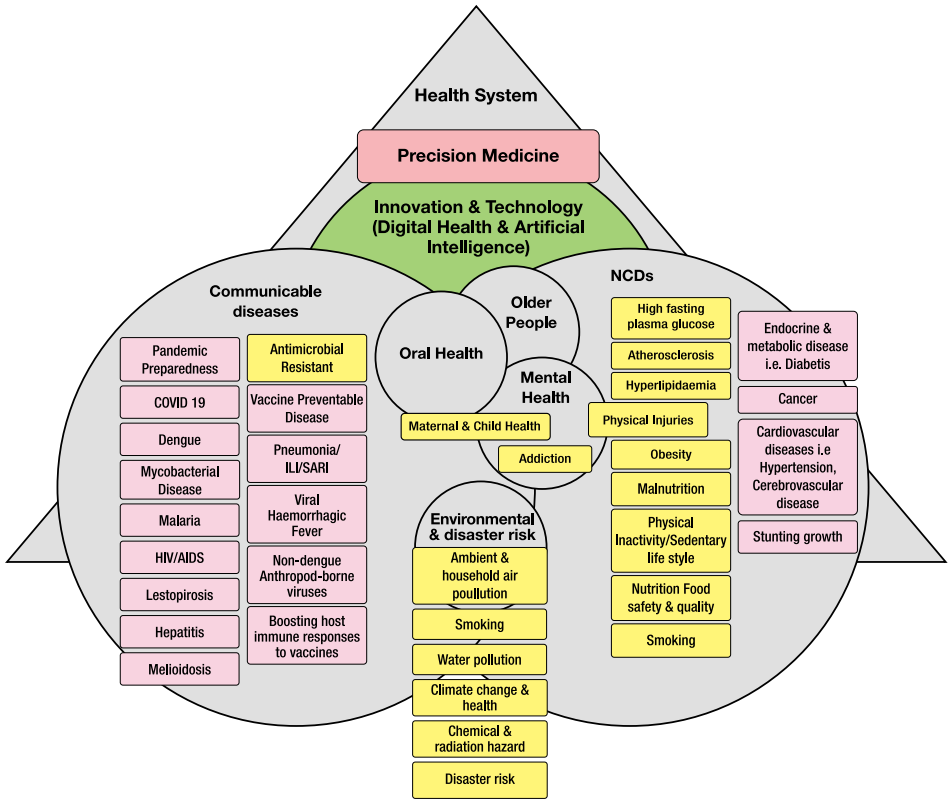

Figure 1. Graphic illustration of priority research areas, diseases and risk factors as identified through the databases search

Note: The grey triangle represents the health system encompassing all areas of research to achieve UHC. The green circle represent technology across all priority areas. The grey circles represent disease and area of research priorities guided by 12MP. The size of the circles indicates the importance of the respective research area as ranked by search finding and expert opinions. The pink boxes within the grey circles illustrate the priority diseases that were identified within the priority research areas. The yellow boxes illustrate the priority risk factors identified and associated with the priority diseases. Precision medicine is an approach across all diseases.

Evidence Map 1 (Health system)

We reviewed a population-based approach to health system, health care financing and health care deliveries on population health coverage and effects in promoting health of the communities. Eligible interventions comprising of policies, financing, regulations and services were reviewed. We considered population as those who were involved in the health system and health care deliveries that were related to process and coverage (e.g., health services). We considered manpower, health technology, health financing, health management and empowerment, integration between public-private and public-public as the intervention or exposure. We identified the outcome as health (i.e., satisfaction among patient and health personnel, waiting time, coverage in the population, awareness in health). Systematic searches retrieved 25588 records. Due to time constraints and limited access to databases, we only filtered published studies for the last five years (2015 – June 2020) through databases search. An additional 446 eligible records were retrieved from other sources, yielding a total of 26034 studies. After removing duplicates, we screened a total of 6635 records. We identified a total of 187 related to health system. Based on existing evidence and through engagement with stakeholders and expert consultations, we identified several areas that present opportunities for health system research to be developed as priorities.

Evidence Map 2 (Communicable Diseases)

We reviewed the effects of interventions and preventions at population level to Communicable disease. Outcomes of interest were hospital admissions and mortality & morbidity attributable to communicable diseases (i.e., COVID-19, Pneumonia/ ILI/SARI, Dengue, TB, Leprosy, Hepatitis, HIV/AIDS, Malaria and anti-microbial resistance). We identified all primary research articles, systematic reviews or scoping reviews and all interventional studies (randomized controlled trial and any clinical trials). Due to time constraints and limited access to databases, we systematically screened 40307 records. Using the reference lists of NMRR, additional 1748 eligible records were retrieved, yielding a total of 42071 studies. After removing duplicates, we screened a total of 34432 studies. We retrieved a total of 1778 full text records. We added and additional 313 records following expert consultation. Of these, we included 679 records for analysis. Most studies were concentrated on prevalence, risk factors, behavioural research, biomedical research and sero-conversion of the viral disease. There appears to be relatively low yield of interventional studies and clinical trials in Malaysia. Only 117 studies were concerned with the intervention. Based on the analysis of the existing evidence, we identified questions on the effectiveness of population-level interventions and targeted therapy to prevent and treat Dengue, mycobacteria diseases, HIV/AIDS, Hepatitis, Malaria, Pneumonia/ILI/SARI and other vaccine preventable diseases in Malaysia. We found 18 studies related to antimicrobial resistance. Therefore, there is a need to strengthen the evidence base regarding the implementation of communicable disease intervention and control in Malaysia.

Evidence Map 3 (Non-Communicable Diseases)

We reviewed the effects of population-level interventions and preventions strategies to NCDs (i.e., diabetes, hypertension, CVD and cancer). Eligible interventions comprise of policies, regulations, new drug therapy or targeted therapy, and environmental changes addressing risk factors for NCDs (i.e., unhealthy diets and excessive body weight). We considered outcomes related to process (i.e., disease coverage, disease improvement status, prognosis and cure), behaviour (e.g. physical activity, nutritional intake), risk factors attributable to NCDs and health (e.g. cardiovascular morbidity and mortality, cancer relapse or remission). Due to time constraints, only 29575 of 50175 records identified through searches were screened. We retrieved a total of 1092 full texts for the EGMs. Of these, a total of 312 studies were analysed for the priorities and research gaps. Most reviews focused on evidence from high-income settings, reporting on widely different types of interventions and outcomes; many were unable to appropriately pool studies and synthesise findings in meta-analyses, and most did not provide report findings that can be readily adapted to the Malaysian setting. Based on the analysis of the existing evidence, we identified a pressing need to evaluate the effectiveness of population-level interventions and targeted therapy to prevent and treat diabetes, hypertension, hyperlipidaemia, CVA and cancer in Malaysia, specifically, the findings on the local population as compared to those in the published literature which is mainly on Western countries.

Evidence Map 4 (Older People)

We reviewed the effects of interventions and preventions for improving the quality of life among older people. Outcomes of interest were improvement of the quality of life which is measured by validated scales, hospital admissions due mortality and morbidity attributable to functional limitation and diseases (i.e., Alzheimer,

dementia, and other communicable and NCDs). All primary research, systematic reviews or scoping reviews, randomized controlled trials or any clinical trials were considered. Systematic searches retrieved 7171 records. Using the reference lists from NMRR, an additional 75 eligible records were identified, yielding a total of 7246 studies. After removing duplicates, we screened a total of 6843 records. We retrieved a total of 2766 full text records. Of these, a total of 434 were analysed for priorities and gaps. Most concentrated on the diseases associated with risk factors, behavioural, support, care and injuries related outcome. There is a distinct lack of trials or longitudinal studies on the effects of rehabilitation, with a specific focus on the prevention of complications and improvement of quality of life as relevant to Malaysian older people. This represent a research gap in the Malaysian setting that should be highlighted with opportunities to be addressed in the next five years.

Evidence Map 5 (Mental Health)

We reviewed the effects of interventions and preventions on mental health. Outcomes of interest were incidence or prevalence of mental health diseases (i.e., depression, schizophrenia and other psychiatric disorder), substance abuse and addiction (i.e., opioids and alcohol), relapsed, repeated hospital admissions or rehabilitation, mortality attributable to mental health diseases (i.e., suicide, suicidal ideation and attempt, and violence). All primary research, survey, systematic reviews or scoping reviews and randomized controlled trials or any clinical trials were considered. We also searched NMRR and WHO trial registers. Systematic searches yielded 4290 records. An additional 47 records were retrieved from other sources, yielding a total of 4337 studies. After removing duplicates, we identified 3619 eligible studies. We retrieved a total of 624 full text records. Of these, a total of 358 studies were included for analysis. Most concentrated on the risk factors and behavioural. Only 11 studies were concerned with rehabilitation and complication. Based on the analysis of the existing evidence, a question on the effectiveness of population-level interventions and prevention for improving mental health were identified in Malaysia.

Evidence Map 6 (Environmental & Disaster Risks)

We reviewed the environmental health risk and disasters that are attributable to environment. Outcomes of interest were identified interchangeably as exposure/intervention (i.e., weather and climate change, occupational health and safety status and issues, waste management, tobacco effect, disaster preparedness especially in man-made disaster, health effect of disaster to the population, and environmental effects on the edible flora and fauna). All primary research, survey, systematic review or scoping reviews, randomized controlled trial or any clinical trials were considered. Systematic searches identified 9300 records from various databases. An additional 103 eligible records were identified through NMRR, yielding a total of 217 studies. After removing duplicates, a total of 5112 titles/abstracts were screened. We excluded a total of 4137 records. A total of 975 records were retrieved for inclusion. Of these, a total of 114 full text were included for research gaps analysis. Most studies were concentrated on the risk factors which contribute to the occurrence and effect of the disaster and crisis preparedness. Therefore, there is a need to strengthen the evidence base regarding the policy and implementation of environmental health prevention and control and disaster preparedness in Malaysia.

Evidence Map 7 (Nutrition, Food Safety and Quality)

We reviewed the effects of interventions and preventions in response to nutrition, food safety, food security and food quality (sovereignty). We also searched biomedical research on physiological mechanisms and risk factors related to nutrition, as well as food safety and quality. Outcomes of interest were variedly defined as obesity, nutritional status, endocrine and metabolic diseases, NCDs-related outcome, morbidity and mortality attributable to nutrition, food safety, food security and food quality. We searched primary research, surveys, systematic or scoping reviews, and randomized controlled trials or any clinical trials. Systematic searches retrieved 10968 records. An additional 230 studies were identified from reference list. After removing duplicates, we screened a total 8138 titles and abstracts. We retrieved a total of 2292 full text studies for the analysis. A total of 1415 records were retrieved for full text. Of these, a total of 227 were included in the gap mapping. Most published studies in Malaysia focussed on biomedical and physiological aspects. Only 147 studies were concerned with risk factors, and 28 evaluated targeted therapy for relatively small groups of population with specific conditions. There appeared to be no studies related to programme developments and intervention to reduce the occurrence disease related to nutrition. We identified opportunities for population-level research in the form of clinical trials (randomised or cluster-randomised) or population-level longitudinal studies on the effects of life style interventions to prevent or treat nutrition-related morbidities and improve quality of life. However, since there is an established Nutrition Research Priorities (NRP) for Malaysia under the 12th Malaysia Plan (2021-2025) which were prepared earlier under the Technical Working Group on Nutrition Research, National Coordinating Committee on Food and Nutrition, MOH, Malaysia[28], we have adopted the top three ranking of research priority areas into our document.

Evidence Map 8 (Oral Health)

We reviewed the literature on the effects of interventions to prevent or treat oral or dental conditions, as well as risk factors for developing oral and dental conditions and their complications. We also examined aspects of health service delivery as relevant to oral and dental health. Outcomes of interest included periodontitis, gingivitis, dental carries, malocclusion and oral cancer) and accessibility to the oral and dental services, diseases related to the oral and dental health. All primary research, survey, systematic or scoping reviews and randomized controlled trials or any clinical trials were covered. Systematic searches retrieved 16705 records. Using the reference lists, an additional 102 eligible records were retrieved, yielding a total of 16807 records. After removing duplicates, a total of 12613 were screened. We retrieved a total of 598 full text records for inclusion. We were unable to retrieve 214 records due to time constraints. Of these, we included a total of 126 studies for evidence gaps analysis. Most studies concentrated on the biomedical and physiological aspects, with very few studies identified in relation to accessibility, effectiveness of interventions, risk factors (i.e., risk factors overlapping with NCDs and biomedical research), and programme developments to increase the occurrence disease related to oral cancer. From the scoping exercise, we identified opportunities for research in the above-mentioned areas, especially in the form of patient or population level interventional or observational studies.

Figure 2 depict the main focus that are embedded within the framework for research and implementation as applied to health system, NCDs and communicable diseases that intends to link to primary research, evidence synthesis and implementation with policy and practice. The areas are complemented by an integrated activity on priority research areas and networking between researchers, stakeholders and community participation aiming to develop larger and comprehensive coverage of research areas with long-term infrastructure and research-to-policy collaborations.

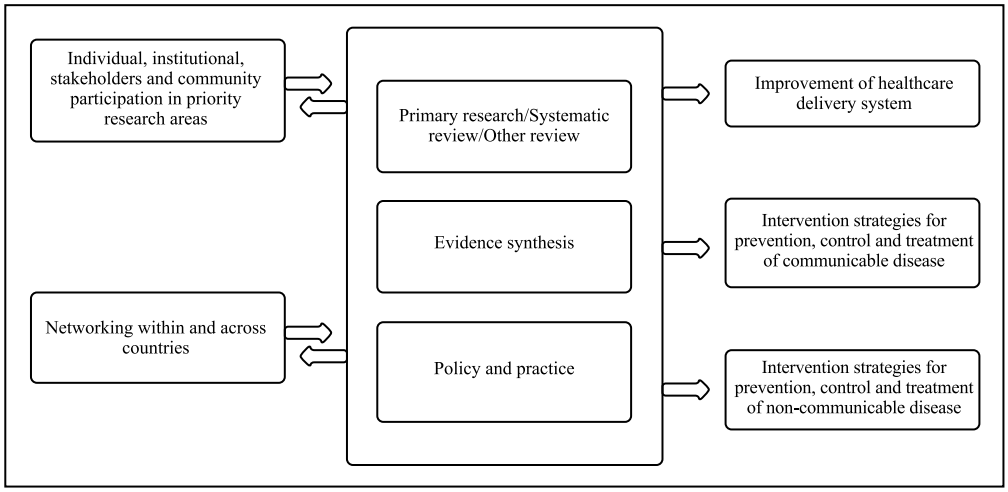

Figure 2. Framework for research and implementation as applied to Health System, Communicable Diseases and NCDs.

Due to limited time, lack of personnel and unavailability of electronic databases, there was incomplete screening of the search results for the evidence maps on population-level interventions to prevent communicable and non-communicable diseases. Our guide to evidence maps could be adapted to derive research priorities for different audiences and purposes in the Malaysian setting and beyond. Due to time and the current situation, our approach also incorporated the Delphi method for building consensus. We identified the technical expert for the Delphi Method from the group of clinicians, programme managers and researchers from the MOH, and the public and private universities. Planning for implementation is inherent in our approach. Very few priority-setting exercises systematically assess whether the research priorities generated have any impact. Our approach to setting evidence-based and stakeholder-informed research priorities emerged as a useful method of strengthening research collaboration within and across Malaysia. During the implementation phase, we will expand on these collaborations in an effort to build long-term capacity and infrastructure for evidence-based health care and public health in Malaysia.

Monitoring, evaluation and review of Health Research Priorities

Monitoring, evaluation and review are essential functions to ensure that health research activities outlined in the HRP document is implemented as planned against stated objectives and desired results. Monitoring is defined as collecting, tracking and analysing data to determine the uptake of priority research activities. In this context, we will develop the indicators and targets which will be linked to the health research priorities which will be monitored by the 12MP-HRP core team. The 12MP-HRP core team will evaluate the uptake of health research priority areas annually based upon the monitoring data. The 12MP-HRP core team will review and gather evidence through monitoring and evaluation processes to assess progress and performance of the research activities. Health research priority reviews require all research institutes and other stakeholders to provide the basis for mutual accountability and information to the 12MP-HRP core team.

CHAPTER 3: HEALTH SYSTEM

Introduction

The WHO defines health system as *"all the organisations, institutions, and resources whose primary intent is to promote, restore or maintain health."*[29] This definition includes the full range of players engaged in the provision and financing of health services including the public, private, voluntary and not-for-profit organisations.

The World Health Report 2000 described the overall mission of a health system as follows: improving health and health equity, in ways that are responsive, financially fair, and make the best, or most efficient, use of available resources.[30] There are also important intermediate goals within the mission: the route from inputs to health outcomes is through achieving greater access to and coverage for effective health interventions, without compromising efforts to ensure provider quality and safety. Health System is represented by multiple disciplines of which it can be overlapping with other disciplines for the priority areas. Therefore, guided by these documents, we divided the priority areas into seven key functions of the health system: (1) healthcare financing, (2) health resources (human and facilities), (3) innovation and technology in health, (4) service delivery, (5) public-public integration, (6) public-private integration (7) equity, and (8) health literacy, community empowerment & mobilization.

Health services are the most visible function of any health system, both to users and the general public. Good health services are those which deliver effective, safe, high quality care to those that need it, when needed, and with minimal waste. Effective health service delivery depends on having key resources which include trained personnel, adequate devices, good infrastructure and information. Many questions remain about how to improve the organisation and management of health service delivery so as to achieve better outcomes.

Governance plays a pivotal role in maintaining and enhancing the quality of care and patient safety in the health system. A good governance function reflects the fact that people entrust both their lives and their resources on the health system.

Therefore, the stewardship of government is vital in developing the necessary regulations that govern the operation of health services so that all involved parties will adhere to them. Specifically, the MOH is responsible in developing, implementing and enforcing health sector policies and regulations to improve the performance of the health system to deliver the optimal standard of care.

Human resources represent the backbone of any health system. It involves the recruitment, training, deployment, and retention of qualified personnel in a health system. The WHO acknowledged human resources as the most important part of a functional health system. Without well-trained fully-equipped and highly motivated personnel, health care delivery will be compromised, leading to serious implications for the health system.

In addition, health financing is a key determinant of health system performance especially from the perspectives of equity, efficiency and quality. Health financing encompasses resource mobilisation, allocation, and distribution at all levels. It plays a fundamental role in improving healthcare service coverage and financial protection in the effort of achieving and sustaining universal health coverage. Therefore, in depth understanding of health financing can address questions on financial protection, equity of access and efficiency of the health system.

Health information system (HIS) is an essential part of health management and a vital component of the health system. However, HIS in many countries suffers from poor management and insufficient resources. As a result, there is limited opportunities to explore into modern innovation and technology advancement in healthcare. The lack of capacity in measurement and analysis of health information are well-known constraints to guide policy-making and resource allocation at national and local levels.

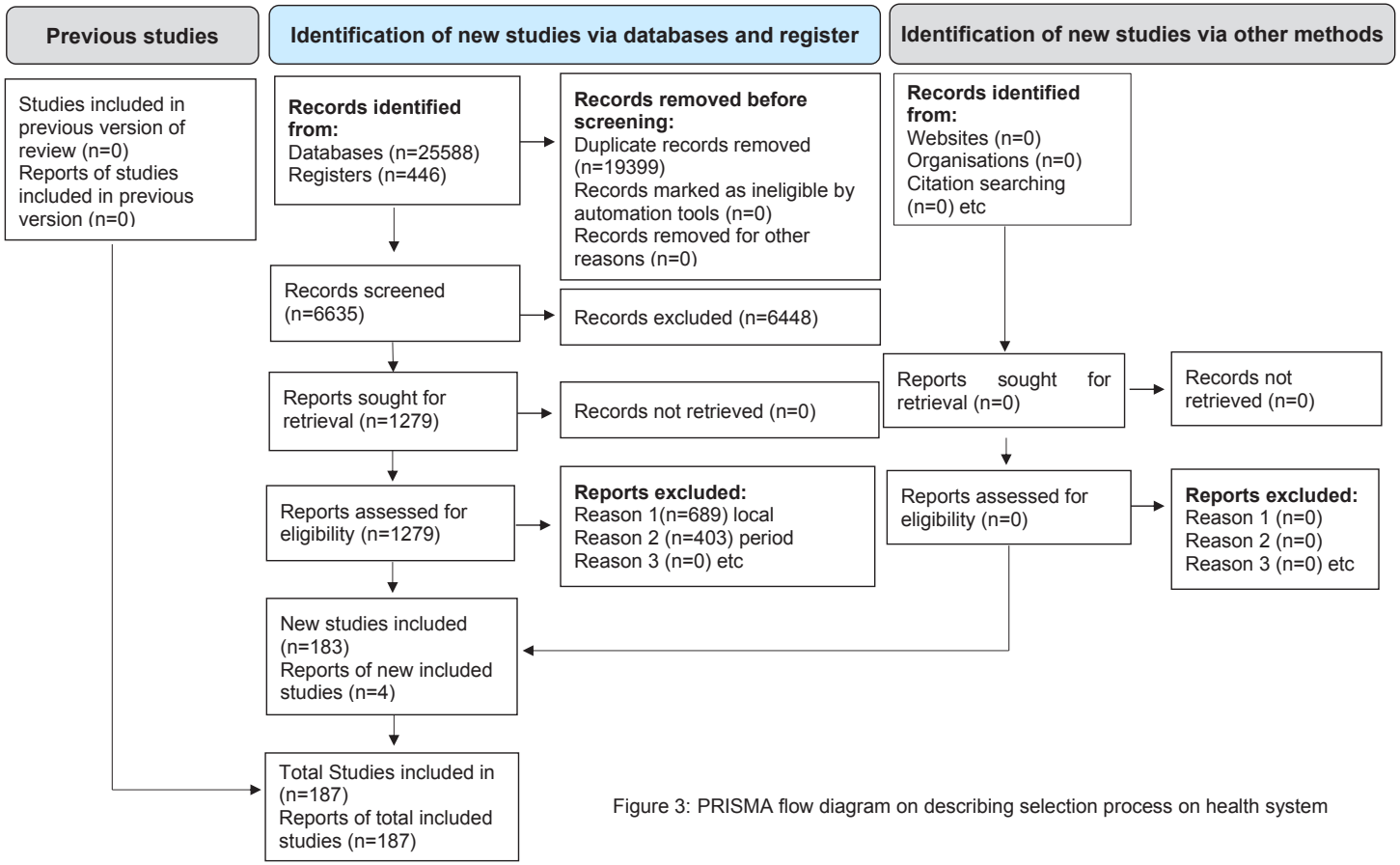

Figure 3: PRISMA flow diagram on describing selection process on health system

Priority Areas for Health System

Color Reference										
RMK-12 Auto-priority		1-15		16-31		32-47		48-63		64-79

National Problem	Research Scope	Gaps & Needs (Rationale)	Focus Area	Expected Output	Rank
Healthcare financing	Affordability	1. Cost recovery of some implemented services on health financing schemes for certain services. Out of pocket spending by public by population groups. 2. Size, location and coverage of health services for vulnerable group.	1. Community opinion on fulfilling some of the users' fees	1. Equitable access in obtaining service in terms of coverage, quality and safety	5
		1. Lack of data regarding the affordability of healthcare in Malaysia	1. The affordability healthcare services in Malaysia. -across public and private sectors -across income brackets -across risk profiles	1. Findings on affordability will inform policies regarding health financing reform	1
			2. The affordability of private health insurance in Malaysia -across income brackets -across risk profiles -to also cover affordability of employer sponsored insurance policies		8
		1. Lack of data regarding the true rate of medical inflation	1. To determine the rate of medical/ healthcare inflation in Malaysia	1. A new CPI for healthcare	7

Color Reference						
RMK-12 Auto-priority	1-15	16-31	32-47	48-63	64-79	

National Problem	Research Scope	Gaps & Needs (Rationale)	Focus Area	Expected Output	Rank
		-Department of Statistics Malaysia (DOSM) Customer Price Index (CPI) for healthcare is derived from a basket of goods which is not representative of the healthcare market			
	Costing	1. Limited costing data on delivery of health care 2. Limited costing data to support the development of a value-based healthcare model	1. Cost analysis in delivering health services (ambulatory care, transportation, in-patient care, non- hospital-based specialist care, etc.) Focus on actual quantum for services (including direct non-medical costs (patient's costs) 2. Determining the cost of delivering healthcare services in Malaysia relative to outcomes. -Across public and private sectors 3. Determining the cost of managing specific diseases in Malaysia on a population and individual level, relative to outcomes. -Across public and private sectors	1. Data to be used in health care planning, budgeting and reimbursements 2. Cost analysis data to be used in health care planning, budgeting and reimbursements	3

Color Reference										
RMK-12 Auto-priority		1-15		16-31		32-47		48-63		64-79

National Problem	Research Scope	Gaps & Needs (Rationale)	Focus Area	Expected Output	Rank
	Efficiency	1. Current MOH budget allocation process is based on historical/line-item budgeting, and is not designed to maximize allocative efficiency 2. Difficulty in targeting government healthcare assistance/subsidies towards lower income/ vulnerable groups, as unable to assess needs/ incomes accurately -current assessment methods are time consuming and labour intensive, resulting in delays in approval of assistance -inclusion/exclusion errors in *Bantuan Sara Hidup* (BSH) database 3. Inefficiency at institutional level; Identifying the best proxy measures of technical efficiency	1. Effectiveness of (allocative efficiency) the current MOH budget allocation process, and the appropriate budget allocation mechanisms/methodology to maximize efficiency 2. Effectiveness/efficiency of the current means-testing approach used by MOH, and other mechanisms can be employed to maximize efficiency 3. Measuring health system performance between institutions; Maintaining output by reducing input	1. New MOH budget allocation mechanism 2. Measures to reduce unnecessary wastage at institutional level	10

Color Reference						
RMK-12 Auto-priority	1-15	16-31	32-47	48-63	64-79	

National Problem	Research Scope	Gaps & Needs (Rationale)	Focus Area	Expected Output	Rank
	Financing	1. There is a need to gauge the public's perception regarding health insurance before embarking on health financing reforms	1. Identifying the public's perception on the need/usefulness of health insurance 2. Identifying employer's perception on the health insurance coverage for employees	1. Understanding of public's perception regarding health insurance	14
			3. Political economy of health system (including health financing) reform		11
		1. Lack of understanding on how the current health financing setup in Malaysia is affected by COVID-19/ economic downturns, and its consequent impacts on access/equity/utilisation	1. To evaluate the impact of COVID-19/ economic downturns/cycles (e.g. during COVID-19) on health financing, and its consequences for healthcare accessibility/equity/utilisation 2. How much fiscal space is available for health, post COVID-19? impact of COVID on access/utilisation/ equity	1. Findings can be used to justify increases in public health spending, or a shift towards alternative forms of public financing for health (e.g., national insurance schemes)	2
		1. Current benefit package not designed according to population health needs and cost effectiveness BP (before premiums)	1. Coverage of services under public health financing system (essential/ universal benefit package)	1. A standardized method for developing BP with proposed essential benefit package taking into account: population health needs, cost effectiveness, budget impact, supply side	4

Color Reference										
RMK-12 Auto-priority		1-15		16-31		32-47		48-63		64-79

National Problem	Research Scope	Gaps & Needs (Rationale)	Focus Area	Expected Output	Rank
				capacity, equity and other ethical considerations	
		1. Inadequate public funding for health 2. Lack of local data regarding the effectiveness of mandatory health insurance schemes in achieving UHC	Actuarial studies for health financing: 1. Cost of providing an essential benefit package of services 2. To analyse the appropriate level of publicly-managed financing needed in order to improve coverage at an individual level 3. To analyse the level of health expenditure required per-capita for various population groups (across age groups, risk profiles), and subsequently to determine the impact of population ageing on health expenditures 4. To analyse appropriate premium rates, taking into account considerations of equity, health expenditure growth, gross domestic product growth, economic impact, fiscal space 5. Effectiveness of mandatory health insurance schemes such as Foreign	1. To determine level of funding required 2. To determine level of public funding required 3. Health care expenditure projections for various scenarios 4. To determine premium rates 5. Evidence regarding the effectiveness of mandatory health insurance schemes in the Malaysian context	9

Color Reference										
RMK-12 Auto-priority		1-15		16-31		32-47		48-63		64-79

National Problem	Research Scope	Gaps & Needs (Rationale)	Focus Area	Expected Output	Rank
			Worker Health Insurance Coverage Schemes (SPIKPA) in improving access/ financial risk protection/health outcomes for the relevant target populations		
		1. Lack of legal and regulatory framework, accountability and transparency; Minimal in the public-private partnership; Unclear about the sustainability in resource generation; Issues and challenges on resource generation from out-of-pocket (OOP) payment 2. Concerns about the sustainability of resource generation from taxes, public charges, sales of natural resources health insurances and employer contributions	1. Private-public partnership in term of governance, resource generation and resource optimization; Financial cross-subsidy system between affluent and poor patients within the private sector 2. Example of a tax system that is capable of financing the necessary level of public spending in the most efficient and equitable way possible. Feasible additional resources to finance priority interventions that assure coverage of the poor within society	1. Formulation of legal and regulatory framework between public and private 2. The best practice to enhance Private-Public Partnership 3. Formulation to achieve sustainable resources between public and private 4. Framework for financial cross-subsidy system between affluent and poor patients within the private sector	6

Color Reference						
RMK-12 Auto-priority	1-15	16-31	32-47	48-63	64-79	

National Problem	Research Scope	Gaps & Needs (Rationale)	Focus Area	Expected Output	Rank
		1. Limited evidence about the incidence of catastrophic health expenditures faced by households and difficulties to ensure financial protection to the household of informal sector and the self-employed	1. Financial barriers in accessing most needed health care services by the household of informal sector and self-employed	1. Establishing and managing new prepayment schemes which is uncomplicated and well-informed benefit package to increase people's awareness of their entitlements for health insurance.	31
Health resources (human and facilities)	Quality of training & competency	1. Information mechanisms of regulation to maintain quality of education, training, and practice	1. Evaluation of training programs, and their role in improving job performance.	1. Expansion of educational programs, and the number of health personnel in a realistic and sustainable manner in various fields manner in various fields	68
			2. Evaluation programs and plans for external scholarship in health sector according to the actual needs of the MoH, and its role in improving career performance and improving the provided services		66
		1. Competency of various human resources for health (HRH) categories to meet the increased demand and expectation, disease pattern complexity, demographic transition, emerging technologies are inadequately assessed	1. Competency measures for HRH categories according to their job demands/ specifications	1. Approaches/ organisational strategies to address the mismatch between competency and job description such as improving the standard of competency of various categories, competency-based placement at	60

Color Reference						
RMK-12 Auto-priority	1-15	16-31	32-47	48-63	64-79	

National Problem	Research Scope	Gaps & Needs (Rationale)	Focus Area	Expected Output	Rank
				appropriate area (e.g., skill matched to task, staff matched to workload)	
	Provider behaviour	1. Limited information on knowledge regarding work-related environment and workload 2. Immigration of health personnel between countries, public and private (problems and solutions) 3. Financial and non - financial incentives to maintain qualified health personnel of health institutions, and increase their satisfaction for the purpose of improving the efficiency and quality of health care 4. Lack of assessment and identification of organisational factors related to corruption	1. Impact of work pressure on the performance of doctors, consultants, and its reflection on the confidence of patients	1. Mix of financial and non - financial regulatory policies to improve the distribution and maintaining health personnel 2. Strategies to improve mental health and practice environment. Strategies to prepare organisations in term of staff, leaders, facilities, to embrace change and what can be done prior from policymakers to ensure smooth implementation of these changes	57
			2. Mental health status among HRH and practice environment, strategies to improve organisational effectiveness		66
			3. Assessment and exploring organisations readiness for change such as readiness study on hospitals		53

Color Reference										
RMK-12 Auto-priority		1-15		16-31		32-47		48-63		64-79

National Problem	Research Scope	Gaps & Needs (Rationale)	Focus Area	Expected Output	Rank
		such as ghost workers, absenteeism or selling of public-funded resources e.g. drugs 5.Lack of comprehensive data on mental health status of HRH and practice environment 6. Limited assessment of readiness of the organisation such as hospitals to embrace change (e.g., implementation of lean healthcare or change of culture)			
	Specialist manpower needs & roles	1. Information the way to control and improve performance.	1. Organisation of the health personnel in order to provide effective services, on various levels regarding the system (primary, secondary and tertiary facilities)	1. Improvement of health service 2. Distribution of manpower in health institutions, and managing them in an effective management and right manner	

Color Reference						
RMK-12 Auto-priority	1-15	16-31	32-47	48-63	64-79	

National Problem	Research Scope	Gaps & Needs (Rationale)	Focus Area	Expected Output	Rank
	Human Resource Management (HRM) workforce lifespan	1. The outcomes of the program/policies introduced for HRH benefit were not comprehensively assessed	1. The effectiveness of strategies employed such as Full Paying Programme (FPP), flexi system and other approaches	1. Effectiveness and sustainability of current strategies in HRH management.	46
	Primary care needs/ health coverages	1. Effect of specialized PHC 2. Evaluation and improvement of the referral system 3. The role of Traditional and Complementary Medicine (T&CM) in PHC setting 4. Challenges in coordination, integration and continuity of care among primary care, nursing care, specialty care and other various healthcare providers including T&CM. (i.e., within and across public, private and other sectors)	1. Identifying the extent of patient satisfaction in the type of the provided PHC service	1. Impact of patient satisfaction on the treatment with the provided health service	37
			2. Efficiency of level of appointments system in PHC		38
			3. Mapping of the PHC facilities and services with T&CM supply demands	2. Strategic planning for T&CM in PHC towards UHC	
			4. Factors that improve or hinder the coordination, integration and continuity of care within and between sectors.		13

Color Reference						
RMK-12 Auto-priority	1-15	16-31	32-47	48-63	64-79	

National Problem	Research Scope	Gaps & Needs (Rationale)	Focus Area	Expected Output	Rank
	Health care needs/ Coverage	1. Lack of evaluation of healthcare programmes, services, work processes including standard operating procedures (SOP) in various areas (e.g., in child and maternal health, food and safety, laboratory, dental, pharmacy, T&CM and other levels of care or relevant fields)	1. Effectiveness, efficiency and health outcomes of programmes and services delivered. Examples include LEAN management of healthcare to improve effectiveness and efficiency; performance benchmarking; T&CM services in PHC/ T&CM units in public hospital/ private healthcare facilities	1. Provide inputs for the strengthening and revision of existing programmes, services, work processes including SOP, clinical practice guidelines and others	16
	Health system research	1. There are major resource limitations in human resource and equipment for quality of care along the chronic disease such as cancer care continuum e.g., majority of subspecialty cancer surgeons and oncologists' practice in the private sector 2. Inadequate of information on the use of	1. Monitoring, evaluation and projection of human resource needs. Human resource/ capacity not well measured creating a low capacity in high quality care, inclusive of highly specialized surgeons, oncologists, psychologists, social workers, physiotherapist, occupational therapists) in public hospitals and remote areas	1. Policy: Data driven evidence-based planning for projection of national needs 2. Policy: High quality service provision by both public and private sector practitioners may be provided across public and private health systems by using innovative financing mechanisms	
			2. Monitoring, evaluation and projection health systems/capacity not well measured creating low access to quality of care e.g., lack of radiotherapy services in east coast of Malaysia, east Malaysia		

Color Reference						
RMK-12 Auto-priority	1-15	16-31	32-47	48-63	64-79	

National Problem	Research Scope	Gaps & Needs (Rationale)	Focus Area	Expected Output	Rank
		T&CM in healthcare system to provide evidence-based decision making	3. Economic implementation of chronic diseases e.g., Patient Navigation (how to reduce patient barriers i.e. reduce follow up, reduce screening).	3. To have efficient planning strategies of T&CM human resource and better integration into the national HHR master plan 4. Improve quality assurance and policy oversight of T&CM medicinal materials	
			4. Study the demand and supply of T&CM health human resource (HHR).		
			5. Evaluation of T&CM medicinal material's supply chain in Malaysia.		
		1. Lack of information on the current status/ coverage and future needs of national healthcare supply (services, health facilities, equipment, and human resource) to provide evidence for future planning	Supply & Demand Study for Healthcare Services, Facilities, Equipment & Human Resources Capacity in Malaysia inclusive of: 1. What is the current healthcare supply in the country in terms of services, health facilities, equipment, and human resource (involving public, private and n on-profit organisation etc.)?	1. To have a comprehensive and integrated strategic planning system / method to ensure efficient planning of service, facility, equipment and human resource	
			2. What is the current healthcare demand (based on burden of diseases) and future needs until 2030?		
			3. Supply and demand gap analysis and propose projected future supply requirements for a 5-year interval until 2030.		

Color Reference										
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National Problem	Research Scope	Gaps & Needs (Rationale)	Focus Area	Expected Output	Rank
			4. Benchmarking of health indicators related to i & ii to the appropriate countries, and where relevant to propose new benchmark indicators based on best available evidence-based findings and / or research globally.		
		1. Inadequate analysis, assessment and/or application of mortality, morbidity, public health (e.g., vaccination, occupational, health, environmental hazards, etc.) as well as T&CM practices and services and clinical data at practice or primary care level to identify and tailor programmes or services needed for the communities	1. Community-oriented provision of health services at practice or primary care level, based on available data (e.g., clinical, mortality, morbidity, public health data, etc.).	1. Strategies that enable or train healthcare innovators to conceptualise, implement, evaluate and disseminate community-oriented primary care programmes	
		1. Inability to provide health services that are convenient to users (i.e., convenient time such as non-traditional service hours or when needed	1. The current needs and expectations of users on healthcare services.	1. Delivery arrangements that could be organised to accommodate both users and providers needs and expectations	32

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National Problem	Research Scope	Gaps & Needs (Rationale)	Focus Area	Expected Output	Rank
		holidays, ability to get appointments, waiting time in doctor's office), delivery methods (telephone, internet, etc.) and other demands as well as expectations of users (i.e., first class ward)			
		1. Lack of information regarding utilization of existing healthcare facilities and equipment (government and private sector) to provide evidence for future planning	1. Utilization of major imaging equipment i.e., Computerized Tomography (CT) scan and Magnetic Resonance Imaging (MRI).	1. To have a comprehensive and integrated strategic planning system / method to ensure efficient planning of service, facility, equipment and human resource 2. To identify the trend of utilization of computerized & Examination (C/E) rooms in MOH hospitals 3. To evaluate and compare utilization of CT scan and MRI in MOH and private hospitals	

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National Problem	Research Scope	Gaps & Needs (Rationale)	Focus Area	Expected Output	Rank
				4. To identify opportunity to optimize utilization: - C/E rooms in MOH hospitals - CT scan and MRI in MOH and private hospitals	
		1. Improving the evidence underpinning performance indicators for health systems assessment. Inadequate concerted and coordinated effort and/or maximising use of resources for health improvement	1. Research on concept and performance frameworks, on all stages of care delivered, covering all domains of healthcare. 2. Research on practice of benchmarking and performance improvement and indicators development. 3. Factors contributing to shortfall in quality and effectiveness of the measures to improve performance *including to identify the impact of quality initiatives in patient care in hospitals. 4. Identify suitable performance indicators for measuring the quality and effectiveness of T&CM services provided at public healthcare facilities.	1. Availability of indicators, benchmarking methodologies and systems, effective strategies, governance, or resources to support the development and improvement initiatives that head of services may want to be incorporated into, implemented or tested (i.e., systems that facilitate and help heads of service to achieve change and improve services) (KPI, etc.)	50

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National Problem	Research Scope	Gaps & Needs (Rationale)	Focus Area	Expected Output	Rank
	Brain drains	Migration is an international issue. Need to understand and develop strategies to retain and attract manpower	Adapting to the challenges of migration and reverse migration of trained HC personnel.	Understanding of migration trends and reasons to enable managers to plan for manpower needs	72
	Foreign contract doctors	1. Efficiency & effectiveness of service 2. Identifying gaps in care	Quality of care, efficiency and value for service.	Standardising and balance care to meet optimal service	74
	Robotics in Healthcare	1. Lack of data showing effectiveness of robotics usage in healthcare setting.	1. Identify hospital services suitable for robotics technology.	1. To conduct routine tasks especially in areas where human resource is limited. 2. Medical robot for precise manipulation of medical instrument beyond human capability	59
	Healthcare facilities	1. Identifying the effect of new technology as compared to current technology	1. AI for biomedical devices and healthcare facilities.	1. Improve the condition and efficiency of healthcare facilities and engineering services at the healthcare facilities	51
			2. Engineering and monitoring system for healthcare facilities.		62
			3. Engineering materials for healthcare facilities.		52

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National Problem	Research Scope	Gaps & Needs (Rationale)	Focus Area	Expected Output	Rank
Innovation and technology in health including AI and precision medicine	Health information management	1. Information Systems Support which is based on health institutions, census and others, in order to generate, analyse, and use reliable information from multiple data sources 2. Information exchange from HIS do not happen directly without needing to map metadata, which affects the content of data collected 3. Unclear relevance of each indicator collected (new or legacy) in accordance to the current health situation in Malaysia. Uncertainty whether all data that are (and has been) collected is properly utilised/analysed 4. Un-unified informatics standards and criteria for information management	1. Sharing and development of electronic medical records (EMR).	1. Improving the notification system and reports in the surveillance system for diseases and risk factors and related vital status 2. Accurate information on health data from EMR 3. Broaden and augment the functions of existing systems in MOH 4.Strategies/ guidelines/innovations/ interventions/solutions for a streamlined HIS to increase efficiency in data management, subsequently improving care continuum for patients and providers across sectors 5. A national guidance documents for establishing HIS for healthcare institution	42
			2. The consequences, benefits and impact of data interoperability.		54
			3. Degree of fragmentations and the extent of silos of existing HIS in MOH.		63
			4. Synthesis and utilisation of routine data that are (and has been) collected e.g. exploration of Big Data analysis. Exploration of new data to be collected and new indicators to be measured.		64
			5. Research of reviewing and establishing unified informatics standards for establishing medical information system.		70
			6. Research of assessing uptake and utilization of cloud/hybrid cloud-based informative system in Malaysia.		76

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National Problem	Research Scope	Gaps & Needs (Rationale)	Focus Area	Expected Output	Rank
		system creating hurdles in information integration and sharing 5. Underutilization of cloud/ hybrid cloud technology-based information system		6. Strategies for cloud/ hybrid cloud-based technology utilization in healthcare informative system	
		1. Verbal autopsies were introduced in Malaysia in August 2017 in order to improve recording and classification of cause of death for the national vital statistics. However, comparison of data quality for cause of death data before and after implementation of verbal autopsies have not been evaluated	1. Compare the quality of cause of death data before and after implementation of verbal autopsies (2016 - 2019).	1. Demonstrates the use of verbal autopsies to improve data quality of vital statistics 2. Enhance & improve national guidelines/SOP for verbal autopsies	77
		1. Clinical coding is an integral part for good quality data for morbidity and mortality statistics. Assessment of knowledge and awareness on clinical	1. Assessment of knowledge, practice and training needs for clinical coding.	1. Provide background information on the level of knowledge and awareness on clinical coding	71

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National Problem	Research Scope	Gaps & Needs (Rationale)	Focus Area	Expected Output	Rank
		coding and identify the issues on clinical coding practise in MOH healthcare facilities		2. Provide recommendations on how to instil awareness and improve the knowledge on clinical coding among healthcare practitioner 3. Better data quality through a more accurate clinical coding on diagnosis and procedures	
		1. The physical Information and Communications Technology (ICT) infrastructure readiness (availability) at each health facility setting e.g., electrical supply and internet accessibility, in accordance to their geographical location was not comprehensively assessed prior the development of a HIS, which will later affect the system's functional performance	1. Physical ICT infrastructure availability in MOH facilities	1. Recommendations on strategies/guidelines to evaluate the physical ICT infrastructure readiness prior HIS development	

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National Problem	Research Scope	Gaps & Needs (Rationale)	Focus Area	Expected Output	Rank
	Biobank and precision medicine	1. To address public, scientific and local needs on sustainability and sound criteria and procedures biobank-specific access policies	1. Data garnered from biobanks can help identifying specific traits that may correlate with higher risk for severe disease, potentially leading to a better understanding of the organism and more targeted therapies	1. Serves as reservoirs for translational and clinical research, providing human samples that can be tested for genetic markers related to specific diseases 2. Serve as a source of primary human tissues, with some storing millions of samples from hundreds of thousands of patients	49
	Quality of information systems and digital health	1. Provision of comprehensive data and information to cover the needs of the health system in planning, evaluation and follow-up, to be placed in a database serving research in health institutions 2. Digital technologies	1. Quality of current health information technology (IT) systems. Evaluate the implementation, quality & reliability of clinical data when compared with old systems, etc.	1. Development of a set of fundamental & additional standards and indicators to track the performance of the health system	58
			2. Expansion of the digital mainframe and technologies in health departments and institutions, and standardize system among different health institutions		55
		1. Various information systems have been developed by MOH with the intention to facilitate	1. Understanding the experiences & needs of decision-makers on the use of evidence in public health decision-making	1. Provide a better understanding on the preferences of decision-makers on the methods	45

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National Problem	Research Scope	Gaps & Needs (Rationale)	Focus Area	Expected Output	Rank
		evidence-based decision making. However, assessment on whether these information systems and the reports produced has fulfilled the needs and expectations of the decision-makers has not been documented	2. Issues on HIS that have been implemented and deployed among MOH human resources (ground user, frontline workers etc)	to get evidence for decision-making 2. Provide input on the decision-makers preferences on how to design and develop information system that is useful and beneficial for the organisation 3. Recommendation of best-practice to develop such systems	69
		1. Data management activities are mostly done manually, which could affect safety and quality of care. HIS should be able to handle data management activities e.g., data collection, storage, quality-assurance, processing, compilation and cleaning	1. Automated technology e.g., the Extract-Transform-Load (ETL) tool for data management purposes. The validation process of IT components to support data management	1. Recommendations on strategies to optimise human resource for data management e.g., staff only need to monitor the ETL process rather than doing the entire data management process manually. 2. Recommendations on solutions to improve data quality.	79

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National Problem	Research Scope	Gaps & Needs (Rationale)	Focus Area	Expected Output	Rank
		1. Provision of high accuracy asset and service data	1. Quality of current asset and service information system (Asset and Services Information System (ASIS), Concept-Aware Social Image Search (CASIS), Computerized Asset Maintenance & Management System (CAMMS))	1. Evaluate the implementation, quality & reliability of data when compared with old systems, etc. 2. Improve quality of data	
	Big Data	1. Under-reporting of chronic disease such as cancer or diabetic incidences in Malaysia reduces ability for data driven decision making 2. Lack of studies studying the socio-economic factors and indicators in Malaysia	1. Quality improvement projects in improving chronic disease such as cancer reporting in all hospitals providing cancer care	Policy: 1. Evidence based policy making for monitoring of chronic disease incidence and outcomes 2. Mandatory reporting of chronic disease	47
			2. Big data (Spatio-temporal incidence of chronic disease and association with socio-economic conditions)		65
	Advanced medical printing	1. Advanced medical printing provides a highly personalized solution for patients in rehabilitation which has not been utilised correctly	1. Gap analysis and strategy of improving utilization of advanced medical printing in fields like rehabilitation medicine	1. Strategy to close the gap of underutilization in advanced medical printing	75

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RMK-12 Auto-priority	1-15	16-31	32-47	48-63	64-79	

National Problem	Research Scope	Gaps & Needs (Rationale)	Focus Area	Expected Output	Rank
Service Delivery	Service contracting	1. Current outsourced support services have not fully achieved expectations and uncertain if value for money (cost effectiveness)	1. Capacity of MOH to monitor and enforced contractual services with special reference to major outsourced services (drug purchase, engineering services, support services, etc)	1. Improved capacity of MOH to use outsourced services effectively. Better utilisation of money spent on services. Improved functioning of outsourced services	78
		1. Concerns in ensuring transparency of healthcare purchasing and contracting, including political involvement, conflict of interest and asymmetrical information between consumer and provider	1. Sharing of supplier and contracting information of healthcare cost and price	1. Publicly accessible platform for supplier information sharing between suppliers; Strategies for contracting the provider that is free from political involvement, conflict of interest and asymmetrical information between consumer and provider	72
	Health regulation	1. Private Healthcare Facilities and Services Act recently enforced and needs evaluation	1. Impact of Private Healthcare Facilities and Services Act on delivery of services (Evaluating implementation, enforcement, private service providers perspective, benefits to consumers of health care)	1. Input to assist revision of Private Healthcare Facilities and Services Act. Suggestions on better implementation, enforcement of the act	44

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RMK-12 Auto-priority		1-15		16-31		32-47		48-63		64-79

National Problem	Research Scope	Gaps & Needs (Rationale)	Focus Area	Expected Output	Rank
	Health planning	1. Geographical mal-distribution of infrastructure and services with lack of equity	1. Mechanisms to regulate service development by private and public healthcare (e.g., How to decide where to build a clinic/hospital)	1. Tools to improve regulate and distribute service development/ delivery by private and public healthcare. Improved equity of services	43
		1. Lack of transparency is associated with poor participation of public in healthcare that could inhibit citizens' efforts/ in giving voice to public, to hold health systems accountable.	1. Transparency in health planning and delivery process to promote and ensure the participation of public in healthcare planning and delivery	1. Strategies/approaches that foster system design to promote transparency	67
		1. International literatures suggest that many MOH do not fully utilise evidence for health planning.	1. Development of monitoring mechanism to monitor and capture the impact of 'Knowledge Translation' and utilization of research	1. System (web-based) for project management and knowledge translation activities	56
	Organisational structure	1. Public not fully involved in health care transformation process. People-centred care (PCC).	1. Public views, acceptability development of intervention and strategies to buy in stakeholders for health care reform	1. Facilitate implementation of healthcare reform initiatives/policies	48
		2. Current trend of social	2. Effectiveness of current trends in ensuring effective health planning which	1. Delivery arrangements and implementation	61

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National Problem	Research Scope	Gaps & Needs (Rationale)	Focus Area	Expected Output	Rank
		media (blog, Facebook, Twitter, etc.) can be used as channels for public engagement to establish PCC.	takes into account representativeness of the voices of the community.	strategies including models of care, interventions or approaches that could be used to facilitate the implementation of healthcare transformation initiatives or policies	
		1.Transparent information/ decision made by government/provider regarding health is not always available to public	1. Readiness of the government/provider to disclose information to the public, and readiness of the public to perceive the information	1. Strategy to improvise quality care and the confidence of public in the government/provider	40
	Person-centred care (PCC)	1. Inadequate patients and care-givers empowerment, harnessing patient and care-givers as a resource to improve safety and clinical outcome	1. Understand, measure and report on patients' experiences, patient care journey, patient and public involvement in delivery of care, association between patient experience, patient safety and clinical effectiveness and patient or community empowerment	1. Evidence to support the formulation of policies, strategies, intervention to improve the safety and quality of health service and its delivery	25
		1. Individuals and communities lack knowledge, skills and support to weigh health information/ advice and make responsible and	1. Initiatives and interventions (including health literacy and effective methods) to help or facilitate people towards shared decision making (SDM) and well-informed health choices as well as empowering individuals, families and communities	1. Policies to promote and foster capacity of individual and community to make well-informed health choices for their health and healthcare,	29

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National Problem	Research Scope	Gaps & Needs (Rationale)	Focus Area	Expected Output	Rank
		informed decisions for their health and healthcare use (e.g., vaccine hesitancy, use of generic medication, T&CM, etc.)		improve health literacy and take action to attain their full potential in health	
		1. Inadequate and/or insufficient access to social support networks during hospital stay and after discharge. This includes access to family, friends, religious elders and or organisations according to the needs of the clients	1. Adequacy of access, expectations and effective approaches in a multicultural society. Effect of lack of access on patient such as client well-being, mental health, continuity of professional care. Clients' perceptions, expectations and legitimate needs beyond medical care that impact access and quality of care	1. The main concerns of clients' needs and expectations, and strategies for the improvement on social support network. Identification of strategies to enable timely changes required for anticipated future needs in enhancing access to social network	24
		1. Concern on clinical quality and safety in healthcare provision, e.g., patient/ family, healthcare personnel and environmental safety including the quality and safety of basic amenities	1. Clinical quality and safety in all healthcare sectors and at different levels of care (e.g., pharmaceutical, laboratory services, oral health services, primary, secondary and tertiary care, etc.)	Policies, delivery arrangements and implementation strategies to enhance safety of healthcare provision and clinical quality of healthcare services	33

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National Problem	Research Scope	Gaps & Needs (Rationale)	Focus Area	Expected Output	Rank
		and supportive physical infrastructure for the older people and users with special needs			
		1. Tools/ models of SDM have been found to be evidence based e.g., patient decision aids (Cochrane review) yet implementation lacking. Shared Decision Making/ Patient Decision Aids (SDM/PDAs) have been developed locally. (SDM/ PDA: pamphlets, videos, web-based tools	1. To test out different models of SDM/PDA in the real world	Models of implementation of PCC in Health Clinics/ Hospital Private sector	39
Public-public integration	Formulation of sectorial strategies, as well as specific technical policies	1. To determine the objectives, trend, and spending priorities via services and identifying the roles of public and private sectors, voluntary bodies and the role of civil society	1. Evaluation of the decentralization policy in health services management	1. Competencies in health management field	41
			2. Evaluation of hospitals policy and management	2. Performance of the research system and the development of specific indicators for the periodic evaluation	28

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RMK-12 Auto-priority	1-15	16-31	32-47	48-63	64-79	

National Problem	Research Scope	Gaps & Needs (Rationale)	Focus Area	Expected Output	Rank
Public-private integration	Private Sector/ NGO Involvement	1. Non-profit/ voluntary sector/ social sector/ private sector's corporate social responsibility (CSR) are untapped resources that can play an effective role in health promotion, prevention and provision/ delivery 2. Lack of evidence to support policy development on how government can effectively foster a more proactive role of non-public players in health sector 3. Need to harness the potential of social/ voluntary and community groups, to participate and expand role in escalated pressure on healthcare system 4. Concern on the potential abuse/ violence by volunteers due to the lack of security screening	1. Role of non-profit/ voluntary sector/ social sector/ private sector's CSR to help address needs of healthcare system such as complementing MOH services (e.g., domiciliary healthcare in community setting, pre-hospital)	1. Improve and sustain NGOs/private sector involvement in healthcare service 2. Enhance multi-sectoral collaboration to improve provision of healthcare services (e.g., public health services, pre-hospital care, dengue, ambulatory care) 3. Interventions, policies and legislations to create productive, coordinated and integrated care	19
			2. Assess the capacity and capability of communities (e.g., NGOs, community groups, Private sector CSR) to manage selected diseases (i.e., communicable and non- communicable diseases). For example, *Komuniti Sihat Pembina Negara* (KOSPEN) and COMBAT initiative		30
			3. Assess the capacity and capability of communities (e.g., NGOs, community groups, Private sector CSR) to manage selected diseases (i.e., communicable and non- communicable		21

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National Problem	Research Scope	Gaps & Needs (Rationale)	Focus Area	Expected Output	Rank
		(safety purposes) and the need for volunteering programmes to be coordinated			
Equity	Equity analysis for SDG and UHC in Malaysia	1. Analysis of the missing information or data which were not routinely collected for the monitoring & evaluation which leads to poor reporting of Malaysia's achievement or progress of certain SDG and UHC indicators 2. Lack of evaluation regarding inequality in delivery of care in terms of *social determinants of health such as public and social policies, *socio-economic status, age, gender, and others, e.g., in wait time, type of services, journey of health care and others *in implementation of FPP	1. What is the distribution of Under-five and Neonatal Mortality Rate – in term of income (poor vs richest); and demography (rural vs urban)?		15
			2. What is the proportion of married or in-union women of reproductive age (WRA) who have their need for family planning satisfied with modern methods: in term of income (poor vs richest); and demography (rural vs urban)?		17
			3. What is the distribution of adolescent birth rate – in term of income (poor vs richest); and demography (rural vs urban)?	1. Evidence to support delivery arrangements and implementation strategies to reduce inequalities and/or improve health at the local and national level	12
			4. Research on the inequalities in the delivery of care and health services utilisation that is present in Malaysia		8

Color Reference										
RMK-12 Auto-priority		1-15		16-31		32-47		48-63		64-79

National Problem	Research Scope	Gaps & Needs (Rationale)	Focus Area	Expected Output	Rank
	Distribution and utilization of resources	1. Maldistribution of resources (money, man-power, asset and facility) at macro-level, state-level, program level and between different provider (public or private); Difficulties and limitations of the needs-based approach	1. Measuring and standardizing health-needs at individual and population level; Equity in distribution of human resources; Equity in distribution between private and public health provider	1. Framework / methodology /mechanism for macro-level resource allocation based on health-needs; Guideline for equitable resource allocation; Public and private sector roles in achieving UHC	
	Healthcare access and responsiveness	1. Inadequate understanding of cultural differences across sub-population poses an issue in terms of acceptability in accessing health/ healthcare. People's interaction with the healthcare system, if adversely influenced in terms of ethnicity, language, social acceptability, taboos and customs could affect health seeking behaviour and consultation processes (i.e., in negotiation and decision making)	1. Cultural issues that hinder communication such as language, social acceptability, taboos and customs that significantly affect access and continuity of care, in terms of magnitude, severity and populations at risk. Options, actions and strategies that could be proven to be effective in improving acceptability in accessing health/healthcare for the population at risk	1. Description of issues to enable the identification of areas for remedial action. Interventions and methods to improve access and health outcomes (e.g., strategies to explore & incorporate patient's cultural values in medical decisions)	20
			2. Accessibility to care, including barriers to use, focusing on vulnerable groups (e.g., the poor, disabled, marginalised, remote rural, urban poor, etc.). Assess the provision of comprehensive healthcare services in remote-rural population and urban-poor via existing strategies (i.e., mobile clinics/ mobile teams/community clinic)	2. Knowledge to improve accessibility and equity in healthcare delivery to achieve SDG 3 for healthcare	22

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National Problem	Research Scope	Gaps & Needs (Rationale)	Focus Area	Expected Output	Rank
		2. Concern that vulnerable groups/under-served areas and communities (e.g., the poor, disabled, marginalised, remote rural, urban poor, etc.) are not receiving optimal care			
Health Literacy, community empowerment and mobilization	Enhanced Health Literacy	1. Development of a national health literacy policy	1. Various measurements of health literacy to ensure health education/promotion programmes penetrates the target groups with the correct levels of information based on known literacy	1. Measures of health literacy on a national level via surveillance and monitoring with a national policy to guide the implementation of health education/promotion activities	26
		2. Enhancing collaboration and partnership across agencies to enhance health literacy	2. Programmes and initiatives to enhance health literacy are needed via collaborative efforts and they need to be evaluated for effectiveness		35
		3. Initiating Malaysian Health Literacy Surveillance System and Health Literacy Index	3. Information to measure national level health literacy via surveillance and index can be seen to set the levels of input invest in health promotion/education materials		36
		4. Improving individual and community awareness on disaster risk communication, climate change and environmental	4. Measures to assess awareness is important in preparation of health education/promotion activities and materials for the purpose of the disaster risk communication, effects of climate	1. Measures of awareness improves effects of activities delivered to target population and increases	34

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RMK-12 Auto-priority	1-15	16-31	32-47	48-63	64-79	

National Problem	Research Scope	Gaps & Needs (Rationale)	Focus Area	Expected Output	Rank
		pollution and zoonotic diseases	change and environmental pollution, and zoonotic disease outbreak	overall health	
	Strengthen coordination, monitoring and evaluation of community participation and mobilisation programmes	1. Community participation and mobilization have been a long-standing method in health education/promotion but is rarely evaluated	1. Assessment of effectiveness in health promotion activities concerning to the community participation and mobilization. E.g.: Communication for Behavioural Impact (COMBI), KOSPEN, etc.	1. Increased health impact through participation and mobilization of communities can be strengthened as possibility tailored to specific target groups	23
	Strengthen supportive environment to empower individuals, families and community	1. Provision of financial resources to support and sustain the programs 2. Establishing dedicated facilities and supportive environment to foster community empowerment 3. Provide capacity building on leadership, organisational and communication skills to community leaders	1. Assessment of mechanisms in providing support to health education/promotion activities to measure its effectiveness on the target population	1. Improvement of activities and services to increase reach towards targeted population in order to improve overall health of the population	18

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National Problem	Research Scope	Gaps & Needs (Rationale)	Focus Area	Expected Output	Rank
		4. Establishing an alliance among trained and empowered health agents			
		5. Establishing intersectoral Committee on "Quality of Life Care“ for vulnerable population/ marginalized (Person With Disabilities/ PWDS)	1. Assessment of QoL of target population through focussed studies to improve services and programmes		27

CHAPTER 4: COMMUNICABLE DISEASES

Introduction

Communicable Diseases are diseases that are contagious and may be transmitted by an infectious agent or its toxins either directly or indirectly from one source to another. Faecal-oral, food, sexual intercourse, insect bites, contact with contaminated fomites, droplets, and skin contact are the most common forms of spread. There are many types of communicable diseases, some of which require notification at the locality of the outbreak to relevant health departments or government agencies. Dengue, tuberculosis, Hepatitis (A, B and C), AIDS/HIV, measles, salmonella, blood-borne illnesses, and COVID-19 are some examples of communicable diseases that are relevant to Malaysia.

Some approaches to control these diseases are by reducing host vulnerability (for example, by immunization), altering the environment in an effort to eradicate aetiological agent origins or vectors, removing opportunities for disease transmission, and inactivating the infectious agent.

Detected in Wuhan, China, the COVID-19 has rapidly spread around the world, infecting more than 180 million individuals worldwide. On 30th January 2020, WHO classified COVID-19 as a global health emergency, followed by declaration as a global pandemic on 11th March 2020. In Malaysia, more than 710,000 cases of COVID-19 reported as of June 2021, with 4,554 death cases and more than 645,000 recovered cases were reported.[31] COVID-19 spreads via airborne droplets and causes symptoms such as high fever, sore throat, myalgia and fatigue when the virus enters the body. However, even if the viral sample is positive, a patient may be an asymptomatic carrier.[32] Despite the development of a few vaccines for COVID-19, preventive measures are very necessary to prevent and monitor the rapid spread of this virus. Preparing for the new normal should be priority for future pandemic outbreaks in Malaysia.

Dengue is a concern of public health for the MOH. Dengue has fallen 11.8% from 52,941 cases to 46,713 cases nationwide, according to statistics from Dec 2019 to

May 2020. While in May 2020, 82 deaths were reported compared with 81 deaths in the same period in 2019.[33] Selangor had the highest number of cases with 27,478 cases, followed by Kuala Lumpur and Putrajaya with 4,908 and Johor with 4,111 cases.[34] There is currently no specific medication or dengue fever vaccine available, and vector control remains the foundation for controlling this disease. All the preventive and control measures available are being used to optimum effect.[35] From a clinical perspective, MOH has worked with both the country's public and private hospitals to report cases of dengue cases with a view to monitor disease spread. MOH has also worked tirelessly with various public and private sectors authorities to ensure that national fogging is carried out in areas reported to have high number of Dengue cases.

12MP Health Research Priorities (12MP-HRP)

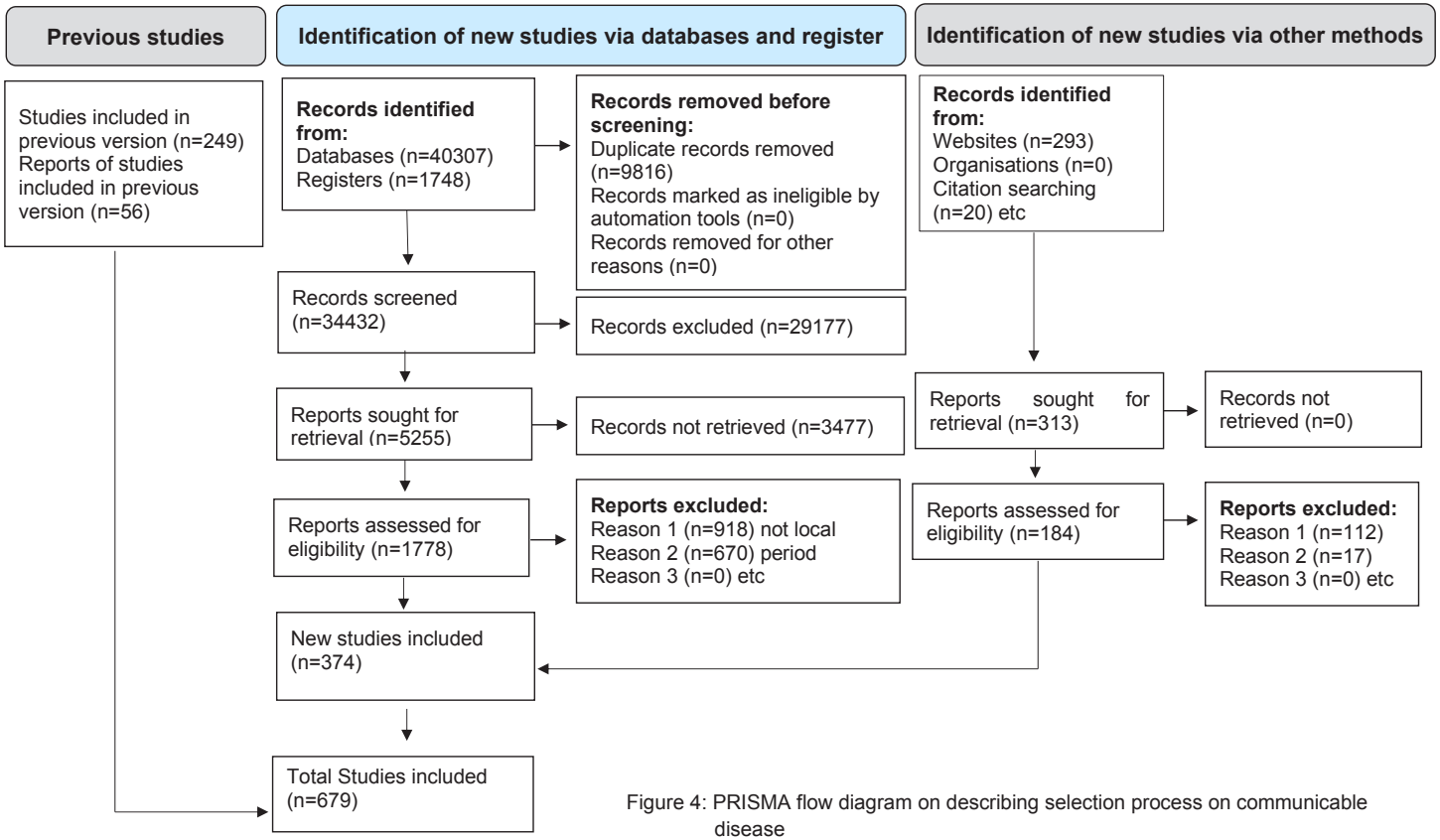

Figure 4: PRISMA flow diagram on describing selection process on communicable disease

Priority Areas For Communicable Diseases

Color Reference										
RMK-12 Auto-priority		1-2		3-4		5-6		7-8		9-11

National Problem	Research Scope	Gaps & Needs (Rationale)	Focus Area	Expected Output	Rank
Pandemic Preparedness	Development of a collaborative research network that will be ready to respond to future pandemics	1. Building research capacity 2. Preparing for outbreak research 3. Fostering collaborations and networks 4. Enhancing communication and knowledge translation	1. Surveillance and control using comprehensive strategy such as AI 2. Epidemiological, molecular and clinical studies for prevention, treatment and management 3. Ethics, legal and social contract such as knowledge translation and communication strategies 4. Engineering strategies	1. Development of a multi-sectoral pandemic prepared team that can respond to future pandemics	
	Modelling for emergence and re-emergence diseases such as TB, malaria or polio for trajectories and unexpected events		Association between social, economic, occupational, residential and cultural factors that affect the spread of communicable disease among foreign workers	Model on detailed integration of social behaviour	
Coronavirus Disease 2019 (COVID-19)	Emerging Disease	1. Origins of the virus, viral properties, transmission 2. Disease pathogenesis, immune response, host factors for disease severity	Studies on the new disease related to the pathogen natural history and behaviour, animal studies, environmental, economic, social adaptation in human	1. A better understanding of the virus, immune response, pathogenesis of diseases and transmission factors 2. Provide understanding	

Color Reference										
RMK-12 Auto-priority		1-2		3-4		5-6		7-8		9-11

National Problem	Research Scope	Gaps & Needs (Rationale)	Focus Area	Expected Output	Rank
		3. Epidemiological factors responsible for levels of transmission – e.g., role of climate, transmission via fomites 4. Effective treatment at different stages of disease – antiviral, immunomodulators 5. Prevention and Control strategies 6. Role of repurposed drugs in treatment of early and late stage		mechanism of mutations and increased transmissibility and offers interventions by developing anti-binding mechanism or suitable vaccine 3. Important to monitor immune response among those naturally infected as well as those who will be vaccinated 4. All these would lead to better prevention, treatment and outcome 5. Prevalence and mortality data 6. Effective and affordable diagnostic accuracy (include costing component), risk factors (preventive) diagnostic and management profiles and vaccine development and clinical trial	

Color Reference										
RMK-12 Auto-priority		1-2		3-4		5-6		7-8		9-11

National Problem	Research Scope	Gaps & Needs (Rationale)	Focus Area	Expected Output	Rank
Pneumonia/ILI/ SARI	1. Prevention and Control 2. Treatment	To improve the efficiency of the monitoring of Pneumonia/ILI/SARI and emerging avian influenza virus	Identification of virus and antigenic changes, epidemiological studies including prevalence, prevention, control and treatment (precision medicine, personalised medicine and immuno-therapy)	1. Prevalence and mortality data 2. Risk factors (preventive) diagnostic and management profiles	8
Dengue	1. Prevention and Control (vector control) 2. Diagnosis 3. Treatment Dengue (MOH annual report 2018[30]) and (*Pelan Strategik Kawalan dan Pencegahan Denggi,* 2016 – 2020[31]	1. Outbreak recurrence, localities, severity, mortality, programme effectiveness 2. Diagnostic test Accuracy (DTA) and point of care diagnostic 3. Immunopathogenesis of dengue 4. Monitoring of dengue patients	1. Cost-effectiveness study on novel / new Dengue control intervention 2. Community studies on hotspots / outbreak localities to develop early warning systems combining entomological (antigen-based detection of Dengue virus in mosquito), epidemiological & climatology data 3. Clinical study on severe dengue and dengue death profiling to identify the risk factors (predictors)	1. Development of novel tool which is effective and affordable (including costing component) for dengue control 2. Development of interactive module, package and system 3. Identification and quantification of Dengue outbreak risk via development of robust dengue forecasting system 4. Disease prognosis/ survival probability modelling, identification of biomarkers of plasma leakage in severe Dengue	1

Color Reference										
RMK-12 Auto-priority		1-2		3-4		5-6		7-8		9-11

National Problem	Research Scope	Gaps & Needs (Rationale)	Focus Area	Expected Output	Rank
Mycobacterial Diseases	**TB and leprosy** 1. Screening 2. Diagnosis 3. Treatment 4. Prognosis 5. Prevention and control 6. Basic science 7. Burden of Disease and Epidemiology	**TB and leprosy** 1. High Risk group screening - active and latent TB 2. Point of care diagnostics and DTA such as new diagnostics for detection of early cases, relapses, drug resistance and viability of Mycobacteriae, sensitivity and specificity test for in vitro systems, drug screening and susceptibility testing 3. Vulnerability to Mycobacteriae diseases affected by structural and socio-economic 4. Disease transmission and infection at key population 5. Burden of Disease-including incidence, Mycobacteriae resistant treatments, latent disease	**TB and leprosy** 1. New invention including development of new point of care tests (POCT) for all forms, including latent and drug-resistant TB, mobile health technology, biomarker 2. Treatment (precision medicine, personalised medicine and immune-therapy), effect and monitoring on disease activity 3. Identify social and biological drivers of drug resistant Mycobacteriae 4. Cost effectiveness of various methods to prevent diseases 5. Effect and optimum duration of IPT in HCWs 6. Early detection of diseases for prevention of further disabilities	**TB and leprosy** 1. Pattern of virulence of Mycobacteriae 2. Populations at risk for Mycobacteriae 3. Effectiveness of control programme 4. Achieving Millennium Development Goal (MDG), (6c: Stop TB partnership –WHO) 5. Incidence and mortality rate 6. Policy guidance and utility for advocacy on cost-effective TB control measures 7. Achieving zero disabilities among new paediatric leprosy patients and grade-2 disability rate of less than 1 case per 1 million people 8. National prevalence of stigma and discrimination associated with leprosy	2

Color Reference										
RMK-12 Auto-priority		1-2		3-4		5-6		7-8		9-11

National Problem	Research Scope	Gaps & Needs (Rationale)	Focus Area	Expected Output	Rank
		6. Treatment prophylaxis	7. Specific interventions against stigmatization and discrimination		
Hepatitis	1. Diagnosis 2. Treatment 3. Prognosis 4. Prevention and control 5. Basic science	1. Global Burden of Diseases study has ranked chronic viral hepatitis and its underlying conditions, such as cirrhosis and liver cancer, among the top 20 causes of death, steeply increasing from 1990 to 2015 2. WHO has aimed to achieve global elimination of both Hepatitis B and C infections by 2030 3. Point of care diagnostics	1. New inventions such as development of rapid test kit and / or POC testing 2. Latest treatment and outcome (clinical trial, precision medicine, personalised medicine and immuno-therapy) 3. Prevention and control including screening program	1. To identify the incidence and prevalence of undiagnosed Hepatitis 2. Effectiveness of treatment and disease complication 3. Outcome of treatment, survival, mortality and morbidity 4. Reduction of disease incidence 5. Awareness and behavioural modification 6. Development of new accurate rapid test kit	5
HIV/ Acquired Immunodefi-ciency Syndrome (AIDS) Aim for Global Goals of Eradicating AIDS	1. Prevention and Control 2. Clinical Management & Treatment	1. Scale up of Pre-exposure Prophylaxis (PrEP) 2. Aim to achieve 95-95-95 goals 3. Focus on drivers of infection in key populations	1. PrEP, HIV testing (DTA), linkage to care, treatment and outcome, behavioural and adherence to treatment and latest treatment (precision medicine, personalised medicine and immunotherapy)	1. The trend of HIV AIDS epidemic – increasing / plateau / decreasing and magnitude – in general population and high-risk groups (HRG) 2. Effectiveness of drug modality	3

Color Reference										
RMK-12 Auto-priority		1-2		3-4		5-6		7-8		9-11

National Problem	Research Scope	Gaps & Needs (Rationale)	Focus Area	Expected Output	Rank
by 2030 Achieving 90-90-90	3. Rehabilitations 4: Basic science	– drug use especially chemsex, sex work, Men sex with men (MSM) 4. Rehabilitation and disease progression 5. Capacity building and training	2. Causal and effect such as community outreach programs and rehabilitation counselling for recreational drug users (and other risk groups) 3. Ageing and HIV	3. Effectiveness of public health interventional control programme 4. Rate of HIV transmission among antenatal mothers (0.02%-0.04%, 1998-2006) 5. Outcome of post needle prick injury intervention 6. Need to achieve Malaysian National Strategic Plan (NSP) 2011 – 2015 7. Incidence rate: 10.88 8. Achieve 90-90-90 goals 9. Improved morbidity and mortality amongst People living with HIV 10. Immediate treatment for diagnosed patient 11. Improvement in the rehabilitation care associated with ageing individual	

Color Reference										
RMK-12 Auto-priority		1-2		3-4		5-6		7-8		9-11

National Problem	Research Scope	Gaps & Needs (Rationale)	Focus Area	Expected Output	Rank
Antimicrobial resistance	Epidemiology and epigenetic of antimicrobial resistance	1. Causes of resistance 2. Epidemiology of transmission 3. Limited data on epigenetic to detect resistance	1. Epidemiology of antimicrobial resistance organism 2. Biological adaptation which lead to resistance, impact of antimicrobial use on levels of antimicrobial resistance in colonizing organisms as well as pathogens within a given community/hospital 3. Clinical diagnosis and disease management 4. Prescribing practices (antimicrobial use patterns) 5. Patient care practices (handwashing, catheter insertion, etc.) 6. Microbiology of resistance such as identification of the most appropriate pharmacokinetic and pharmacodynamics factors, determination of the maximum efficacy and	1. Data on epigenetic 2. List of antimicrobial resistance 3. Prescribing guideline	6

Color Reference						
RMK-12 Auto-priority	1-2	3-4	5-6	7-8	9-11	

National Problem	Research Scope	Gaps & Needs (Rationale)	Focus Area	Expected Output	Rank
			minimum emergence of resistance for an antimicrobial 7. Determination of the dose and duration of therapy that maximizes efficacy and minimize emergence of resistance		
Meliodosis	1. Epidemiology 2. Diagnosis 3. Treatment	1. Clinical risk factors and exposure risks 2. Rapid laboratory detection of *Burkholderia pseudomaliei* infection 3. Effectiveness of existing and latest treatment regime with antibiotics	Epidemiological, clinical, risk factors, basic science such as genomic study in relation with geographical distributions of disease, DTA, treatment (precision medicine, personalised medicine and immune-therapy) and management	1. Reduce mortality and morbidity 2. New algorithm in detection of *Burkholderia pseudomaliei* 3. New treatment strategy	6
Malaria	1. Prevention and Control (vector control) 2. Diagnosis 3. Treatment	1. Outbreak response strategies 2. Biological adaptation, leading to resistance - Addressing transmission	1. Mapping of receptive areas of malaria 2. Identification of genetic or chemical marker for all malaria parasite to assist the development of molecular-based POCT for Malaria	1. Mapping of malaria re-introduction risk 2. Development of highly sensitive POC testing for all species of malaria rapid test kit for all malaria species	3

Color Reference										
RMK-12 Auto-priority		1-2		3-4		5-6		7-8		9-11

National Problem	Research Scope	Gaps & Needs (Rationale)	Focus Area	Expected Output	Rank
	4. Basic Science	3. Diagnostic tests and point of care diagnostics	3. Study zoonotic malaria (human to human transmissibility of *Plasmodium knowlesi,* distribution of infected macaques) and insecticide resistance among anopheles mosquito	3. Establishing evidence of human to human *P. knowlesi* transmission, and to develop risk map of *P.knowlesi* infection 4. Mapping of insecticide resistance in vector (*Anopheles* sp.)	
Vaccine preventable for diseases	1. Prevention and Control 2. Diagnosis 3. Treatment	1. Novel strategies to increase vaccine coverage 2. Outbreaks in settings with high coverage 3. Optimal age of vaccination 4. Reasons for low confidence in vaccines 5. Outbreak response strategies 6. Strengthen routine immunization & surveillance 7. Susceptibility profiles	1. Vaccines development for emerging and re-emerging diseases including techniques, capacity building 2. Identifying causal and effect of outbreaks in settings with high reported vaccination coverage 3. Identification and establishment effective strategies to increase coverage of first and second dose vaccination for vaccines preventable diseases 4. Determination of carrier rate and serotype distribution, DTA, among	1. Achieve and maintain high levels of population immunity by providing high vaccination coverage with two doses of measles- and rubella-containing vaccines 2. Monitor disease using effective surveillance and evaluate programmatic efforts to ensure progress 3. Develop and maintain outbreak preparedness, respond rapidly to outbreaks, and manage cases 4. Communicate and engage to build public confidence and demand for immunization	7

Color Reference										
RMK-12 Auto-priority		1-2		3-4		5-6		7-8		9-11

National Problem	Research Scope	Gaps & Needs (Rationale)	Focus Area	Expected Output	Rank
		8. Measures of vaccine coverage 9. Epidemiology & surveillance 10. Epidemiology & surveillance for diphtheria, pertussis and pneumococcal diseases 11. Point of care diagnostic and rapid cost-effective laboratory diagnosis Antitoxins	Malaysia population 5. Develop and produce certain anti-toxin	5. Support cost-effective operations and improve vaccination and diagnostic tools 6. Support cost-effectiveness operation and improve vaccination and diagnostic tools 7. Point of care diagnostic kits for rapid detection of potential outbreaks 8. Production of readily available anti toxin for effective management of patients. Reduce dependencies on imported products 9. Prevent case fatalities	
Boosting host immune responses to vaccines	1. Nutritional interventions (supplements e.g., vitamin D, E, probiotics) 2. Moderate exercise	1. Evidence to show that nutrition modulates host immune system to produce better responses to vaccines 2. Evidence to show that moderate exercise modulates host immune system to produce better responses to vaccines	Vaccination experimental model and clinical trial	1. Effectiveness of the vaccines 2. List of natural ways to boost immunity	11

Color Reference										
RMK-12 Auto-priority		1-2		3-4		5-6		7-8		9-11

National Problem	Research Scope	Gaps & Needs (Rationale)	Focus Area	Expected Output	Rank
Leptospirosis	1. Prevention and Control (vector control) 2. Diagnosis	1. Geospatial analysis of environmental risk factors of leptospirosis 2. Point of care diagnostics	1. Behavioural, social science and awareness for leptospirosis outbreak and sporadic cases 2.Development new rapid / POC testing, DTA	Guideline or awareness programme Screening tool	4
Viral Haemorrhagic Fever (VHF) (Ebola, Marburg, Lassa Fever, Crimean Congo Haemorrhagic Fever, Rift Valley Fever)	1. In view of continuous exposure to zoonoses either from outside Malaysia or locally exposed (COVID-19, Avian Influenza, MERS-CoV, Nipah, Ebola), there must be national capacity to DETECT, ISOLATE and MANAGE the infection. The implications of these infections are great due to public health concern	1. WHO has listed VHF as infections of Public Health Concern (including Ebola, Marburg, Lassa Fever, Crimean Congo Haemorrhagic Fever and Rift Valley Fever) and important VHF to be included in surveillance 2. Currently there is limited capacity to detect and manage cases of VHF. Challenges- VHF are Risk Group 3 and 4 microorganism and need risk assessment before enable laboratory testing	Studies on DTA, prevention, expanded surveillance to include wildlife and facilities where animals are reared as food, expand laboratory capabilities by developing newer diagnostics, treatment and management, precision medicine or personalised treatment	1. Able to predict outbreak caused by VHF 2. Laboratory capacity is key for detection, isolation and managing any VHF 3. Able to stop spill-over of zoonotic infection to human by enhanced surveillance	9

Color Reference										
RMK-12 Auto-priority		1-2		3-4		5-6		7-8		9-11

National Problem	Research Scope	Gaps & Needs (Rationale)	Focus Area	Expected Output	Rank
	2. Develop newer testing tools/ algorithm 3. Expand One Health capacity- Increase surveillance among certain wildlife including non-human primates, rodents etc. Expand roles to include multi-agencies including veterinary services, agricultural services, etc.	3. Wildlife are the reservoir for many pathogens including zoonoses such as Ebola, Marburg, Lassa Fever, Crimean Congo Haemorrhagic Fever and as well as other important pathogens such as Coronavirus, Avian Influenza. Important to strengthen laboratory and surveillance capacity as currently there is limitation of such services due to lack of training or lack of infrastructures (BSL3)			
None-dengue Arthropod-borne viruses (Chikungunya, Yellow Fever and Zika)	1. Strengthen and expand detection of other important arboviruses such as Chikungunya, Yellow Fever and Zika	1. Currently there is limited capacity to detect and manage cases of arboviruses other than dengue 2. Currently limited labs can diagnose Chikungunya, Yellow Fever and Zika	DTA for the identified diseases, expand laboratory capabilities by developing newer diagnostics, Repurposing and identify existing drugs for existing disease.	1. Enable strengthened diagnosis of neglected tropical disease (NTD) including Chikungunya Fever, Yellow Fever and Zika 2. Laboratory capacity is key for detection of Chikungunya, Yellow Fever and Zika	10

Color Reference										
RMK-12 Auto-priority		1-2		3-4		5-6		7-8		9-11

National Problem	Research Scope	Gaps & Needs (Rationale)	Focus Area	Expected Output	Rank
	2. Develop newer testing tools/ algorithm 3. Treatment and management	3. Safe and effective vaccine is available for Yellow Fever. CEPI has listed Chikungunya as one of the priority infections for vaccine development due to morbidity of the diseases. Zika is a neglected diseases now after 2016 as cases of zika associated microcephaly has reduced. Nevertheless, Zika has public health importance		3. Availability of safe and effective anti-viral or safe and effective vaccine	10

CHAPTER 5: NON-COMMUNICABLE DISEASES

Introduction

Non-Communicable Diseases (NCDs) are the world's largest cause of death, mostly CVD, cancers, chronic respiratory disease and diabetes. The NHMS in 2019 showed that the prevalence of risk factors associated with NCDs continues to increase. It was estimated that 1.7 million people in Malaysia have three major risk factors while currently 3.4 million people are living with two major NCDs risk factors. The prevalence of diabetes in adults has increased from 3.5 million in 2015 to 3.9 million in 2019, whereas it was estimated that 6.4 million people have hypertension that increases with age.[3]

The rapid increase in the number of people suffering from NCDs poses one of the major challenges facing Malaysia's current healthcare system. It was estimated that 40.0% and 16.6% of older people in Malaysia use ambulatory healthcare services and are admitted to hospital, respectively.[3] NCDs can be preventable which requires a shift in attitudes and preferences of individuals. Current behaviours such as unhealthy diets (less consumption of fibres, high consumption of salt and trans-fat), sedentary lifestyles, and smoking have resulted in the increasing of NCDs burden in this country.

The 10-year National Strategic Plan for Non-Communicable Diseases (NSP-NCD) 2016-2025[36] is a strategic plan to provide an over-arching framework to strengthen the prevention and control of NCDs in Malaysia. The NSP-NCD 2016-2025 adopts 4 priority areas of the Global Action Plan for the Prevention and Control of Non-Communicable Diseases (GAP-NCD) 2013-2020 and The Global Monitoring Framework for NCDs (GMF-NCD);

1. Life-course approach
2. Empowerment of people and communities
3. Evidence-based strategies
4. Multi-sectoral action

Table 5 shows the national targets as of 2025. The MOH has developed and published several action plan documents and initiatives relating to NCDs and the risk factors. The seven action plans and initiatives are:

1. National Strategic Plan for Tobacco Control 2015-2020
2. Policy Options to Combat Obesity in Malaysia 2016-2025
3. Salt Reduction Strategy to Prevent and Control NCD for Malaysia 2015-2020
4. National Strategic Plan for Active Living 2016-2025
5. Malaysia Alcohol Control Action Plan 2013-2020
6. National Strategic Plan for Cancer Control Program 2016-2020
7. Strengthening Chronic Disease Management at Primary Care Level through the Enhanced Primary Health Care (EnPHC) initiative

Table 5: NCDs targets for Malaysia 2025 (Source: NSPNCD 2016)

Indicator		Global Target	Malaysia	
			Baseline	Target (2025)
1.	Risk of premature mortality from CVD, cancer, diabetes, or chronic respiratory disease	25% relative reduction	20.0%	15.0%
2.	Prevalence of current tobacco use in person aged 15+ years	30% relative reduction	23%	15%
3.	Mean population intake of sodium	30% relative reduction	8.7gm	6.0gm
4.	Prevalence of insufficient physical activity	10% relative reduction	35.2%	30.0%
5.	Harmful use of alcohol (prevalence of Heavy Episodic Drinking – HED)	10% relative reduction	≤1.2%	≤1.2%
6.	Prevalence of raised blood pressure	25% relative reduction	32.2%	26.0%
7.	Prevalence of diabetes and obesity	Halt the rise	≤15%	≤15%

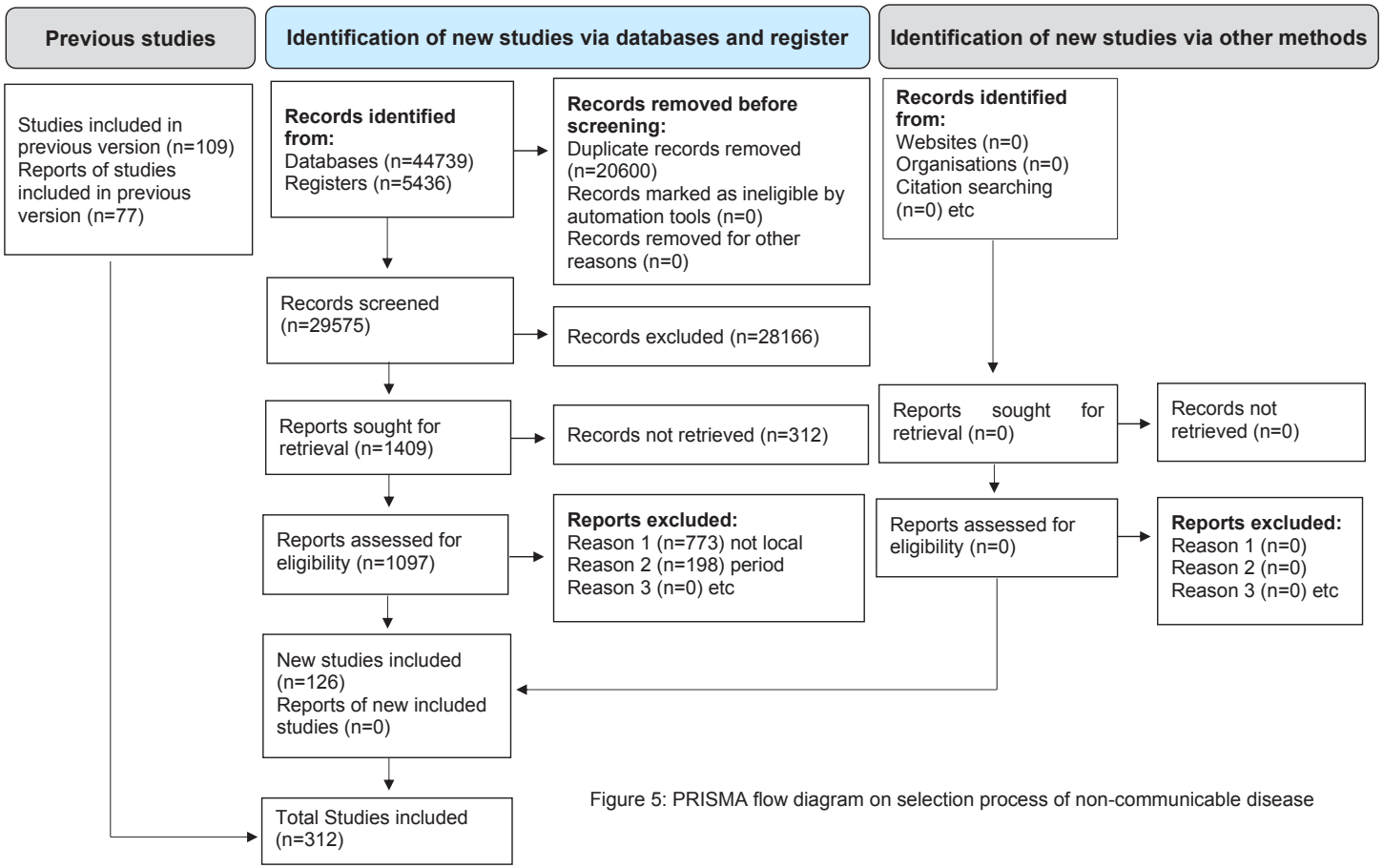

Figure 5: PRISMA flow diagram on selection process of non-communicable disease

Priority Areas for Non-Communicable Diseases

Color Reference					
RMK-12 Auto-priority	1-11	12-22	23-33	34-44	45-55

National Problem	Research Scope	Gaps & Needs (Rationale)	Focus Area	Expected Output	Rank
Endocrine and Metabolic Diseases	Diabetes	1. High national prevalence of diabetes 2. Poor screening and low uptake among population and health care workers 3. Low uptake of screening among population 4. Low screening rate of high-risk population among health care works 5. Prevalence of diabetes among children and Gestational Diabetes Mellitus (GDM) mother 6. To determine the appropriate use of information to empower individuals and healthcare professionals to make personalized decisions for achieving the optimal outcome 7. Personalized medicine because clinical risk factors	**Biomedical** 1. Collecting and utilizing Malaysian genomic datasets for both diabetes and diabetes complications (cardiovascular, nephropathy, retinopathy and neuropathy)	Identification of risk factors from patent of genome	54
			2. Identifying biomarkers		42
			3. The impact of phenotype, ethnicity and genotype on progression of diabetes and its complication		45
			Diagnosis 1. Inexpensive and clinically useful screening tool (biochemical/physical features) to identify high risk individuals among children/adult/pregnant mothers with obesity due to limited resources (Including validation study)	This should lead to improved return of investment on endocrine and metabolic disease into the future	12
			2. Interventions to improve screening uptake (either via patients, or provider, or both)		5
			Treatment 1. Pharmacotherapy in combination with healthy behaviour interventions for diabetes	1) Effective personalised therapy/targeted therapy	5

Color Reference						
RMK-12 Auto-priority	1-11	12-22	23-33	34-44	45-55	

National Problem	Research Scope	Gaps & Needs (Rationale)	Focus Area	Expected Output	Rank
		and glycaemic control alone cannot predict the development of complications	2. Slow escalation (clinical inertia) of treatment	2) Better control of Intermediate clinical outcomes (e.g. glycaemic control, Blood Pressure (BP) control) 3) Reduction in microvascular and macrovascular complications in longer term	38
			3. Study on T&CM for diabetes		55
			4. Patient empowerment for self-management		30
			5. Use of natural products/ supplement for treatment		49
			Prevention and control 1. Genomic architecture of diabetes and the development of precision medicine to personalize diabetes prevention and management	Reduction of complications from DM	43
			2. Awareness for screening criteria and how does it translate in the field practice		32
			3. Intervention study on NCDs prevention		22
			4. Intervention study on NCDs among high-risk groups		22
			5. Evaluation study on NCDs programme		32
			6. Development and evaluation of health promotion on NCDs prevention		33

Color Reference						
RMK-12 Auto-priority	1-11	12-22	23-33	34-44	45-55	

National Problem	Research Scope	Gaps & Needs (Rationale)	Focus Area	Expected Output	Rank
			7. Monitoring of NCDs risk factors in the population through the NHMS		14
Cardiovascular diseases (CVD)	Hypertension	1. High prevalence of hypertension 2. Risk factor associated with hypertension 3. Poor hypertension control and lack of improvement over the past decade	**Biomedical** 1. Molecular processes in the pathogenesis of hypertension including gene, microRNA and epigenetic changes	Identification of risk factors among the risk group through genomic characterization	52
			2. Greater translational research including use of a systems biology approach to identify novel protein targets in the causal pathway for hypertension to identify new biomarkers or treatments to prevent and reverse the consequences of hypertension		50
			Treatment 1. Pharmacological management for systolic hypertension	Effective personalised therapy/targeted therapy	23
			2. Management of resistant hypertension		20
			3. Benefits and costs associated with a personalized absolute risk-based threshold vs. current blood pressure threshold for hypertension		44

Color Reference						
RMK-12 Auto-priority	1-11	12-22	23-33	34-44	45-55	

National Problem	Research Scope	Gaps & Needs (Rationale)	Focus Area	Expected Output	Rank
			Prevention and Control a. National Hypertension Surveillance system for the detection, management and control including in vulnerable populations such as indigenous group, younger age group and adolescent as well as for the examination of public health policies on hypertension detection and control		21
			b. Risk factors control (e.g., reduce weight, reduce salt intake, smoking cessation, increase physical activity)		16
	Hyperlipidaemia	Younger age of onset	**Biomedical** 1. Molecular processes in the pathogenesis of hyperlipidaemia including gene, microRNA and epigenetic changes	Identification of risk factors among the risk group through genomic characterization	51
			2. Greater translational research including use of a systems biology approach to identify novel protein targets in the causal pathway for hypertension to identify new biomarkers or treatments to prevent and reverse the consequences of hyperlipidaemia		48

Color Reference						
RMK-12 Auto-priority	1-11	12-22	23-33	34-44	45-55	

National Problem	Research Scope	Gaps & Needs (Rationale)	Focus Area	Expected Output	Rank
			Treatment 1. Pharmacological management for hyperlipidaemia		19
			2. Management of resistant hyperlipidaemia		26
			3. Benefits and costs associated with a personalized absolute risk-based threshold vs. current lipid threshold for hyperlipidaemia		41
			4. Risk factors control (e.g., reduce weight, diet, increase physical activity)		19
			Diagnosis Improve screening at population level		15
	Cerebrovascular accident (CVA)	Care regarding stroke-related impairments, such as cognitive problems, aphasia, mobility problems, vision impairment, fatigue and lack of fitness and risk factors for mortality and morbidity	The utilisation of existing health facilities and care	To reduce mortality and morbidity	24
Neurodegenerative diseases	Biomarkers for diagnosis	Biomarkers for diagnosis	Experimental model of neurodegenerative diseases (Alzheimer's disease, Parkinson's disease)	To better understand the pathophysiology as well as test newer therapeutics	47

Color Reference						
RMK-12 Auto-priority	1-11	12-22	23-33	34-44	45-55	

National Problem	Research Scope	Gaps & Needs (Rationale)	Focus Area	Expected Output	Rank
	Newer drugs and impact of bioactive compounds	Newer drugs and bioactive compounds	Cells, rat, zebra-fish, worm		46
	Healthy life-style and development of these conditions	Prevention methods			
Cancer	Cancer immunotherapy, combination therapy, and precision oncology	New treatment	1. Cell base therapy		25
			2. Targeted therapy		21
	Genomic and immune analysis of tumour cells and tumour microenvironment	1. Precision medicine using other innovative low-cost technologies may be needed as great strides in areas of genomics / tumour microenvironment have been achieved elsewhere 2. Predictive (Diagnosis for identification of tumour resistant drug) and prognostic markers (Markers that determine prognosis of cancer)	1. Molecular characterisation of the tumour genome 2. Molecular characterisation of the tumour microenvironment		25

Color Reference						
RMK-12 Auto-priority	1-11	12-22	23-33	34-44	45-55	

National Problem	Research Scope	Gaps & Needs (Rationale)	Focus Area	Expected Output	Rank
	Advanced technologies to catalyse cancer breakthroughs	For early detection and management to prolong survival of patient	1. Advanced technologies for the detection, monitoring, and characterisation of tumours		7
			2. Therapeutic approaches to improve delivery of antitumor cargoes		27
	Epidemiological studies	Along the cancer care continuum beginning from cancer prevention, to early diagnosis, prompt treatment, and cancer survivorship period until the end of life	1. Primary preventive strategies	For early detection of cancer, ensuring access to optimal cancer care, as well as improved cancer survival and cancer survivorship	6
			2. Early detection of cancer		8
			3. Treatment outcomes		1
			4. Patient-centred outcomes		2
			5. Supportive care in cancer		4
			6. Cardio-oncology		3
			7. Hospice/ end of life care		10
	Nutritional interventions	To prevent or reduce incidence of cancer	Nude mice model of human cancers		34
			Syngeneic mouse models of cancer		34
		To boost anti-cancer immune response	Syngeneic mouse models of cancer		37
	Heathy life-style interventions	To prevent or reduce incidence of cancer	Nude mice model of human cancers		36

Color Reference						
RMK-12 Auto-priority	1-11	12-22	23-33	34-44	45-55	

National Problem	Research Scope	Gaps & Needs (Rationale)	Focus Area	Expected Output	Rank
			Syngeneic mouse models of cancer		37
		To boost anti-cancer immune response	Syngeneic mouse models of cancer		39
	Public health – public and patient behaviour	1. Late presentation of cancer is a major problem in Malaysia evident by poor survival rates compared to other upper middle-income countries	1. Effective communication interventions	1. Improved health messages and communication strategies may increase early stage cancers	13
		2. It has been found to be due to a complex interplay of socio-economic, psychological and the public utilisation of both allopathic and alternative medicine	2. Community navigation towards early diagnosis	2. Improved navigation from community, primary care providers to diagnostic and treatment centres will improve timeliness and quality of of cancer diagnosis	6
			3. Cost-effectiveness of screening for top 3 cancers breast, colorectal and lung cancer	3. Policy: Evidence based decision for adopting cancer screening in Malaysia	11
		It is known that we are losing patients from our follow-up because of their preference to alternative compared to conventional	1. Prevalence of non-proven cancer therapy preference compared to conventional therapy among public and cancer patients, reasons why and its impact on cancer outcome	Improve cancer survival rate	28

Color Reference						
RMK-12 Auto-priority	1-11	12-22	23-33	34-44	45-55	

National Problem	Research Scope	Gaps & Needs (Rationale)	Focus Area	Expected Output	Rank
		therapy, and possibility of coming back to our health system in advance stage, however, there is no statistic available that can be used as a baseline to set a target in addressing the issue	2. Evaluation of non-proven therapy media advertisement / claims and the effect to cancer patient's decision making on the choice of treatment and the most common types of non-proven therapies preferred		28
			3. Survey on public and Health Care Providers awareness on cancer risk factors and knowledge on sign and symptoms of most common cancers	Down staging cancer at diagnosis (MNCR 2012-2016 stage II & IV 63.7%)	17
	T&CM intervention	Lack of evidence on safety, effectiveness and risks on concurrent use of T&CM (e.g., herbal medicine) with conventional cancer therapies	1. Safety of the herbs used in herbal therapy as an adjunct treatment for cancer patient 2. The effect of T&CM (e.g., herbal therapy, acupuncture) on the quality of life of cancer patients	Establish evidence-based of T&CM as adjunct treatment for cancer patients	
Maternal Health Issue	Postnatal morbidity: specific for venous thromboembolism (VTE) and Pulmonary Embolism (PE) (Women 15-49 years)	1. One of commonest cause of maternal deaths 2. The risk of VTE is increased 4- to 5-fold in pregnancy compared to not pregnant 3. Obstetrics embolism accounted for 16% of sudden maternal mortality	1. A facility-based study regarding the incidence & identifying the risk factors for VTE & PE among postnatal mothers	Establish evidence-based/ value-based medicine regarding the current burden of VTE/ PE among postnatal mothers and revising the current protocol/ Critical Practice Guidelines (CPG) for management of VTE/PE	9

Color Reference						
RMK-12 Auto-priority	1-11	12-22	23-33	34-44	45-55	

National Problem	Research Scope	Gaps & Needs (Rationale)	Focus Area	Expected Output	Rank
		4. 90% of PE are due to deep vein thrombosis (DVT)	2. Intervention that reduce VTE i.e., clinical trial for low molecular weight heparin (LMWH) prophylaxis		19
	Anaemia in Pregnancy (pregnant women)	1. Anaemia affects 40% of pregnant women worldwide 2. Prevalence of anaemia in Pregnancy: 29.3% (NHMS 2016) 3. Anaemia in pregnancy affects Perinatal and Neonatal Health	1. Clinic -based study to determine the status of anaemia and associated risk factors during the early stages of pregnancy to plan appropriate interventions before pregnancy	Establish evidence-based/ value-based medicine regarding the current burden of anaemia in pregnancy and revising the current protocol/ CPG	9
			2. Longitudinal data throughout pregnancy based on two data (≤12 weeks of pregnancy and +36 weeks of pregnancy) to improve the management of prevention and control of anaemia during pregnancy		9
	Abortion (adolescent females & young mothers aged 12-24)	1. Prevalence of 'ever had abortion' was 15.9 (NHMS 2016) 2. Sexual activity among teens are increasing but the contraception still low 3. Cardiopulmonary resuscitation (CPR) in Malaysia has been stagnant past 20 years and Age-Specific Fertility Rates (ASFR) has been declining.	1. Specific survey (non-household) towards target population (teens or young mothers) regarding episode of abortion with focus on determining risk factors and identify knowledge, attitude and practice (KAP)	1. Review of current SOP to prevent unsafe abortion, enhanced public -private partnership, improve referral system 2. Potential revision of current legislation for medicolegal issues	31

Color Reference						
RMK-12 Auto-priority	1-11	12-22	23-33	34-44	45-55	

National Problem	Research Scope	Gaps & Needs (Rationale)	Focus Area	Expected Output	Rank
		Best hypothesis of declining ASFR is due to abortion, easy access of online abortion pills and existing social stigma towards pregnancy of out of wedlock			
Tobacco	Tobacco and e-cigarette	1. One of the main risk factors of NCDs 2. High prevalence of smoking in the population 3. Few tobacco cessation programmes implemented such as health promotion, *"Klinik Berhenti Merokok",* Quit Centre and "No Smoking Area enforcement"	1. Monitoring of tobacco and e-cigarette use in the population through household and school-based surveys	Evaluation of the tobacco cessation programme implementation in Malaysia	40
			2. Evaluation of the impact of tobacco control programme in Malaysia		35
			3. Effectiveness of the tobacco cessation programme implementation in Malaysia		35
	Smoking		Conducting research on effects new smoking products from the perspective of Health, Economic and Population		29

CHAPTER 6: OLDER PEOPLE

Introduction

It is estimated that low- and middle-income countries are ageing rapidly from 2020 to 2030.[37] In Malaysia, the older population is defined as people over the age of 60, in accordance with the United Nations (UN) cut-off age. Older people account for 3.5 million (10.7%) of Malaysia's total population of 32.7 million (Department of Statistics, Malaysia, 2020). Malaysia is expected to be an ageing nation by 2030 with 15% of the population being categorised as older people.[38] The NHMS 2018 showed that functional limitation and depression are more prevalent among Malaysian older people.[39] The survey also showed high prevalence of diabetes, hypertension and hypercholesterolemia among Malaysian pre-ageing and ageing populations. The National Policy for Older Persons (2011)[40] outlines three policy proposals aimed at enhancing the wellbeing of older people:

1. To enhance the respect and self-worth of older people in the family, society and nation
2. To develop the potential of older people so that they remain active and productive in national development and to create opportunities for them to continue to live independently
3. To encourage the establishment and the provision of specific facilities to ensure the care and protection of older people.

As Malaysia is experiencing demographic changes, there will be an increase in demand for research and knowledge on the healthcare of older people. Therefore, healthcare workers (HCW) must be equipped with the skills to assess and manage older people. Research prioritization on health and health-related issues should be encouraged in order to create a robust and evidence-based standard in older people care and management.

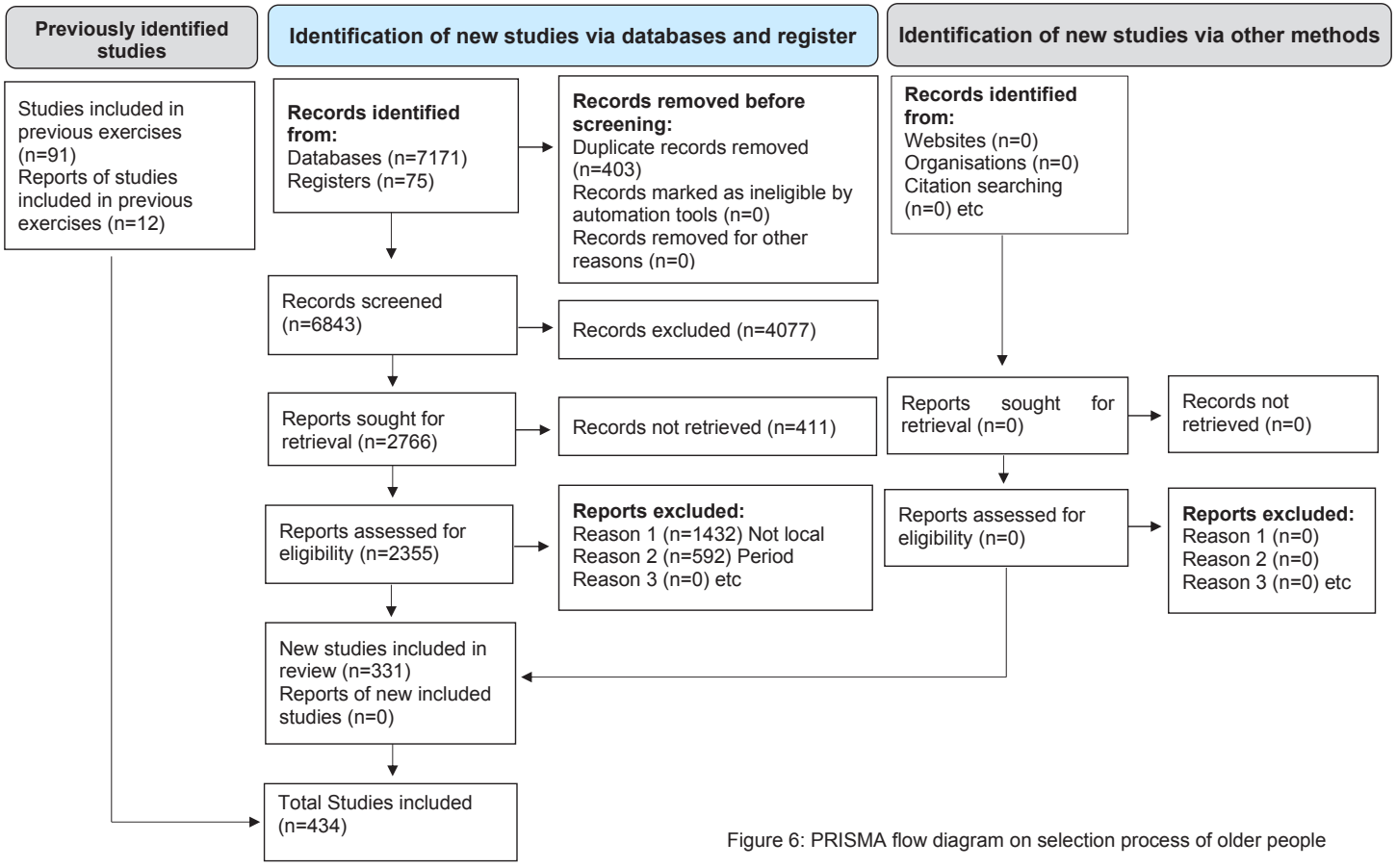

Figure 6: PRISMA flow diagram on selection process of older people

Priority Areas for Older People

Color Reference				
1-4	5-8	9-12	13-16	17-20

National Problem	Research Scope	Gaps & Needs (Rationale)	Focus Area	Expected Output	Rank
Improving Quality of Care for Older Adults	1. Identifying problems in clinically complex or non-independent older adults 2. Benefits and burden of aggressive disease in older people 3. Gaps in care for vulnerable ageing population such as older adults with limited literacy or in prison, aged care industry 4.Healthy ageing	Better understanding on the biology of ageing and its impact on the prevention, progression, and prognosis of disease and disability	1. Interventions that extend lifespan also extend health span		14
			2. Factors influencing the portion of lifespan spent in good health — suggesting that interventions that extend life can reduce the burden of multiple diseases		11
			3. Identify genetic, molecular and cellular factors that determine the rate of ageing processes		20
			4. Identify and characterize interventions that hold the promise of increasing healthy lifespan		12
			5. Identify factors associated with successful ageing and resilience against disease and dysfunction		4

Color Reference				
1-4	5-8	9-12	13-16	17-20

National Problem	Research Scope	Gaps & Needs (Rationale)	Focus Area	Expected Output	Rank
	Population ageing on the economy, health prevention behaviour patterns and health access among the older people	1. Assist in improving the healthcare services of older people such as data on health prevention behaviour patterns and the use of health facilities practiced 2. Assist in planning economic development of health among the older people	1. The impact of population ageing on the economy, health prevention behaviour patterns	1. Strategic planning by policymakers (MOH, Ministry of Women, Family and Community Department (KPWKM)) agencies and NGOs to reduce depression and NCDs among the older people 2. Enhance public-private partnership 3. Econometric modelling for ageing population 4. As a reference and SOP to be used by MOH health personnel as well as caregivers of the older people 5. As a reference manual for use by senior caregivers	15
			2. Identify the latest data on the use of healthcare facilities (public and private), barriers and recommendations among older people in Malaysia		7
			3. Cost-effectiveness analysis / burden of economic impact towards certain underprivileged population i.e., Peka B40 recipients		13

Color Reference				
1-4	5-8	9-12	13-16	17-20

National Problem	Research Scope	Gaps & Needs (Rationale)	Focus Area	Expected Output	Rank
				6. Implementation of intervention packages for patients and those at risk of depression at the national, state or district level (for example in health clinics and senior clinics) 7. Improvements in the clinical management of older adult patients with depression	
Older people health issues	Mental health such as Dementia (including Alzheimer disease), depression, schizophrenia and Alzheimer	Data on development of Alzheimer's disease and most other forms of dementia, in addition to diseases and conditions (e.g., type 2 diabetes, hypertension, and vascular disease) that are associated with increased dementia risk.	Determine how cellular and molecular bases of changes associated with ageing contribute to the development and course of age-related dementia and treatment response. Life course approaches to determine the contributing factors to dementia such as education level, controlling NCD	Dementia Registry	16

Color Reference				
1-4	5-8	9-12	13-16	17-20

National Problem	Research Scope	Gaps & Needs (Rationale)	Focus Area	Expected Output	Rank
	Other chronic diseases such as DM, HPT, CVD and other communicable disease	Ageing is associated with changes at multiple physiological levels. Research is needed to enable us to predict, identify, and where necessary address these changes.	1. Develop and/or identify biomarkers (including genetic, epigenetic, molecular, cellular, immunological, metabolic, imaging, and microbiome-related) that are applicable to ageing.		19
			2. Determine how cellular and molecular changes associated with ageing contribute to decreased resilience and increased morbidity and influence response to treatment of age-associated conditions.		18
	Geriatric Syndrome (incontinence, cognitive impairment and dementia, depression, falls, frailty) among the older people.	1. The burden of Geriatric Syndrome (national prevalence based on NHMS 2018): - 8.5% dementia - 11.2%Depressive symptoms - 2.9% Stress Urinary incontinence (UI), - 3.4% Urge UI - 15.0% Falls 2. Data on key factors contributing to the increase in geriatric syndrome	1. Identify the impact of geriatric syndrome among the older people on the use of health facilities including cost assessment	1. Evidence-based/ Value based Medicine for strategic planning by policymakers (MOH, KPWKM), related agencies and NGOs to reduce Geriatrics Syndrome among the older people 2. As a reference and SOP to be used by MOH health personnel as well as caregivers of the older people	3
			2. Determine latest input on the prevalence trends of geriatric syndrome (incontinence, dementia, depression, falls and frailty among the Malaysian older people)		2
			3. Interventional studies for Geriatrics Syndrome treatment and management		1

Color Reference				
1-4	5-8	9-12	13-16	17-20

National Problem	Research Scope	Gaps & Needs (Rationale)	Focus Area	Expected Output	Rank
		trends and those at risk was vital for public health and clinical management 3. Assist in the planning of preventive activities to HRG based on evidence-based from the solidarity of intervention studies.	4. Cost-effective analysis on the intervention of Geriatrics Syndrome	3. As a reference manual for use by senior caregivers 4. Implementation of intervention packages for patients and those at risk of Geriatrics Syndrome at the national, state or district level (for example in health clinics and senior clinics) 5. Improvements in the clinical management of older adult patients with Geriatrics Syndrome	8
Caring society and capacity building of society	1. Social support, specific care, living environment at home or specialised nursing home/old folks' home 2. Mobility, nutrition, disability and frailty	Ageing is associated with changes at multiple physiological levels. Research is needed to enable us to predict, identify, and where necessary address these changes	1. Care in the nursing home/old folk home		5
			2. Expert care by the carers at home or nursing home/ old folk home		10
			3. Facilities and medical care		6
			4. Home based care		9
			5. Personalised food and nutrition supplies		17

CHAPTER 7: MENTAL HEALTH

Introduction

The World Health Organization (WHO) defines the aim of mental health as a state of well-being in which every individual realizes his or her own potential, can cope with the normal stresses of life, can work productively and fruitfully, and is able to make a contribution to her or his community.[41] Mental, neurological and behavioural disorders are common which can cause immense suffering. A WHO report states that 264 million people globally suffer from depression and 20 million people from schizophrenia; 107 million people are affected by alcohol use disorders and 71 million by drug use disorders.[42] Another published WHO report shows that 50 million people suffer from dementia of which 60 – 70% were contributed by Alzheimer.[43] People with these disorders are often subjected to social isolation, poor quality of life and increased mortality. These disorders are at the cause of staggering economic and social costs. As well-being is a desirable goal for many people, its inclusion in the definition of mental health raises concerns. Substance abuse is also called drug abuse which is referred to as the harmful or dangerous use of psychoactive substance, including alcohol and illicit drugs. Alcohol, amphetamines, barbiturates, benzodiazepines, cannabis, cocaine, hallucinogens, methaqualone and opioids are most frequently associated with drugs. The use of psychoactive substances can lead to a syndrome of dependence - a cluster of behavioural, cognitive and physiological phenomena that emerge after prolonged use of the substance and usually include a strong desire to take the drug, difficulties in controlling its use, persistence in its use despite adverse consequences, greater priority given to drug use than to other activities and obligations, increased tolerance, and often physical withdrawal.[44]

Figure 7: PRISMA flow diagram on selection process of mental health

Priority Areas for Mental Health

Color Reference				
1-5	6-10	11-15	16-20	21-23

National Problem	Research Scope	Gaps & Needs (Rationale)	Focus Area	Expected Output	Rank
Addiction	**Substance abuse** 1. Illicit drugs such as methamphetamine, opioids	1. No available national data on incidence and prevalence 2. High relapse for drug use	Treatment, prevention, rehabilitation, complimentary therapy for addiction such as pharmacotherapy, methadone and other components of treatment (spiritual support, rehabilitation, acupuncture)	1. National-level data on the use of illicit drugs with appropriate record of the user groups 2. Research that evaluate the effectiveness of pharmacological and non-pharmacological interventions for addiction with relevance to Malaysia	3
	2. Alcohol abuse	1. Identification of risk group	1. Prevention (epidemiology, identification of vulnerable groups for early intervention), monitoring & evaluation (level of toxicity), interventional strategies and training	Locally-relevant evidence base on the following: 1. Research on profile of the at-risk groups 2. Research on the role of educational interventions and legislation on reducing the incidence of alcohol abuse	4
			2. Identification of HRG for drinking behaviour and addiction		7
			3. Drunk driving		1

Color Reference				
1-5	6-10	11-15	16-20	21-23

National Problem	Research Scope	Gaps & Needs (Rationale)	Focus Area	Expected Output	Rank
	Behavioural 1. Gaming disorders 2. Cyberbully 3. Internet addiction 4. Pornographic addiction	1. No data on gaming disorders especially among youth	Determination of prevalence, causal and risks, intervention and validation study	Evidence to inform local practice and policy	2
Depression and other psychiatry disorders	Chronicity of the disease	1. Prevention of suicide 2. Impact on family members	1. Evidence on locally validated instrument in assessing various mental health problems in community	Availability of evidence base on the following: 1. Research on locally-validated instruments in assessing various mental health problems 2. Research on holistic care of a person with depression, suicide and other psychiatry conditions that incorporate the roles of family and close community	15
			2. Functional social, intellectual, physical and psychological problems experienced by family members		11
			3. Intervention to manage suicidal ideation/plan and depression at schools		8

Color Reference				
1-5	6-10	11-15	16-20	21-23

National Problem	Research Scope	Gaps & Needs (Rationale)	Focus Area	Expected Output	Rank
	Treatment	1. Method of treatment whether with drug monotherapy or combination of medications or medications with psychotherapy 2. Type of medication use 3. Optimal treatment strategy for different stage of depression for different population	1. Comparison of treatments – which treatment is most effective	The availability of guidelines to inform practice on the following areas: 1. Research and treatment compliance and effectiveness 2. Research on the risk factors of non-compliant patients 3. Research on differential effects of various delivery regimen as stated in suggested research areas	22
			2. Specific parameters of exercise in each population for effective treatment of depression		23
			3. Cost effectiveness of different treatment		16
			4. The long-term effectiveness of different strategies for different age of groups		20
			5. The disaggregated effect of treatment modality between psychotherapy and pharmaceutical therapy		17
			6. Determinants of response to different therapies between age groups and genders		14
	Child and Adolescent mental health & suicidal ideation (5 - 17 years)	1. Child & Adolescent among the highest population having burden of mental health 2. Prevalence: ● NHMS 2017: Adolescent Mental Health (13-17 years)	1. Specific study to the target population to identify risk factors and commence intervention i.e. school-based intervention studies	Establish evidence-based/ value-based medicine regarding the current burden of mental health and revising the current protocol/ CPG/ Guideline/ Training Module	5

Color Reference					
1-5	6-10	11-15	16-20	21-23	

National Problem	Research Scope	Gaps & Needs (Rationale)	Focus Area	Expected Output	Rank
		Depression: 18.3% Anxiety: 39.7% ● NHMS 2019: - Depression (adult): 2.3% Child 5-15yrs (overall MH): 7.9%	2. To determine the effectiveness of school-based mental health intervention problem such as peer support programme, counselling, coping skill		6
Violence (Adult)	Physical, emotional and sexual violence (18 years above)	1. Finding from WHO, Multi-country Study on Women's Health and Domestic Violence against Women found that between 15% and 71% of women ever in a relationship experienced physical or sexual violence by their intimate partner	1. Facility-based study to screen and offer subsequent intervention	Establish evidence-based/ value-based medicine regarding the current burden of violence and revising the current protocol/ CPG	13
		2. Prevalence of lifetime IPV (ever): 4.94% among PN mothers 3. Household Survey in Peninsular Malaysia (USM): 8.0% lifetime IPV	2. Study on violence awareness, prevention and management among the HRG		10

Color Reference				
1-5	6-10	11-15	16-20	21-23

National Problem	Research Scope	Gaps & Needs (Rationale)	Focus Area	Expected Output	Rank
	Violence & abuse - SDG and UHC in Malaysia	Analysis of the missing information or data which were not routinely collected for the monitoring & evaluation which leads to poor reporting of Malaysia's achievement or progress of certain SDG and UHC indicators	How big is the proportion of the population subjected to physical psychological or sexual violence in the previous 12 months		12
			What is the proportion of children who experienced any physical punishment and/ or psychological aggression by caregivers in the past months		9
			What is the proportion of young women and men who experienced sexual violence		12
			How extensive is the coverage of services for severe mental health disorder		10
Physical Injury	Intentional and unintentional injuries	1. Injuries (RTA and self-harm) are among the top 10 contributors to premature mortality in Malaysia	Evaluation of granular data on injuries, including domestic abuse and self-harm, collected by various public agencies to reveal factors associated with disparities in incidence, treatment and outcome	Development of effective targeted policies to reduce disparities	19
		2. Epidemiology of injuries, specifically disparities in incidence, treatment and outcome, not well understood	Follow-up qualitative exploration to understand contextual factors contributing to disparities		21

Color Reference				
1-5	6-10	11-15	16-20	21-23

National Problem	Research Scope	Gaps & Needs (Rationale)	Focus Area	Expected Output	Rank
		3. Such disparities are likely to result from social determinants of health, therefore potentially avoidable	Study on disability and injury rehabilitation		18

CHAPTER 8: ENVIRONMENTAL & DISASTER RISKS

Introduction

Environmental issues have serious effects on human beings and natural resources. Among the common environmental issues include natural and industrials hazards, weather and climate change,[45] toxicity of tobacco smoke, air and water pollution, bad diet, and wastes. Human beings are increasingly exposed to these hazards depending on their occupation, lifestyle, place of residence, air quality, and food habits.[46]

Malaysia population, just like other developing countries, faces potential health threats due to occupational and environmental hazards. New challenges such as increasing usage of chemicals in industries, household products, and cosmetics, as well as the effect of climate change need to be taken seriously because their adverse effects are not well studied in our environment. Disease patterns such as food-, water- and vector-borne, weather-related (e.g., heat stroke), and toxic agent-related diseases should be closely monitored and communicated to the policymakers to prevent future problems.

Disasters that result from natural or man-made events affect food production, water supply, and ecosystem functioning. These lead to the emergence of infectious disease outbreaks, especially vector-borne diseases. Plan of action to prepare, manage, and reduce the effects of any disaster need to be detailed out in order to facilitate the future development of effective strategies in disaster management. Therefore, identification of research areas for environmental and disaster risks will focus on the challenges stated above.

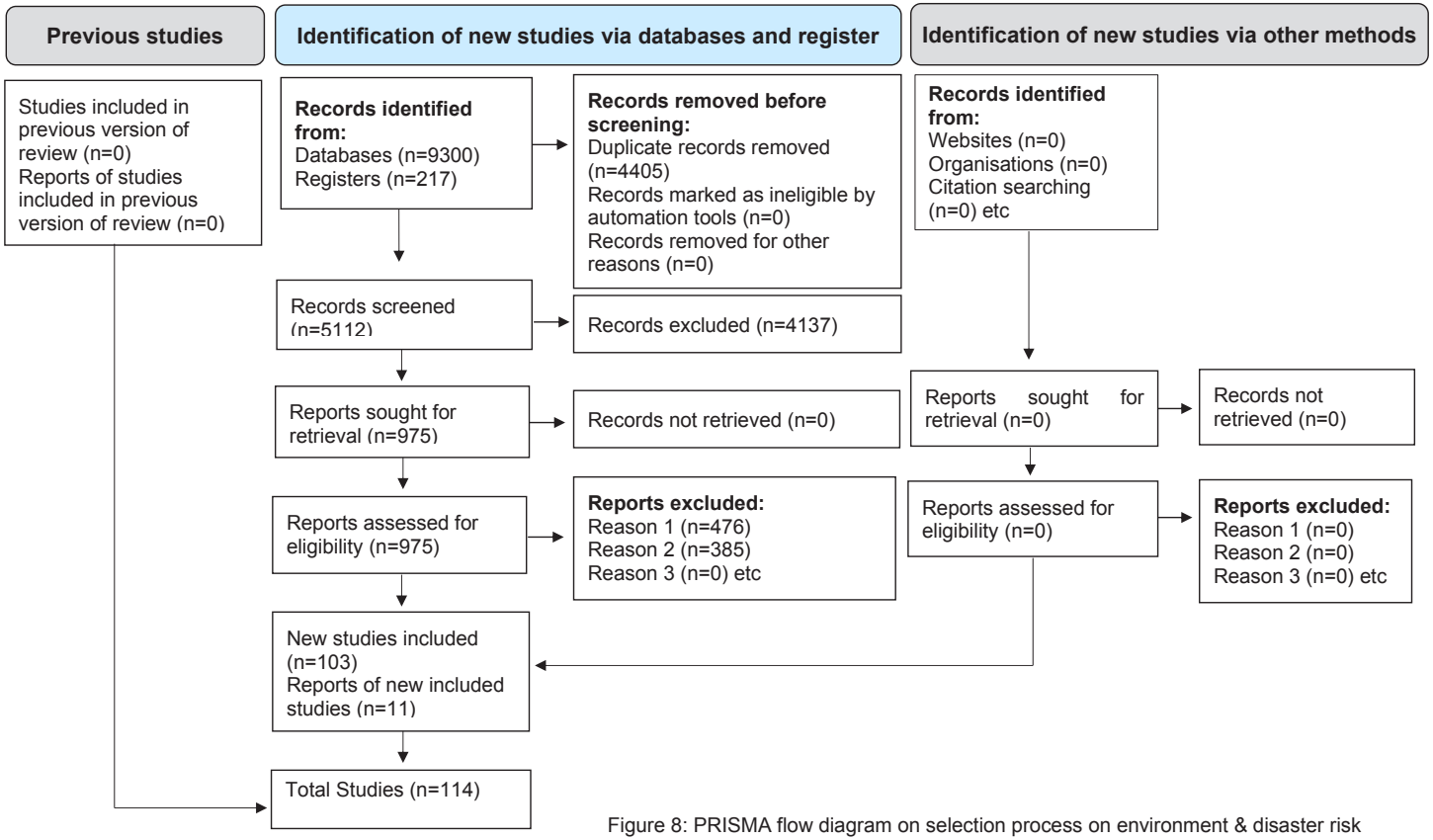

Figure 8: PRISMA flow diagram on selection process on environment & disaster risk

Priority Areas for Environmental & Disaster Risk

Color Reference										
RMK-12 Auto-priority		1-4		5-8		9-12		13-16		17-20

National Problem	Research Scope	Gaps & Needs (Rationale)	Focus Area	Expected Output	Rank
Environment health and safety	Climate change and health	The climate related health outcomes will rise significantly due to climate. Expanding the evidence base health is essential for better understanding and management of climate related health risk	Climate change and climate-sensitive diseases (e.g., vector borne diseases, food and water borne diseases, communicable diseases, zoonotic diseases, heat related illness, green technology etc.)	Research outcomes to improve policy on climate change and health	
			Health vulnerability and adaptation assessment including in extreme weather events (e.g., precipitation/ flood, draught, haze, urban heat island, etc.)		
	Occupational Health	Burden of occupational disease and injury arising from the workplace. Current studies mainly focus on prevalence, and limited study on effective intervention	Interventional study and early return to work (e.g., cost, and effective intervention for ergonomic and work-related musculoskeletal disorder, occupational cancer, etc.)	Identify priority area for intervention for early intervention to improve workplace condition, accident and occupational injury, disease follow-up system and registry among workers.	6
			Insurance claims in occupational disease and accidents in Social Security Organisation (SOCSO) and Insurance company. (Health Economics)		16
			Commuting accidents specifically looking into fatigue, stress, depression, etc)		8

Color Reference						
RMK-12 Auto-priority	1-4	5-8	9-12	13-16	17-20	

National Problem	Research Scope	Gaps & Needs (Rationale)	Focus Area	Expected Output	Rank
		Chemical and ionizing radiation hazards health effect such as neuropathy, occupational asthma and occupational cancer appear after long time of exposure	Chemical management system, KAP in the workplace	Strategic plan for chemical and ionizing radiation hazard management among Malaysian workers. This should include the effectiveness of the medical surveillance programme implemented	11
			Health effects of chemicals and ionizing radiation in healthcare facilities and industries		7
	Waste management	Scarcity of data on health issues related to solid waste, e-waste and radioactive waste management	Solid waste management and health issues.	Improving solid waste, e-waste, and radioactive waste management	10
			e-Waste management and health issues		9
			Radioactive waste and health effects		4
		Initiative for 3R (Recycle, Reduce and Reuse) is one of the programmes to support the green building activities in Malaysia. The effectiveness of the programme in health care facilities is never been assessed	3R and its implementation in health facilities	Evaluation of 3R programme in healthcare facilities	19

Color Reference					
RMK-12 Auto-priority	1-4	5-8	9-12	13-16	17-20

National Problem	Research Scope	Gaps & Needs (Rationale)	Focus Area	Expected Output	Rank
	Toxic Chemicals	Despite a widespread belief of heavy chemical use in daily life of Malaysians, the actual chemical risk has not been evaluated (e.g., there is no household toxic agent list to-date)	Knowledge, attitude and practise related to chemical (e.g., household product, etc.)	Develop toxic chemical exposure profile in Malaysia	14
			Toxicovigilance in public health sector including human biomonitoring		
		Chemical exposure and toxic effects to children	Birth cohort study on environmental health	Establish health effects among children due to chemical	
		There are a lot of unregistered traditional medicine and cosmetic that are available in Malaysia market	Toxic effect of alternative/ traditional medicine and cosmetic in Malaysia	Develop toxic profile for traditional medicine and cosmetic	18
			Poisoning cases in Malaysia, the agent and causes		17
	Urbanization	Urbanization impacts to health (e.g., residential area and development, industrialisation, agriculture, water supply, etc.)	Clean water and emerging water contaminant	Identify burden of emerging water contaminants and the need for developing standards	2
			Exposures to fine particulate matter during animal feeding operations		20

Color Reference						
RMK-12 Auto-priority	1-4	5-8	9-12	13-16	17-20	

National Problem	Research Scope	Gaps & Needs (Rationale)	Focus Area	Expected Output	Rank
	Air pollution	Analysis of the missing information or data which were not routinely collected for the monitoring & evaluation which leads to poor reporting of Malaysia's achievement or progress of certain SDG and UHC indicators	Burden of disease attributed to ambient air pollution (e.g., morbidity and mortality for CVD, respiratory diseases, cancer, etc.)	A comprehensive M&E report for SDG and UHC in Malaysia to be used for benchmarking with other countries	3
			Burden of disease attributed to household/ indoor air pollution (eg. Sick Building Syndrome)		15
			Assessment of air pollution among population residing near the heavy industrial and in urban areas		1
Disaster and health risk in man-made disaster (industrial)	Disaster preparedness and response in man-made disaster	Increasing man-made disaster (industrial) in Malaysia, and scarcity of data in context of preparedness and response	Preparedness and response in man-made disaster (e.g., healthcare and community resilience, risk communication, etc)	Improving preparedness, response and resilient status	12
	Health effect of disaster to population and responder	Limited data on toxic effects related to man-made disaster	Health effects of man-made disaster to surrounding population and responder (e.g., risk assessment, cancer risk, chronic health effect, cohort, etc.)	Establish data profile for post-disaster health monitoring	5
			Bioaccumulation of toxic agent for flora and fauna in disaster area		13

CHAPTER 9: NUTRITION, FOOD SAFETY & QUALITY

Introduction

Nutrition and food safety and quality are interrelated and prominent to health and quality of life. Nutritious, safe and quality food can improve nutritional status and well-being of nations. Malaysia is currently undergoing rapid industrialisation and mega-trend changes. As a result, there are significant lifestyle changes characterized by unhealthy dietary practices and sedentary lifestyles. The double-burden of malnutrition poses a major national challenge due to this unhealthy lifestyle. The NHMS 2019 reported that 21.8% of children under five years old were stunted, while 9.7% and 14.1% were wasted and underweight, respectively.[3] About 30% of children aged 5 to 17 years were overweight or obese. Approximately 21% of adults aged 15 to 49 years, including 30.4% of women were anaemic, whereas 18.3%, 30% and 38.1% of adults had raised blood glucose, blood pressure and blood cholesterol, respectively. In addition, more than half of adults were overweight or obese (50.1%). As reported in the previous national surveys, approximately 69% to 95% of Malaysians do not consume adequate fruits or vegetables.[3,39,47] Additionally, food security is an issue of concerns among Malaysians, particularly in the low-income group, in which food insecurity can affect health directly or indirectly through nutritional status.[48] A sustainable diet-related chronic diseases prevention must begin during the critical period of early human development. Additionally, the nutritional status of women of reproductive age is also one of the important elements in producing a healthy generation.

Nutrition research and development (R&D) play a vital role in providing the basis for solutions to health-related issues, allowing the Malaysian population to have a healthy and productive life.[49] Food and nutrition have a major key influence on health, economics, agriculture, and politics. New and innovative approaches to food and nutrition help to create a sustainable food system transformation in tandem with market demands and advances in technology. They have to keep pace with policymakers to engage in formulating evidence-based nutritional guidance and policies. Large-scale or nationwide studies are needed for the execution of addressing critical national public health problems and concerns.

The nutrition components in HRP are adopted from the latest Nutrition Research Priorities (NRP) in Malaysia for the 12MP (2021-2025)[28] This NRP was established based on the national needs as delineated in the revised National Plan of Action for Nutrition of Malaysia (NPANM) III (2016 – 2025) to underscore the importance of nutrition in enhancing population health, preventing diet-related diseases, and strengthening food and nutrition security. Hence, the nutrition components in HRP shall focus on the following national priority areas, namely: i) maternal, infant and young child (IYC) nutrition, ii) national food and nutrition situation, iii) life course approach to food intake and dietary practices, iv) nutritional deficiencies and excesses, v) overweight and obesity, vi) diet related NCDs, and vii) nutrient and non-nutrient composition of foods.

Ensuring food safety and the supply chain has becoming more complex and challenging. The globalization of food supply, the changing of consumption patterns as in greater preference towards processed and semi processed food, and the application of new technology including new ingredients in food production, may cause populations to be more exposed to food hazards. Therefore, research areas for food safety and quality under 12MP-HRP are developed based on the present food safety and quality issues such as food safety status and health risks, consumer behaviour, food fraud, food safety system, and food safety analysis.

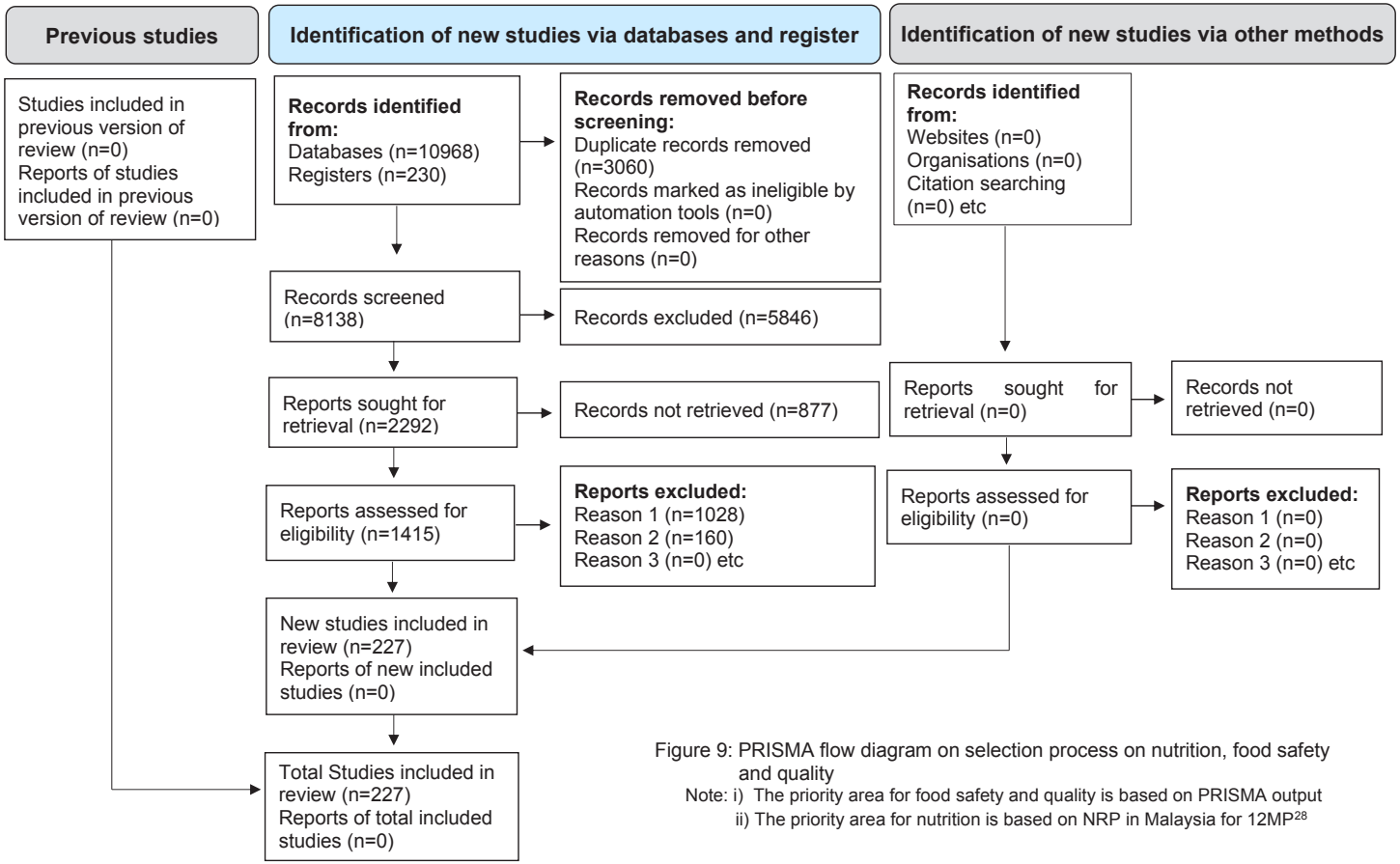

Figure 9: PRISMA flow diagram on selection process on nutrition, food safety and quality

Note: i) The priority area for food safety and quality is based on PRISMA output
ii) The priority area for nutrition is based on NRP in Malaysia for 12MP[28]

Priority Areas for Nutrition, Food Safety and Quality

Color Reference								
	NRP		1-2		3-4		5-6	

a) Nutrition					
National Problem	Research Scope	Gaps & Needs (Rationale)	Focus Area	Expected Output	Rank
Maternal, Infant and Young Child Nutrition	A 1. Maternal nutrition/ nutritional status and its outcome to mothers, infants and young children	There is limited information on the impact of anaemia on maternal and infant and young child (IYC) health outcomes, chronic diseases, psychological and cognitive outcomes Anaemia status is urgently required so that appropriate interventions can be taken to treat and prevent maternal related diseases	A 1.1 Nutrition in the first 1000 days of life and health outcomes	Scientific data on maternal nutritional status for future intervention/ programme planning	1
			A 1.2 The impact of maternal anaemia on mothers' health and nutritional status		2
			A 1.3 The impact of maternal anaemia on IYC health and nutritional status		1
			A 1.4 The impact of maternal nutritional status during pregnancy and lactation on breast milk composition and infant growth		1
			A 1.5 The impact of maternal dietary intake during pregnancy and lactation on breast milk composition and infant growth		1
			A 1.6 Dietary patterns and nutritional status among mothers of marginalised groups (single mothers, homeless, hard core and urban poor)		1
			A 1.7 The impact on maternal nutritional status due to changes in income status, mental health, lifestyle during/post COVID-19 pandemic		1

Color Reference					
NRP	1-2	3-4	5-6		

National Problem	Research Scope	Gaps & Needs (Rationale)	Focus Area	Expected Output	Rank
	A 2. Maternal gestational weight gain and outcome to mothers, birth, infants and young children	There is limited information on the impact of inappropriate gestational weight gain on maternal and IYC health outcomes, chronic diseases, psychological and cognitive outcomes Gestational weight gain status is urgently required so that appropriate interventions can be taken to treat and prevent related consequences	A 2.1 The impact of maternal gestational weight gain on mother's health and nutritional status (*anthropometry and biochemistry*)	Scientific data on the effect of inappropriate maternal gestational weight gain for future intervention/ programme planning	1
			A 2.2 The impact of maternal gestational weight gain on IYC health and nutrition		1
			A 2.3 The impact of COVID-19 pandemic on maternal nutrition and gestational weight gain including assessment of dietary intake and for early detection and treatment of under-nourished pregnant women		1
	A 3. Maternal GDM and outcome to mothers, infants and young children	There is limited information on the impact of GDM on maternal and IYC health outcomes. GDM can have adverse consequences on maternal and child health	A 3.1 The impact of maternal GDM on mothers health and nutritional status	Scientific data of maternal GDM on mother's health and nutritional health for future intervention/ programme planning	2
			A 3.2 The impact of maternal GDM on IYC health and nutritional status		1
	B 1. The impact of IYC nutritional status on growth and development	The availability of local studies on this issue is limited. With the rise in stunting cases in Malaysia	B 1.1 Relationship between malnutrition/ stunting/ low birth weight and cognitive development	Scientific data on impact of IYC nutritional status on growth and development for future	1

Color Reference					
NRP	1-2	3-4	5-6		

National Problem	Research Scope	Gaps & Needs (Rationale)	Focus Area	Expected Output	Rank
		of recent times, it is imperative to study how this factor could possibly have a role to play in cognitive development of a child. In addition, understanding the demographic of stunting cases is required to tackle the issue IYC nutritional status have been shown to have an impact on growth and cognitive of infants and young children	B 1.2 The impact of socio-economic status on malnutrition/ stunting/ low birth weight	IYC interventions/ programme planning	1
	B 2. The impact of feeding practices and dietary adequacy on IYC nutritional status and health outcomes	The availability of local studies on these issues are limited. Feeding practices among infant and young children requires more exploration to understand the pattern and its relationship to growth and development	B 2.1 The impact of care feeding practices on child development (cognitive, psychomotor and psycho-social)	Scientific data on impact of feeding practices and dietary adequacy on IYC nutritional status and health outcomes for future intervention/ programme planning	3
			B 2.2 Relationship between IYC feeding practices with malnutrition (overweight, obesity, underweight, stunting and wasting)		2
			B 2.4 Relationship between IYC feeding practices with infections and allergies (acute respiratory infection, asthma, gastro enteritis, eczema)		2

Color Reference					
NRP	1-2	3-4	5-6		

National Problem	Research Scope	Gaps & Needs (Rationale)	Focus Area	Expected Output	Rank
		IYC feeding has long term impact on growth, development and health status	B 2.6 Relationship between IYC feeding with macronutrient sufficiency		1
			B 2.7 Appropriate complementary feeding practices (timeliness, adequacy, diversity, frequency, safety)		1
			B 2.9 The impact of COVID-19 pandemic on children's nutrition, including assessment of dietary intake and evaluation for early detection and treatment of child wasting		1
	B 3. IYC feeding practices of children with special needs and marginalised groups (single mothers, homeless, hard core and urban poor)	Marginalized and special needs groups have different issues, which is important to be understood. The findings will potentially be useful in planning for health and intervention strategies for these groups Socio-cultural differences among the various marginalised groups (single mothers, homeless, hard core and urban poor) affect feeding practices, dietary intake and nutritional status. Information is	B 3.1 Dietary patterns and nutritional status among infants and young children of marginalised groups (single mothers, homeless, hard core and urban poor)	Scientific data on IYC feeding practices of children with special needs and marginalised groups (single mothers, homeless, hard core and urban poor) for future intervention	1
			B 3.2 The impact of COVID-19 pandemic on food security and IYC feeding practices in relation to socio-economically vulnerable families from marginalised groups (e.g., single mothers, homeless, hard core and urban poor)		1

Color Reference					
NRP	1-2	3-4	5-6		

National Problem	Research Scope	Gaps & Needs (Rationale)	Focus Area	Expected Output	Rank
		required to address the service needs of these marginalized groups Lack of information on feeding practices among infants and young children with special needs in Malaysia Information is required to address feeding practices among infants and young children with special needs	B 3.3 Dietary patterns and nutritional status among infants and young children with special needs		1
	B 4. The impact of parental lifestyle on birth and infant outcomes.	Lack of information on parental lifestyle on birth and infant outcomes in Malaysia. Foetal programming plays an important role in birth and health outcomes of infants. Thus, exploring parental lifestyle impact on their infants is highly needed Information is required to address parental lifestyle on birth and infant outcomes in Malaysia	B 4.1 The impact of parental lifestyle on birth and infant outcomes including adaptation to new norms post-COVID-19 pandemic	Data on impact of parental lifestyle on birth and infant outcomes are available for future intervention/ programmes planning	1

Color Reference					
NRP	1-2	3-4	5-6		

National Problem	Research Scope	Gaps & Needs (Rationale)	Focus Area	Expected Output	Rank
		Information on postpartum practices is limited. More exploration in this area is needed to help improve confinement practices and understand its association to improving maternal health outcomes Confinement practices during postpartum (controlling, restricting or responsive) have been shown to have an impact on maternal health, breastfeeding practice and breastmilk composition	B 4.2 The impact of mother's belief and confinement practices during postpartum on maternal health, breastfeeding practices and breastmilk composition		2
	C 1. Evaluation of current strategies/ programmes/ policies for mothers	Information on evaluation of nutrition education and breastfeeding strategies/ programmes/ activities is limited. Various programmes have been conducted however, up to date, the effectiveness and outcome of these programmes are not	C 1.1 Evaluation on the effectiveness of nutrition education on mothers' health	Evaluation data of current strategies/ programmes/ policies for mothers to enhance the effectiveness of future programmes	1
			C 1.2 Evaluation on the effectiveness of post-natal home visit on breastfeeding practices		1
			C 1.3 Evaluation on the effectiveness of BFHI		1

Color Reference					
NRP	1-2	3-4	5-6		

National Problem	Research Scope	Gaps & Needs (Rationale)	Focus Area	Expected Output	Rank
		measured well. Thereby, conducting periodic evaluation of programmes would provide data to improvements and outcomes Many programmes have been implemented over the years. Hence, evaluation is needed to assess the effectiveness of the programmes			
	C 2. Evaluation of current strategies/ programmes/ policies for infants and young children	Information on evaluation of IYC feeding strategies/ programmes/ activities is limited. Various programmes have been conducted however, up to date, the effectiveness and outcome of these programmes are not measured well. Thereby, conducting periodic evaluation of programmes would provide data to improvements and outcomes	C 2.1 Evaluation on the effectiveness of nutrition education on infant and young children's health	Evaluation data of current strategies/ programmes/ policies for infants and young children to enhance the effectiveness of future programmes	1

Color Reference					
NRP	1-2	3-4	5-6		

National Problem	Research Scope	Gaps & Needs (Rationale)	Focus Area	Expected Output	Rank
		More nutrition education programmes on IYC feeding and health have been produced over the years. Hence, evaluation is needed to assess the effectiveness of these programmes			
	D 1. Development of strategies/ programmes/ policies on maternal and IYC nutrition	Lack of information on perception, knowledge and attitude towards human milk bank among the public and parents. Human milk bank is a growing interest in Malaysia as there are needs for it. However, public understanding and perception are important to ensure its application in the future Perception, knowledge and attitude status towards human milk bank among the public and parents is urgently required so that	D 1.1 Public perception, knowledge and attitude towards human milk bank.	Scientific data for development of strategies/ programmes/ policies on maternal and IYC nutrition for future intervention/ programmes planning and implementation	1
			D 1.2 Parents' perception, knowledge and attitude towards human milk bank		1

Color Reference					
NRP	1-2	3-4	5-6		

National Problem	Research Scope	Gaps & Needs (Rationale)	Focus Area	Expected Output	Rank
		appropriate programmes can be developed to enhance breastfeeding practices			
		Lack of information on the impact of promotion and advertisement on consumption of Growing Up Milk (GUM) and commercial complementary foods Mother's choice of GUM and complementary food may be influenced by aggressive advertisement and promotion, informative labelling and attractive packaging of milk products	D 1.3 Parents understanding on the different types of milk (e.g., infant formula vs GUM vs full cream milk) and commercial complementary food		1
	D 2. Evaluation of strategies/ programmes/ policies on maternal, IYC nutrition.	Lack of information on the effectiveness of the implementation of mother friendly workplace strategies and induced lactation/re-lactation programme. Impact evaluation of programmes	D 2.1 The impact of mother friendly workplace (e.g., lactation breaks, availability of crèche, breastfeeding room, maternity leave) on exclusive breastfeeding and breastfeeding duration	Evaluation data for strategies/ programmes/ policies on maternal, IYC nutrition to enhance the effectiveness for future programmes	1
			D 2.2 Factors influencing success of lactation induction and re-lactation		1

Color Reference					
NRP	1-2	3-4	5-6		

National Problem	Research Scope	Gaps & Needs (Rationale)	Focus Area	Expected Output	Rank
		is much required to ensure its sustainability and improvements Providing mother-friendly facilities at the workplace may support breastfeeding			
		D 2.4 Evaluation on the effectiveness of the MOH guidelines in relation to BF practices for suspected or confirmed COVID-19 cases and the effect on BF duration	D 2.3 Evaluation on the effectiveness of antenatal programmes on anaemia, GDM and gestational weight gain		1
			D 2.4 Evaluation on the effectiveness of the MoH guidelines in relation to BF practices for suspected or confirmed COVID-19 cases and the effect on BF duration		1
National Food and Nutrition Situation	A 1. Regular national surveys for monitoring global and national nutrition indicators	Lack of comprehensive national food and nutrition security data To support the implementation and monitoring of the objectives of NPANM III, 2016-2025: To strengthen food and nutrition security	A 1.1 Comprehensive assessment of nutritional status (anthropometric, dietary intake and practices, clinical and biochemical data) for all age groups covering key components; through: A.1.1.1 Regular NHMS by Institute of Public Health, NIH Malaysia: - NHMS 2021: Maternal and Child Health Survey	Comprehensive national food and nutrition security data for future intervention/ programmes planning	1

Color Reference					
NRP	1-2	3-4	5-6		

National Problem	Research Scope	Gaps & Needs (Rationale)	Focus Area	Expected Output	Rank
		To ensure and support nutrition sensitive national food production as stipulated in National Agro Food Policy (DAN) 2.0 (2021-2030)	- NHMS 2022: Adolescent Health - NHMS 2023: NCD and Healthcare Demand - NHMS 2024: Nutrition Survey - NHMS 2025: Communicable Diseases		
			A.1.1.2 .National/ large longitudinal studies on priority areas and groups; - Malaysian Children Longitudinal Study (from pregnancy until 18 years old) - Malaysian Heart Study		2
			A 1.2 Studies on global and national nutrition parameters/ indicators/ targets; - Sustainable Development Goals (SDG) 2030 ■ Anemia among children among 6.0-59.9 months ■ Undernourishment status among population - Global Nutrition Target (GNT) 2025 - National Plan of Action for Nutrition of Malaysia (NPANM) III, 2016-2025		1

Color Reference					
NRP	1-2	3-4	5-6		

National Problem	Research Scope	Gaps & Needs (Rationale)	Focus Area	Expected Output	Rank
	A 2. Food and nutrition security among vulnerable groups	Limited data at national level. In line with NPANM III and Shared Prosperity Vision 2030 and other National Food Security Priority Indicators	A 2.1 Assessment of food and nutrition security among vulnerable groups by using FIES: A 2.1.1 under-five children	Comprehensive national food and nutrition security data among vulnerable groups for future intervention/ programmes planning	1
			A 2.1.2 WRA		1
			A 2.1.3 older people		2
			A 2.1.4 indigenous people in Peninsular, Sabah and Sarawak		1
			A 2.1.5 refugees		3
			A 2.1.6 B40 (urban, rural poor)		1
			A 2.1.7 people with special needs		1
	A 3. Incorporation of nutrition components into national studies conducted by other agencies	To optimise other determinants of food and nutrition security via inclusion of nutrition components by the relevant key stakeholders (e.g., social determinants)	A 3.1 Incorporation selected nutrition components into national studies conducted by various agencies (government or non-government sectors); - Household Income and Expenditure Survey (HIES) by DOSM -Assessment of Household Dietary Diversity (HDD) at National Level using HDD Scale - Analysing food security using household survey data		1

Color Reference					
NRP	1-2	3-4	5-6		

National Problem	Research Scope	Gaps & Needs (Rationale)	Focus Area	Expected Output	Rank
			- Food deprivation among vulnerable population using Household Hunger Scale		
	A 4. Determination of national foods and nutrition transition over time	Lack of comprehensive national trend data on food and nutrition transition in Malaysia. To provide evidence to the relevant stakeholders for policy making and programme planning	A 4.1 Assessment of national foods and nutrition transition over time through food and nutrition surveillance system A 4.1.1 National Food Balance Sheet (FBS) to examine trend in food supply and dietary energy supply (DES)	Scientific data on national foods and nutrition transition over time for intervention/ programmes planning	2
			A 4.1.2 HIES data to examine changes in food expenditure and affordability		1
			A 4.1.3 Series of NHMS datasets to measure secular trend in food and nutrition indicators		1
			A 4.2 Determination on changes of dietary patterns and behaviours including measuring shifts to ultra-processed food		1
	A 5. Strengthening methods for population-based assessment of nutritional status/ biomarkers	High reliance on self-reports The baseline data important for need assessment and decision making process (policies and programmes)	A 5.1 Development of feasible and reliable methods for population-based assessment of - dietary intake - physical activity - micronutrient status	Scientific data on feasible and reliable methods for population-based assessment of nutritional status/ biomarkers for future research planning	2

Color Reference					
NRP	1-2	3-4	5-6		

National Problem	Research Scope	Gaps & Needs (Rationale)	Focus Area	Expected Output	Rank
			A 5.2 Harnessing technology for timely data collection, processing and reporting (i.e., electronic FFQ)		1
	B 1. Evaluation on the existing national nutrition programmes of MoH	Limited data on the effectiveness of national nutrition programmes Ensuring proper implementation, coordination, monitoring and evaluation of programmes and projects	B 1.1 National evaluation of the effectiveness of the Baby Friendly Hospital Initiative (launched in 1992)	Scientific data on effectiveness of national nutrition programmes for enhancing future programmes	1
			B 1.2 National evaluation of the effectiveness of the Baby Friendly Clinic Initiative		1
			B 1.3 National evaluation on the effectiveness of the iron and folate supplementation to combat iron deficiency anaemia among pregnant mothers		1
			B 1.4 Evaluation on the effectiveness of the universal salt iodisation to eradicate Iodine Deficiency Disorder (IDD)		1
			B 1.5 National evaluation on meeting Malaysian dietary guidelines following the Malaysian Food Pyramid 2020 and Malaysian Healthy Plate (SSS) 2020		1

Color Reference					
NRP	1-2	3-4	5-6		

National Problem	Research Scope	Gaps & Needs (Rationale)	Focus Area	Expected Output	Rank
	B 2. Evaluation on the existing national nutrition programmes by other ministries	Limited data on the effectiveness of national nutrition programmes. Ensuring proper implementation, coordination, monitoring and evaluation of programmes and projects	B 2.1 Evaluation on the effectiveness of national programme such as School Meal Programme (*Program Hidangan Berkhasiat di Sekolah HiTS*)	Scientific data on the effectiveness of national nutrition programmes by other ministries for enhancing future programmes	1
			B 2.2 Evaluation of food-related social safety net programme (e.g., Food Bank, MyKasih)		2
			B 2.3 Evaluation of urban farming to promote diet quality in households and community by Department of Agriculture		2
	B 3. Evaluation on the existing national nutrition programmes for private sectors	Limited data on the effectiveness of national nutrition programmes Ensuring proper implementation, coordination, monitoring and evaluation of programmes and projects	B 3.1 Evaluation on the awareness and effectiveness of voluntary Front of Pack Labelling (FOP) including Healthier Choice Logo (HCL)	Scientific data on the effectiveness of national nutrition programmes by private sectors for enhancing future programmes	1
			B 3.2 Evaluation on the effectiveness of Sugar Sweetened Beverages (SSB) Tax		1
	C 1. Determination of the factors/ causes affecting food and nutrition security status	Limited national data on factors/ causes affecting food and nutrition security status	C 1.1 Causes / factors contributing to food insecurity (availability, accessibility, utilization and stability) and the coping strategies among vulnerable groups; - under-five children - WRA	Scientific data on factors/ causes affecting food and nutrition security status for future intervention/ programmes planning	1

Color Reference					
NRP	1-2	3-4	5-6		

National Problem	Research Scope	Gaps & Needs (Rationale)	Focus Area	Expected Output	Rank
		To achieve SDG goal to end hunger (SDG 2.1.1 & 2.1.2) by 2030 and align with shared prosperity vision of the *Wawasan Kemakmuran Bersama* 2030	- older people - indigenous people in Peninsular, Sabah and Sarawak - refugees - B40 (urban, rural poor) - people with special needs		
			C 1.2 Causes/ factors contributing to specific national nutrition issues in the country; - stunting among under-five children - anaemia among WRA- childhood obesity - diet-related NCDs (e.g., diabetes, hypertension) - inadequate micronutrient intake (e.g., calcium, iron, iodine)		1
			C 1.3 Multidimensional determinants contributing to unhealthy dietary practices in targeted groups, including; - individual and family - community and society - social environment - cultural and food environment - spiritual factors - law and regulation		1

Color Reference								
	NRP		1-2		3-4		5-6	

National Problem	Research Scope	Gaps & Needs (Rationale)	Focus Area	Expected Output	Rank
	C 2. Determination on the outcome/ impact of food and nutrition security	Lack of information on the outcome or impact of food and nutrition security To ensure the overall impact of food security, including direct and indirect costs, on the nutritional well-being of the Malaysian population	C 2.1 Assessment of outcome/ impact of nutrition and food security; - obesity, eating behaviour, nutritional status - cost benefit analysis - quality of life - morbidity and mortality	Scientific data on the outcome or impact of food and nutrition security for future intervention/ programmes planning	1
	C3. Assessment on the impact of pandemic outbreaks/ disaster on food security and nutritional status	The crucial of assessing the outcome or impact of pandemic outbreaks/ disaster on food security and nutritional status This scientific evidence is intended to enlighten and contribute to the development of comprehensive and integrated Food and Nutrition in Emergency Guidelines	The impact of pandemic outbreaks on the nutrition situation in the country (e.g., nutritional status, food consumption, food supply chain, agriculture landscape, food prices/ trade and food environment/ availability)	Scientific data on impact of pandemic outbreaks/ disaster on food security and nutritional status for intervention/ programmes planning	1

Color Reference								
NRP		1-2		3-4		5-6		

National Problem	Research Scope	Gaps & Needs (Rationale)	Focus Area	Expected Output	Rank
Life Course Approach to Food Intake and Dietary Practices	A 1. Effects of personal and environmental factors on food intake	Although studies are available on the role of personal and environmental factors on diet quantity and diet quality, the available information is restricted to only certain aspects of the personal and environmental factors and diet quantity or quality	A 1.1 Effects of personal and environmental factors on diet quantity (nutrients, energy, food serving).	Comprehensive data on effects of personal and environmental factors on food intake for future intervention/ programmes planning	1
			A 1.2 Effects of personal and environmental factors on diet quality (dietary pattern, dietary diversity)		1
			A.1.3 Effects of emergency situation (e.g., flood, epidemic of infection diseases) on diet quantity and diet quality		1
	A 2. Effects of personal and environmental factors on dietary practices	Lack of information on the influence of personal and environmental factors towards eating out, late night eating practices, fast/ convenient/ restaurants/ hawkers food, food truck and food delivery	A 2.1 Personal and environmental factors influencing eating out and late night eating	Comprehensive data on effects of personal and environmental factors on dietary practices for future intervention/ programmes planning	1
			A 2.2 Personal and environmental factors influencing intake of fast /convenient/ restaurants/ hawkers food, food truck and food delivery		1
			A.2.3 Effects of emergency situation (e.g., flood, drought, infectious diseases) on dietary practices (e.g., unhealthy eating habit/practice - compulsive over eating or under eating, food rationing, meal pacing)		1

Color Reference									
NRP		1-2		3-4		5-6			

National Problem	Research Scope	Gaps & Needs (Rationale)	Focus Area	Expected Output	Rank
	B 1. Effects of food intake and dietary practices on physical, mental and social well-being	Limited information/ studies on the effects of food intake and dietary practices on short-term and long-term nutrition and health status	B 1.1 Effects of early childhood food intake and dietary practices on morbidity and mortality	Scientific data on effects of food intake and dietary practices on physical, mental and social well-being for intervention/ programmes planning	2
			B 1.2 Effects of early childhood food intake and dietary practices on stunting		1
			B 1.3 Effects of early childhood food intake and dietary practices on NCD risk		1
	C 1. Identification/ development of effective strategies/ interventions to improve diet quantity and quality	More information on effective strategies/ interventions that are tailored to the specific needs of life stage/ socioeconomic/ community groups is needed	C 1.1 Identification/ development strategies/interventions to improve diet quantity and quality of children and adolescents	Scientific data on the development of effective strategies/ interventions to improve diet quantity and quality for future intervention planning	3
			C 1.2 Identification/ development strategies/ interventions to improve diet quantity and quality of older people		3
			C 1.3 Identification/ development strategies/ interventions to improve diet quantity and quality of vulnerable groups (e.g., *Orang Asli*, B40, orphan)		3
			C 1.5 Identification/ development community empowerment strategies in promoting healthy eating; i. To promote milk, fruits and vegetables consumption ii. To reduce intake of salt, sugar and fat		1

Color Reference					
NRP	1-2	3-4	5-6		

National Problem	Research Scope	Gaps & Needs (Rationale)	Focus Area	Expected Output	Rank
			C 1.6 Identification/ development age-specific innovative and interactive tools to promote healthy eating		1
			C 1.7 Identification/ development effective delivery strategy of nutrition programs/ interventions by healthcare professionals to targeted population		2
	C 2. Strengthening of existing strategies/ interventions to improve diet quantity and quality	Limited information on evaluation of existing nutrition strategies / interventions aimed to address diet quantity and quality	C 2.1 Evaluation on the impact of nutrition components into 'edible garden project' (community, school, household)	Comprehensive information on evaluation of existing nutrition strategies / interventions aimed to address diet quantity and quality for future intervention planning	3
			C 2.2 Evaluation on the impact of school food environment (school canteen, food outside school area)		1
			C 2.3 Evaluation on the impact of nutrition campaigns (e.g., *Suku Suku Separuh)*		2
			C 2.4 Evaluation on the impact of school meal programmes		2
			C 2.5 Evaluation on the delivery platform/ mode of nutrition education (digital based, social media, printed materials).		2

Color Reference				
NRP	1-2	3-4	5-6	

National Problem	Research Scope	Gaps & Needs (Rationale)	Focus Area	Expected Output	Rank
	D 1. Improvement in methods/ tools/ instruments for assessment of food Intake	Validated methods/ tools/ instruments are needed to improve food intake assessment	D 1.1 Development/ adoption/ modification and validation of methods/ tools/ instruments to assess food intake	Scientific data on the validated methods/ tools/ instruments for food intake assessment for future research	1
	D 2. Improvement in assessment tools/ instruments of dietary practices	Validated tools/ instruments are needed for assessment of dietary practices	D 2.1 Development of tools/ instruments for assessment of dietary practices (e.g., perception, beliefs, values, attitude, barriers)	Scientific data on validated tools/ instruments for assessment of dietary practices for future research	1
			D 2.2 Validation of tools/ instruments for assessment of dietary practices (e.g., perception, beliefs, values, attitude, barriers)		2
Nutritional Deficiencies and Excesses	A 1. Association between macronutrient* status with health outcomes *Macronutrient: Carbohydrate, Protein and Fat	Lack of data for policy and programmes	A 1.1 Association between macronutrient intake and health outcomes (e.g., NCD, malnutrition) among various age groups	Scientific data on macronutrient for policy and programmes	2

Color Reference					
NRP	1-2	3-4	5-6		

National Problem	Research Scope	Gaps & Needs (Rationale)	Focus Area	Expected Output	Rank
	A 2. Association between micronutrient* status with health outcomes. *Micronutrient: Vitamin A, vitamin D, vitamin B1, vitamin B2, vitamin B12, folate, iron, iodine, zinc, selenium, calcium, chromium, sodium, potassium	Lack of data for policy and programmes	A 2.1 Determination on association between selected micronutrient intake and health outcomes (e.g., anaemia, Neural Tube Defect (NTD), Cognitive impairment and Intelligence Quotient (IQ), Growth Retardation, bone mineral density, obesity, diabetes, stunting and infectious disease) among various age groups	Scientific data on micronutrient for policy and programmes	1
	B 1. Development of studies to determine macronutrient* and micronutrient** status of all age groups	Lack of data on suggested nutrient status in vulnerable groups Lack of data on food product enriched or fortified with micronutrient	B 1.1 Studies on suggested micronutrient status among specific groups (e.g., *Orang Asli*, Urban Poor, B40)	Scientific data on macronutrient and micronutrient status among vulnerable group for policy and programmes	2
			B 1.2 Studies to investigate the intake and status of macronutrient and micronutrient among children <5 years old		1
			B 1.4 Studies to investigate the intake of macro and micronutrient among older adults (Urban poor, B40)		3

Color Reference				
NRP	1-2	3-4	5-6	

National Problem	Research Scope	Gaps & Needs (Rationale)	Focus Area	Expected Output	Rank
	*Macronutrient: Carbohydrate Protein Fat **Micronutrient: Vitamin A Folate Vitamin B12 Vitamin C Vitamin D Iron Calcium Zink Iodine Selenium Chromium Potassium				
	B 2. Evaluation on the current intervention to improve micronutrient* and macronutrient** status	Lacking data on hematinic supplementation in pregnancy: 1. Compliance by mothers 2. Cost effectiveness of supplementation programme	B 2.1 Profiling iron deficiency anaemia risk factor characteristics among pregnant women (B1)	Comprehensive data on effectiveness of current intervention to improve macronutrient and micronutrient status to enhance future intervention	2
			B 2.2 Comparison of cost effectiveness study of combination and single dose iron supplementation among pregnant women		3

Color Reference								
NRP		1-2		3-4		5-6		

National Problem	Research Scope	Gaps & Needs (Rationale)	Focus Area	Expected Output	Rank
	*Micronutrient: *Folic acid, iron, vitamin C, vitamin B complex (hematinics) *Micronutrient: *Iodine **Macronutrient: Carbohydrate Protein Fat	Increasing findings of congenital hypothyroidism in infants in Peninsular Malaysia. Lacking data on maternal iodine status Universal Salt Iodization (USI) will be enforced starting September 2020. Evaluation studies on the impact of USI is needed	B 2.3 Evaluation on the effectiveness of salt iodisation intervention (usage, handling, storage, toxicity, health impact)		1
	B 3. Conduct new intervention to improve macronutrient* and micronutrient** status *Macronutrient: Carbohydrate Protein Fat **Micronutrient: Vitamin A Folate	Double burden of malnutrition on the rise Lack of data on specific micronutrient and the impact to the health outcome	B 3.1 Protein, calcium, Vitamin D, and iodine rich food intervention for growth and development of under 5 years old children	Scientific data to improve macronutrient and micronutrient status for future intervention/ programmes planning	1
			B 3.3 Intervention to reduce sugar consumption		3
			B 3.4 Nutrition intervention on weekly iron and acid folic supplementation among WRA		2

Color Reference				
NRP	1-2	3-4	5-6	

National Problem	Research Scope	Gaps & Needs (Rationale)	Focus Area	Expected Output	Rank
	Vitamin B12 Vitamin C Vitamin D Iron Calcium Zink Iodine Selenium Chromium Potassium				
Overweight and Obesity	A 1. Relationship between waist circumference (WC), waist-hip ratio (WHR), waist-height ratio (WHtR) and body mass index (BMI) on NCDs	WC is an important indicator of central obesity. Cut-off points for WC of adults, adolescent and children are known, but its relationship with co-morbidities is yet to be identified. WHR and WHtR are other tools to be explored in future studies	A 1.1 Definition of obesity for Malaysians based on WC	Scientific data on the relationship between WC, WHR, WHtR, and BMI on NCDs for future research and intervention/ programmes planning	2
			A 1.2 Cohort study to identify appropriate WC cut-off points, WHR, WHtR and BMI for Malaysians based on co-morbidities		1
			A 1.3 Association of WHR, WHtR and BMI with NCDs risk factors		1
	A 2. Relationship between adiposity and NCDs risk factors	There is lack of sufficient data and the health consequences of higher body fat in Malaysian lacks scientific basis	A 2.1 Relationship between body composition and morbidity in adult Malaysians	Scientific data on the relationship between adiposity on NCDs for future research and intervention/ programmes planning	1
			A 2.2 Relationship between body composition and health risks in children and adolescents		2

Color Reference					
NRP	1-2	3-4	5-6		

National Problem	Research Scope	Gaps & Needs (Rationale)	Focus Area	Expected Output	Rank
	A 3. The impact of early nutrition on development of adult obesity	Defining early predictors of obesity in Malaysia is important, as premature age of adiposity rebound and catch-up growth (after foetal, neonatal and infant growth retardation) have repeatedly been shown to be strong determinants of obesity in later life	A 3.1 Establishment appropriate growth standard chart from birth to adulthood in order to define the normal age-range for onset of adiposity rebound of healthy children in various ethnic groups in Malaysia (cohort study)	Development of growth standard chart in Malaysia and data on the impact of early nutrition on development of adult obesity for future research and intervention/ programmes planning	1
			A 3.2 Definition and identification on paediatric population groups that are at risk of neonatal or post-natal catch-up growth		2
			A 3.3 The relationship between gestational weight gain and breastfeeding practices on the development of obesity		1
			A 3.4 Obesity in pregnancy: Epidemiology, mechanisms, nutritional and metabolic management		2
			A 3.5 Preconception weight status of the mother and spouse and the relationship with childhood obesity (cohort study)		2
			A 3.6 Is early-life antibiotic exposure associated with obesity in children		3

Color Reference				
NRP	1-2	3-4	5-6	

National Problem	Research Scope	Gaps & Needs (Rationale)	Focus Area	Expected Output	Rank
	A 4. The impact of obesity on social and economic cost	Economic costs of obesity are important issues for health care providers and policymakers alike. Effort to quantify the magnitude of economic burden of obesity-related morbidity and mortality is vital to reduce healthcare cost	A 4.1 The economic and personal health costs of overweight and obesity	Scientific data on the impact of obesity on social and economic cost for future policy and programmes planning	1
			A 4.2 The economic burden of obesity and obesity-related chronic diseases		1
		Obesity has a significant impact on health-related quality of life (QOL) and functional capacity of individual in the society	A 4.3 Psycho-socio-cultural determinants and quality of life in obese population		2
	A 5. Association of dietary intake, appetite control, eating behaviour and inflammatory status with obesity	Eating behaviour especially heavy meal consumption during night-time and dieting may affect energy intake. Psychological mechanisms influencing eating behaviour may help maintain appropriate body weight gain. Improper weight loss methods may lead to yoyo effect on body weight	A 5.3 Night eating syndrome and its relationship with obesity	Scientific data on the association of dietary intake, appetite control, eating behaviour and inflammatory status with obesity for future intervention/ programmes planning	2
			A 5.4 Energy intake regulation among late night eaters		1

Color Reference					
NRP	1-2	3-4	5-6		

National Problem	Research Scope	Gaps & Needs (Rationale)	Focus Area	Expected Output	Rank
			A 5.5 Identification of psychological mechanisms influencing eating behaviour		2
			A 5.6 Weight loss methods being practiced by Malaysian population		3
			A 5.8 The role of diet composition on body weight (relevant food database: sugar, fatty acids, prepared meals/cooked foods, fast foods, international cuisine)		3
			A 5.9 The role of food addiction for weight control and obesity		2
	A 6. Determination of socio-cultural factors influencing obesity	Public perception of health in relation to obesity influences the success of obesity prevention and management	A 6.1 Parental perception of childhood obesity	Scientific data on socio-cultural factors influencing obesity for future intervention/ programmes planning	3
			A 6.2 Food cultures and socio-cultural determinants of food habits (including native minorities)		2
			A 6.3 Socio-cultural determinants of body image		3
			A 6.4 Inter-disciplinary approach to decision making in food and nutrition (nutrition sociology, anthropology and psychology)		2

Color Reference					
NRP	1-2	3-4	5-6		

National Problem	Research Scope	Gaps & Needs (Rationale)	Focus Area	Expected Output	Rank
			A 6.5 Obesity at workplace, stigmatisation, well- being and productivity (efficacy and follow up)		1
			A 6.6 Understanding babies born small for gestational age (SGA) and its effects on obesity, metabolic syndrome, hypertension, insulin resistance and diabetes		2
			A 6.7 The effect of obesity on employment discrimination		1
			A 6.8 Weight stigma as a psychosocial contributor to obesity		2
	A 7. Effect of metabolic predisposition to onset of obesity	Identification of individuals who are predispose to obesity is important as there is poor prognosis for the success of long-term management of obesity	A 7.1 Metabolic predisposition to adult-onset of obesity (efficacy and follow up)	Scientific data on the effect of metabolic predisposition to onset of obesity for future intervention/ programmes planning	1
			A 7.2 Metabolic predisposition to childhood-onset of obesity (efficacy and follow up).		2
	A 8. Association between physical inactivity, sedentary lifestyle and obesity	With the advent of technological advances, Malaysians lead a sedentary lifestyle and consequently higher rates of obesity. There is a need for in depth understanding	A 8.1 Effect of working hours on opportunity for physical activity and exercise	Scientific data on the association between physical inactivity, sedentary lifestyle and obesity for future intervention/ programmes planning	1
			A 8.2 Survey of existing physical activity curriculum and co-curriculum programme in schools		3

Color Reference					
NRP	1-2	3-4	5-6		

National Problem	Research Scope	Gaps & Needs (Rationale)	Focus Area	Expected Output	Rank
		of the current situation and factors affecting physical inactivity and sedentary lifestyle	A 8.3 Assessment of physical activity and sedentary level using objective methods		2
			A 8.4 Factors influencing physical activity and sedentary level in older adults and older people		1
			A 8.5 Using Geographic Information Systems (GIS) to show trends in obesity (including fitness centre, recreational centre and 24 hours food outlet)		1
			A 8.6 Relationship between sleeping pattern and obesity in all age group		2
			A 8.7 Obesity and the Built Environment (opportunities and barriers)		1
	A 9. Determination of genetic factors influencing development of overweight and obesity	Genes and the environment interact to influence development of overweight and obesity. To date, studies in this area carried out in Malaysia are scarce	A 9.1 The genetics of childhood obesity	Scientific data on genetic factors influencing development of overweight and obesity for future intervention/ programmes planning	3
			A 9.2 Determination of heritability of obesity-related phenotypes		3
			A 9.3 Phenotyping of eating behaviour and food intake		2

Color Reference					
NRP	1-2	3-4	5-6		

National Problem	Research Scope	Gaps & Needs (Rationale)	Focus Area	Expected Output	Rank
			A 9.4 Salivary epigenetic biomarkers as predictors of emerging childhood obesity		2
			A 9.5 Understanding food behaviour, eating practices and appetite control among children with genetic/syndromic obesity		1
	A 10. Obesity and COVID-19	Obesity has now been identified as an independent risk factor for severity of illness and death rates due to Covid-19. The scarcity of information regarding the increased risk of illness for people with a higher BMI has led to ambiguity and might increase anxiety, given that these individuals have now been categorized as vulnerable to severe illness if they contract COVID-19. Thus, there is a need for more evidence on pathophysiological aspects through research on some	A10.1 Interaction between Renin-angiotensin-aldosterone system (RAAS) inhibitors and ACE2 in the context of COVID-19	Scientific data on obesity and Covid-19 for intervention/programmes planning	1
			A10.2 Cytokine storm intervention in the early stages of COVID-19 pneumonia		2
			A10.3 The role of adipose tissue in viral shedding		3
			A10.4 Obesity a risk factor for Severe COVID-19 infection: thrombosis susceptibility		2
			A10.5 Obesity-related respiratory function in COVID-19 infection		2
			A10.6 Risk of mechanical ventilation in obese COVID-19 infection		2

Color Reference				
NRP	1-2	3-4	5-6	

National Problem	Research Scope	Gaps & Needs (Rationale)	Focus Area	Expected Output	Rank
		key areas such as adipose tissue biology, comorbidities related to thrombosis and obesity-related respiratory function, altered gut microbiota, immunity and nutrition	A10.7 Altered gut microbiota in obese COVID-19 infection		2
			A10.8 Obesity-related intestine inflammation in COVID-19 infection		3
			A10.9 Immune cell perturbation linked to obesity in COVID-19 infection		2
			A10.10 Future COVID-19 vaccination response in Obesity		2
			A10.11 Phytochemicals influence on gut microbiota and inflammatory diseases (COVID-19) in obese individuals		2
			A10.12 Leptin deficiency/resistance association on dysregulation of cytokine production and susceptibility toward infectious diseases		2
			A10.13 Obesity and COVID-19: the role of food and nutrition		2

Color Reference					
NRP		1-2		3-4	5-6

National Problem	Research Scope	Gaps & Needs (Rationale)	Focus Area	Expected Output	Rank
	B 1. Development and evaluation of obesity prevention and intervention programmes	In dealing with inequalities in health status as a fundamental principle of public health, it is necessary to consider the specific issues which make particular groups more vulnerable to weight gain. There is a lack of available model for the prevention and intervention programme for obesity	B 1.1 Development and evaluation of pre-school and school-based behavioural intervention programmes for the prevention of overweight and obesity in children	Scientific data on the development and evaluation on obesity prevention and intervention programmes for enhancing future intervention/ programmes planning	2
			B 1.2 Development, implementation and assessment of the effectiveness of appropriate obesity intervention programmes in adolescents		2
			B 1.3 Effectiveness of existing nutrition and physical activity curriculum and co-curriculum programme in pre-school and school-going children		3
			B 1.4 Evaluation of best practices in workplace and institutional settings for obesity prevention and intervention		2
			B 1.5 Effectiveness of existing obesity intervention programmes to reduce prevalence of diabetes, hypertension and CVD in community (i.e., KOSPEN initiative. *Jom Mama & MyBFF, Suku Suku Separuh & Cergas 3SC*)		1

Color Reference					
NRP	1-2	3-4	5-6		

National Problem	Research Scope	Gaps & Needs (Rationale)	Focus Area	Expected Output	Rank
			B 1.6 Effectiveness of park-based obesity prevention and management programme		3
			B 1.7 Evaluation on the effectiveness of the media campaign to prevent obesity		2
			B 1.8 Impact of television advertising of foods and beverages high in fat and/ or high in sugar in childhood obesity		2
			B 1.9 Cost effectiveness of obesity prevention and/ or intervention programmes		1
	B 2. Development and evaluation of obesity management programmes	Success rate of the various approaches to obesity management is low, and as such there is a need to develop more practical and effective approaches	B 2.1 Effectiveness of drugs and supplements/herbs in obesity management	Scientific data on the development and evaluation of obesity management programmes for enhancing future programmes	3
			B 2.2 Development and evaluation of behaviour modification strategies for management of obese adults and children		2
			B.2.3 Development and evaluation of strategies for promotion of weight loss and weight maintenance, and prevention of weight regain		1
			B 2.4 Effectiveness of health education in managing obesity and its co-morbidities		3

Color Reference				
NRP	1-2	3-4	5-6	

National Problem	Research Scope	Gaps & Needs (Rationale)	Focus Area	Expected Output	Rank
	B 3. The impact of policies and environment (food and physical activity) on obesity	There is lack of data on the impact of policies and the environment on obesity. To prevent and manage obesity, governments, food industries, the media, communities and individuals need to work together to modify the environment so that it is less conducive to weight gain	B 3.1 Determination of political and macro sociological factors that contribute to overweight and obesity in the population	Scientific data on impact of policies and environment (food and physical activity) on obesity for future policy planning	2
			B 3.3 The roles of food industry advertising and broadcasting agencies towards healthy eating and obesity prevention		1
			B 3.4 The roles of school canteens, cafeteria, restaurants and food service industries (including food-truck) towards healthy eating and obesity prevention		2
			B 3.5 Effectiveness of food service and restaurant empowerment programme on obesity prevention and management		3
			B 3.6 The impact of social and built environment on physical inactivity, sedentary and obesity prevention		2
			B 3.7 The 'obesogenic' environment and its effects on dietary intake and obesity		1
			B 3.8 Compliance of food service providers towards current dietary guidelines		2

Color Reference					
NRP	1-2	3-4	5-6		

National Problem	Research Scope	Gaps & Needs (Rationale)	Focus Area	Expected Output	Rank
			B 3.9 Reception of public health and nutrition messages: an analysis of socio-cultural and socio-economic differentiation for tailoring of healthy eating messages		2
			B 3.11 Association between use of SSB and childhood obesity prevalence		2
			B 3.12 Effects of the removal of sugar subsidies on prevalence of obesity		1
			B3.13 Household food insecurity and its association with obesity		2
	C 1. Identification of new methods to define obesity	Obesity has traditionally been defined based on BMI cut-off points. However, it is known that BMI does not truly reflect body composition	C 1.1 Development National Growth Chart and comparison with international standards using NHMS 2019 data	A novel finding of new methods to define obesity for future research and intervention planning	1
			C 1.2 Identifications of other indices to define obesity (waist neck circumference)		2
	C 2. Identification of novel strategies to prevent and manage obesity	Novel and practical intervention strategies are important for the prevention and treatment of obesity	C 2.3 Comparison on the effectiveness of different methods of weight reduction for obese individuals	Novel strategies to prevent and manage obesity for future intervention/ programmes planning	3
			C 2.4 Randomised Control Trials of obesity prevention programmes (individual/ group)		3

Color Reference					
NRP	1-2	3-4	5-6		

National Problem	Research Scope	Gaps & Needs (Rationale)	Focus Area	Expected Output	Rank
			C 2.5 Psycho sociological, nutritional management and assessment of obese patients' pre and post bariatric surgery		2
			C 2.6 The use of new technology AI in the prevention and treatment of obesity		1
Diet-Related Non-Communicable Diseases	A 1. Consolidation of aetiological data of diet-related NCDs risk and control	Require more published aetiological data for targeted implementation and strengthening future intervention programmes for prevention and control of diet-related NCDs	A 1.1 Systematic reviews and meta-analysis on the aetiological data of diet-related NCDs risk and control	New evidence on aetiological data of diet-related NCDs risk and control for future intervention/ programmes planning	1
			A 1.2 Scoping reviews on the aetiological data of diet-related NCDs risk and control		2
	A 2. Role of nutritional genomics and metabolomics in diet-related NCDs risk and control	Inadequate scientific data on mechanistic role and interaction between diet/nutrient intake, biomolecules and genes in the Malaysian population for personalised management of risk and control for diet-related NCDs	A 2.1 Studies on nutrigenomics and metabolomics in relation to diet-related NCDs risk and control	Genomics and metabolomics data in diet-related NCDs risk and control for future intervention/ programmes planning	3
			A 2.2 Identification of new nutritional biomarkers for diet-related NCDs risk and control		2
			A 2.3 Development of nutrigenomics-based personalized nutrition intervention programmes for diet-related risk and control		1

Color Reference				
NRP	1-2	3-4	5-6	

National Problem	Research Scope	Gaps & Needs (Rationale)	Focus Area	Expected Output	Rank
	A 3. Association of diet and lifestyle factors in relation to diet-related NCDs risk and control	Inadequate published data from case control and cohort studies related to dietary and lifestyle risk factors and control of diet-related NCDs among Malaysians. This data is needed to develop targeted implementation and strengthening future intervention programmes for prevention and control of diet-related NCDs	A 3.1 Nutrient and food group (e.g., ultra-processed foods, SSB, energy densed food) intakes and risk and control of diet-related NCDs	Scientific data on the association of diet and lifestyle factors in relation to diet-related NCDs risk and control for future intervention/ programmes planning	1
			A 3.2 Dietary patterns (e.g., *a priori*, *a posteriori or* hybrid-defined) and risk and control of diet-related NCDs		1
			A 3.3 Eating patterns, dietary practices and risk and control of diet-related NCDs		1
			A 3.4 Intrauterine exposures and long term consequences of risk and control of diet-related NCDs		2
			A 3.5 Contribution of diet and lifestyle to disease related complication among those with diet-related NCDs		1
			A 3.6 Contribution of gut microbiome in development and prognosis of diet-related NCDs		2

Color Reference								
NRP		1-2		3-4		5-6		

National Problem	Research Scope	Gaps & Needs (Rationale)	Focus Area	Expected Output	Rank
	A 4. Behavioural nutrition issues related to diet-related NCDs risk and control	Inadequate qualitative studies on behaviour, perception, beliefs, motivation, barriers, facilitators which relate to diet-related NCDs risk and control. These behaviours are unique for each population and data should be derived from Malaysian studies as a foundation in developing strategies for prevention and control of diet-related NCDs	A.4.1 Understanding of behaviour, beliefs, motivation, perception, barriers and facilitators with relate to diet-related NCDs risk and control	Scientific data on behavioural nutrition issues related to diet-related NCDs risk and control for intervention/ programmes planning	1
	A 5. Social and environmental factors in association with diet-related NCDs risk and control	Inadequate published data on social and environmental factors which relate to diet-related NCDs risk and control. These factors are unique for each population and data should be derived from Malaysian studies as a foundation in developing strategies for prevention and control of diet-related NCDs	A 5.1 Determination of psychosocial factors influencing dietary behaviours leading to NCDs risk and control	Scientific data on social and environmental factors in association with diet-related NCDs risk and control for future intervention/ programmes planning	1
			A 5.2 Food insecurity and risk and control of diet-related NCDs among vulnerable groups (e.g., older people, children, women at reproductive age, aboriginals, B40 and urban poor)		1
			A 5.3 Food environment and the risk and control of diet-related NCDs		1

Color Reference					
NRP	1-2	3-4	5-6		

National Problem	Research Scope	Gaps & Needs (Rationale)	Focus Area	Expected Output	Rank
			A.5.4 Built environment and the risk and control of diet-related NCDs		2
			A 5.5 Food related-inequalities i.e., food cost/ purchasing power/ socioeconomic status and the risk and control of diet-related NCDs		1
	B 1. Consolidation of interventional data related to prevention and control of diet-related NCDs	Require evidence-based data to implement and strengthen future intervention programmes for prevention and control of diet-related NCDs	B 1.1 Systematic reviews and meta-analysis on the interventional data for prevention and control of diet-related NCDs	New data on interventions related to prevention and control of diet-related NCDs for future programmes planning	1
			B 1.2 Scoping reviews on the interventional data for prevention and control of diet-related NCDs		2
	B 2. Development of novel and innovative diet and lifestyle intervention specific to age groups for prevention and control of diet-related NCDs	Inadequate availability of novel and innovative diet and lifestyle intervention specific for age groups for prevention and control of diet-related NCDs including during public health emergencies and threat. Practice of traditional intervention strategies are no longer	B 2.1 Development and evaluation of theory grounded intervention studies for prevention and control of diet-related NCDs	Scientific data on the development of novel and innovative diet and lifestyle intervention specific to age groups for prevention and control of diet-related NCDs for future programmes planning	1
			B 2.2 Development and evaluation of integrated and multi-faceted intervention (e.g., peer support, group therapy, structured nutrition therapy) for prevention and control of diet-related NCDs		1

Color Reference					
NRP	1-2	3-4	5-6		

National Problem	Research Scope	Gaps & Needs (Rationale)	Focus Area	Expected Output	Rank
		effective in modern society who impacted from globalisation and nutrition transition in Malaysia	B 2.3 Development and evaluation of dietary and lifestyle interventions using interactive web-based technology/mobile app technology for prevention and control of diet-related NCDs		1
			B 2.4 Development and evaluation of dietary and lifestyle interventions using adaptive mode of response during public health emergencies and threat for prevention and control of diet-related NCDs		1
	B 3. Development of new nutritional products for prevention and control of diet-related NCDs	Inadequate published scientific evidences on local functional foods, nutraceuticals and dietary supplements for prevention and control of diet-related NCDs. Malaysia, a tropical country, is rich with local underutilised plants which contains unexplored bioactive compounds	B 3.1 Development and evaluation of potential local functional foods, nutraceuticals and dietary supplements for prevention and control of diet-related NCDs	Scientific data on the development of new nutritional products for future prevention and control strategies of diet-related NCDs	1
			B 3.2 RCTs on the efficacy and effectiveness of local functional foods, nutraceuticals and dietary supplements for the prevention and control of diet-related NCDs		1

Color Reference				
NRP	1-2	3-4	5-6	

National Problem	Research Scope	Gaps & Needs (Rationale)	Focus Area	Expected Output	Rank
	C 1. Evaluation of nutritional care delivery system for prevention and management of diet-related NCDs	Inadequate published data on effectiveness of nutritional care delivery system for prevention and management of diet-related NCDs including during public health emergencies and threat. The data could be used to strengthen nutritional care delivery system in Malaysia	C 1.1 Assessment of awareness among health care providers on importance of nutritional care delivery system and guidelines for prevention and management of diet-related NCDs	Evaluation data of nutritional care delivery system in enhancing future for prevention and management of diet-related NCDs	2
			C 1.2 Evaluation of effectiveness of nutritional care delivery system for prevention and management of diet-related NCDs		1
			C 1.3 Evaluation of effectiveness of nutritional care delivery system for prevention and management of diet-related NCDs during public health emergencies and threat		1
			C 1.4 Determination of the factors that influences client's adherence to dietary advice (intervention) for prevention and management of diet-related NCDs		2
			C 1.5 Evaluation on the effectiveness of existing tools (Medical Nutrition Therapy (MNT), Quality Assurance Program (QAP), CPG, SOP) in relation to for prevention and management of diet-related NCDs		1

Color Reference				
NRP	1-2	3-4	5-6	

National Problem	Research Scope	Gaps & Needs (Rationale)	Focus Area	Expected Output	Rank
	C 2. Monitoring and benchmarking nutrition policies to improve outcomes of diet-related NCDs risk and control	Inadequate monitoring and benchmarking of nutrition policies with regards to prevention and control of diet-related NCDs. The data could be used to strengthen nutrition policies in Malaysia	C 2.1 Evaluation on the effectiveness of the nutritional component in community intervention initiatives (e.g., KOSPEN, KOSPEN PLUS) on diet-related NCDs risk and control	Scientific data on monitoring and benchmarking nutrition policies to improve outcomes of diet-related NCDs risk and control to strengthen existing policy and plan future policy	1
			C 2.2 Understanding the role of food industry and its association with diet-related NCDs risk and control using business impact assessment		2
Nutrient and Non-nutrient Composition of Foods	A 1. Analysis of macro and micronutrients in foods	1. Incomplete macro and micronutrients data for raw, processed and prepared foods 2. No available data on human breast milk	A 1.1 Determination of macronutrients (sugars, dietary fibre, fatty acids and amino acid) in view of an increase prevalence of over and undernutrition	Updated scientific data of macro and micronutrients in foods for future research planning and implementation	1
			A 1.2 Determination of micronutrients (e.g., iodine, selenium, zinc, magnesium, iron, chromium, vitamins) in view of micronutrient deficiencies among susceptible population (maternal, women at reproduction age, children below 5 years old and older adults)		2
			A 1.3 Determination of macro and micronutrients in different cultivars and varieties (e.g., rice, vegetables, fruits, tubers, roots and legumes)		3

Color Reference				
NRP	1-2	3-4	5-6	

National Problem	Research Scope	Gaps & Needs (Rationale)	Focus Area	Expected Output	Rank
	A 2. Collation of macro and micronutrients data using standardised procedures	1. Scattered and lack of nutrient data 2. Insufficient resources (money, man, machine, materials and management) 3. Increasing number of product reformulation in the market	A 2.1 Collation and validation of existing data from food industry into Malaysian Food Composition Database (MyFCD)	More accurate macro and micronutrients data using standardized procedures for future research planning and implementation	1
			A 2.2 Collation and quality assessment of existing data from published articles into MyFCD		2
	B 1. Addition of ethnic foods items	1. Inadequate nutrient data for ethnic foods	B 1.1 Determination of nutrient content of ethnic foods from different states	Nutrient data of ethnic and underutilised foods items for future research planning and implementation	1
	B 2. Addition of new emerging food items	1. No available nutrient data for hipster foods 2. Rapid modification of foods due to lifestyle changes 3. Introduction of new food from other countries	B 2.1 Determination of nutrient content of hipster foods (e.g., *pisang goreng cheese, corn dog, bubble tea*)	New data on addition of emerging food items for future intervention/ programmes planning	1
			B 2.2 Determination of nutrient content of street foods (e.g., *cakoi, apam balik*)		1
			B 2.3 Determination of nutrient content of fusion foods (e.g., *spagetti masak lemak cili padi*)		1

Color Reference					
NRP	1-2	3-4	5-6		

National Problem	Research Scope	Gaps & Needs (Rationale)	Focus Area	Expected Output	Rank
	B 3. Addition of underutilised foods	1. Insufficient data available. 2. Many underutilised foods believed to have health promoting components without scientific evidence	B 3.1 Determination of nutrient content of underutilised (fruits, vegetables and edible animals source) relating to nutrition and food security	Scientific data on addition of underutilised foods for future intervention/ programmes planning	1
	C 1. Analysis of phytochemicals in foods	1. Insufficient data available for specific polyphenols 2. Many reported health benefits 3. Increasing number of functional food products in the market.	C 1.1 Determination of polyphenols content in plant -based foods	Scientific data on phytochemicals and anti-nutrient data in foods for future intervention/ programmes planning	1
	C 2. Analysis of anti-nutrients in foods	1. Lack of data on impact of anti-nutrients on bioavailability of minerals	C 2.1 Determination of anti-nutrients contents (e.g., phytates, oxalates, caffeine, tannin, theobromine etc.) in plant foods	Scientific data on analysis of anti-nutrients in foods for future intervention/ programmes planning	1

Color Reference								
	NRP		1-2		3-4		5-6	

National Problem	Research Scope	Gaps & Needs (Rationale)	Focus Area	Expected Output	Rank
	D 1. Improvement of analytical methods and related methodologies	1. Lack of robust, rapid, methodologies using latest technologies	D 1.1 Adoption, modification and validation of analytical and instrumentation methods for nutrients and non-nutrients	Scientific data on improvement of analytical methods and related methodologies for future research planning and implementation	1
			D 1.2 Modification of procedures for sampling, preparation and storage of foods		2
	D 2. Development of reliable and accurate methods in food analysis	1. Inadequate quality assurance and control among laboratories (universities, research institutes and government related labs) 2. Challenges in analysing food components at low levels due to complexity of food matrices	D 2.1 Method validation of nutrients and non-nutrients analysis in various matrices and concentrations	Scientific data on development of reliable and accurate methods in food analysis for future research planning and implementation	1
			D 2.2 Inter and intra-laboratory comparison using reference materials.		2

Color Reference					
NRP		1-2		3-4	5-6

b) Food Safety and Quality					
National Problem	Research Scope	Gaps & Needs (Rationale)	Focus Area	Expected Output	Rank
Food Safety Status and health risk	Evidence based food safety information to prevent foodborne illness and protect public health	Changes in food consumption pattern, latest invention and innovation in food production may lead to emerging food safety issue and health risk Changes in environment including rapid development in industrial and agriculture sector may lead to food contamination Evidence based information is important in designing food safety policies and control measures	1. Food safety status on new foods or new trends in food preparation/ production such as radioactive compounds, Genetic Modified Organism etc.	Strengthen food safety management by using of science and evidence based information Research output should be able to highlight new evidence/discoveries in food safety status. Research paper should able to propose a concrete suggestion for intervention strategies	6
			2. Emerging and remerging microbial hazard in food, toxin and antibiotic resistance		1
			3. Chemical hazard on Total Diet study		1
			4. Allergen studies		5
Food Safety Culture	Behavioral Study	Living in the world without boundaries has changed the consumer demands, preference and habit for food. Thus, it is important for any interventions to address matters from food safety culture	1. Consumer Behavioral study on food safety aspect such as the assessment on KAP, perception study etc.	Establish consumer preference and pattern thus providing the intervention control measure to enhance food safety	2
			2. New technologies/ application in advancing food safety promotional activities		4

Color Reference					
NRP	1-2	3-4	5-6		

National Problem	Research Scope	Gaps & Needs (Rationale)	Focus Area	Expected Output	Rank
Food Fraud	Food Integrity, Fraud and Traceability	Food fraud is an intentional and adulteration of food products due to economic manipulation and demands	Traceability and authenticity of Malaysian premium food product	Effectively address and combat food fraud for Malaysia sustainability in food safety and trade	5
Food Safety system	Sustainability of Food Safety System	Limited information on the adequacy and effectiveness of current food safety system implemented in Malaysia	Implementation of food safety certification system	Improves food safety strategies and policies	5
New advance technology	Advance analytical tools for food safety measure	To develop the principles behind current and emerging monitoring technologies for rapid and early detection of food contamination incidents and disease	Any new advent invention or innovation technologies for food safety analysis such as Whole-genome Sequencing (WGS), Information and Records Management Society (IRMS), Human Resources Management System (HRMS), metabolomics etc.	The application of various advance screening and confirmatory test platforms for food safety analysis	3

CHAPTER 10: ORAL HEALTH

Introduction

The Global Burden of Disease Study 2017 estimated that oral diseases affect close to 3.5 billion people worldwide, with caries of permanent teeth being the most common condition.[50] Dental caries and periodontal diseases have been considered the most important global oral health burdens. At present, the distribution and severity of oral diseases vary among different parts of the world and even within the same country or region. Globally, it is estimated that 2.3 billion people suffer from caries of permanent teeth and more than 530 million children suffer from caries of primary teeth.[51] The majority of oral health conditions are dental caries (tooth decay), periodontal diseases, oral cancers, oral manifestations of HIV, oro-dental trauma, cleft lip and palate, and noma (a severe gangrenous disease starting in the mouth that mostly affect children). Due to urbanization and changes in living conditions, the prevalence of oral diseases continues to increase. This is primarily due to inadequate exposure to fluoride in the water supply and oral hygiene products such as toothpaste and poor access to oral health care services in the community.

Most oral health conditions are preventable and can be treated in their early stages. The majority of oral diseases share modifiable risk factors (such as tobacco use, alcohol consumption and an unhealthy diet high in free sugars) common to the four leading NCDs (CVD, cancer, chronic respiratory disease and diabetes). Oral diseases disproportionally affect the poor and socially-disadvantaged members of society. There is a very strong and consistent association between socioeconomic status (income, occupation and educational level) and the prevalence and severity of oral diseases.[52] Such association exists from early childhood to older age, and across populations in high-, middle- and low-income countries.[50] For the purpose of this 12MP-HRP, the identification of research priorities are based on the oral diseases and services.

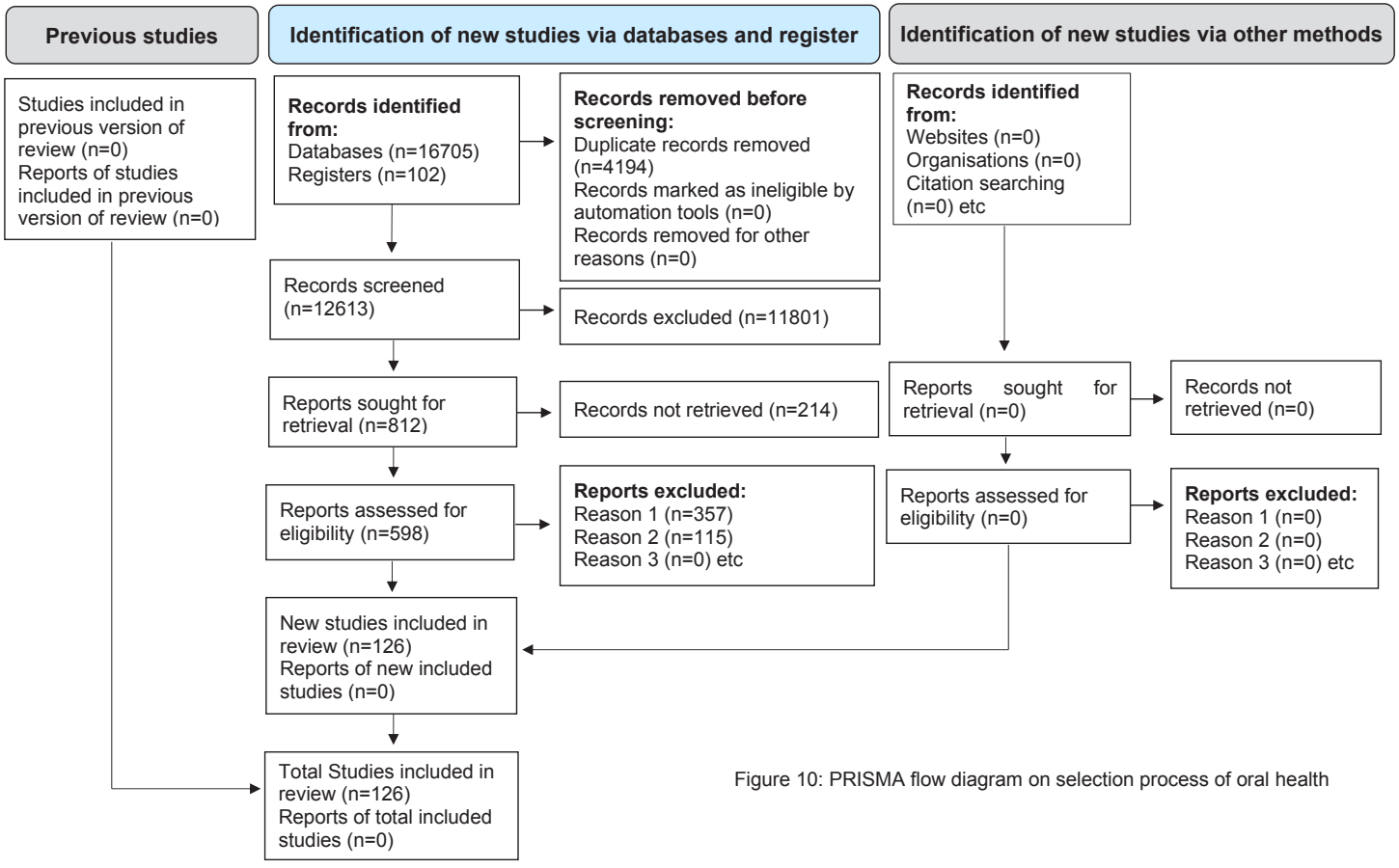

Figure 10: PRISMA flow diagram on selection process of oral health

Priority Areas for Oral Health

Color Reference				
1-2	3-4	5-6	7-8	

National Problem	Research Scope	Gaps & Needs (Rationale)	Focus Area	Expected Output	Rank
Oral health diseases	Dental carries, periodontal condition, soft and hard tissue lesions, Molar-Incisor hypomineralization (MIH), facial and dental trauma, oral health problem related-to occupational and handicapping dento-facial anomalies	1. Burden of oral disease 2. Lack of awareness/ empowerment in oral health 3. Mobilize and strengthen oral health promotion and preventive activities at local and national levels	1. Prevention, treatment and factors associated with dental carries and other oral conditions as stated in research scope	Reduction of incidence of oral health diseases in population and to improve their oral health related quality of life	2
			2. Impact on quality of life among children, youth and adult in urban and rural		6
			3. Knowledge, attitude, practice and oral health literacy among children, youth and adult in urban and rural		4
			4. Evaluation of existing preventive and promotion of oral health programme		1
Access to dental services	Reduction of oral health inequalities at a community or population level	1. Limited of data on access to dental services 2. Collaboration between Dental health professionals with other health professionals to help improve oral health	1. Accessibility and barriers to dental services for people with special needs and vulnerable people	Equal access to oral health services in the general public and people with special needs	6
			2. Accessibility to dental services be improved for the general public		5
			3. One stop centre for dental health professionals and other health professional		6

Color Reference				
1-2	3-4	5-6	7-8	

National Problem	Research Scope	Gaps & Needs (Rationale)	Focus Area	Expected Output	Rank
Oral cancer	Early detection and diagnosis of oral cancer	Early detection/diagnosis of oral cancer	Identification of effective ways of improving early detection/diagnosis and predictors of oral cancer	Early treatment, reduce mortality and morbidity	7
Digital technologies	i. 3D or 4D modelling (i.e. in braces, cavities or oral cancer ii. Electronic Dental Record	Use of digital technologies in oral health	Digital technologies, including robotics and AI in the provision of dental care	New techniques in the production of braces and other dental care and in evaluating severity of oral conditions	3
			2. Evaluation of Electronic Dental Record	Evidence based data for recommendation to roll out throughout Malaysia	8

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Appendix

Area 1: Health System

"Health System" OR "Healthcare Delivery" OR "Health Management" OR "Health Services" OR "Health Priority" OR "Health Delivery" OR "Health Prevention" OR "Health Status" OR "Healthcare Provider" OR "Delivery of Healthcare" OR "Health care Reform" OR "Health Policy" OR "Primary Healthcare" OR "Quality of Healthcare" OR "Health Outcome" OR "Healthcare Outcome" OR "Healthcare Utilisation" OR "Health Maintenance Organizations" OR "Healthcare Policy" OR "Health Services Research" OR "Health Resource Allocation" OR "Healthcare Planning" OR "Healthcare Financing" OR "Healthcare Provider and System" OR "Healthcare Quality" OR "Health Information System" OR "Health Research Priority*" OR "National Health Programs" OR Organizational Culture" OR "Medical Order Entry System" OR "Public Sector" OR "Public Policy" OR "Public-Public Sector" OR Public-Private Sector" OR Private Sector" OR Informal Sector" OR "Clinical Service" OR "Decision Support System" OR "Private Health Care" OR "Healthcare facilities" OR "Health regulation" OR "Healthcare access"

AND

"Manpower" OR "Management" OR "Engagement" OR "Finance*" OR "Afford*" OR "Cost*" OR "Economic" OR "Technology" OR "Innovation" OR "Empowerment" OR "Integration" OR "Management Strateg*" OR "Mutual Health Organization" OR "Healthcare Cost" OR "Health Personnel" OR "Employee Incentive Plan" OR "Health Insurance" OR "Health Financing" OR "Community Financing" OR "Community Health Finance Organization" OR "Community Based Health Organization" OR "Health Workforce" OR "Transition of Care" OR "Inter-professional" OR "Inter-department" OR "Inter-facility" OR "Intra-hospital" OR "Patient Care Planning" OR "Patient Care Management" OR "Patient-centred Care" OR "Continuity of Patient Care" OR "Progressive Patient Care" OR "Nursing care" OR "Health Manpower" OR "Healthcare Personnel" OR "Personnel Management" OR "Health Expenditures" OR "Healthcare Cost" OR "Healthcare Reform" OR "Health Maintenance Organization" OR "Reimbursement" OR "Worker*" OR "Administration" OR "Professional Practice*" OR "Health Workforce" OR Health Worker" OR "Organization" OR "Efficiency" OR "Health Resources" OR "Provider behaviour" OR "Primary care" OR "Bio bank" OR "Digital health" OR "Big data" OR "Artificial Intelligence" OR "Medical Printing" OR "Service Delivery" OR "Service contract*" OR "Person-centered care"

AND

"Longevity" OR "Patient Satisfaction" OR "Population Health" OR "Population Satisfaction" OR "Population Happiness" OR "Life Satisfaction" OR "Life Pleasure" OR "Cooperative Medical Scheme" OR "Life Contentment" OR Life Gratification" OR "Self-realization" OR "Self-fulfilment" OR "Reduce Wasting Time" OR "Awareness" OR "Physical Functioning" OR "Heath Personal Satisfaction" OR "Prepaid Health Plan" OR "Personnel Turnover" OR "Government Regulation" OR "Health Plan" OR "Policy Making" OR ""Medical" OR "Rural Health" OR "Health Coverage" OR "Health Achievement" OR "Long Life" OR "Quality of training" OR "Training quality" OR "Competency" OR "Brain Drain" OR "Equity"

AND

"Malaysia" OR "Malaysian*"

AREA 2: Communicable Disease

"Communicable Disease*" OR "Infectious Disease*" OR "Influenza Pandemic" OR "Pandemic Preparedness" OR "Emerging Disease" OR "Coronavirus Disease 2019" OR "Covid-19" OR "NCoV 2019" OR "2019-nCoV" OR "Wuhan Disease" OR "Wuhan Corona Virus" OR "Chinese Disease" "Acute Respiratory Distress Syndrome" OR "ARDS" OR "Pneumonia" OR "Bacterial Pneumonia" OR "Streptococcus Pneumoniae" OR "Viral Pneumonia" OR "Influenza" OR "Fungal Pneumonia" OR "Influenza-like Illness" OR "ILI" OR "Severe Acute Respiratory Infections" OR "SARI" OR "Dengue" OR "Dengue Fever" OR "Aedes Aegypti" OR "Mosquito" OR "Infected Mosquito" OR "Dengue Haemorrhagic Fever" OR "Dengue Shock Syndrome" OR

"Mycobacterial Disease" OR "Tuberculosis" OR "TB" OR "TB Disease*" OR "Mycobacterium Tuberculosis" OR "TB Bacteria" OR "Leprosy" OR "Hepatitis" OR "Hepatitis A" OR "HAV" OR "Hepatitis B" OR "Acute Viral Hepatitis" OR "Human Immunodeficiency Virus" OR "HIV" OR "Acquired Immunodeficiency Syndrome" OR "AIDS" OR "Malaria" OR "P. Falciparum Infection" OR "Parasitemia" OR "Vaccine Preventable Disease" OR "Measles" OR "Rubeola" OR "Acute Childhood Infection" OR "Measles Virus" OR "Diphtheria" OR "Upper Respiratory Tract Illness" OR "Laryngitis" OR "Pharyngitis" OR "Tonsillitis" OR "Corynebacterium Diphtheriae" OR "Pertussis" OR "Bordetella Pertussis" OR "B. Pertussis" OR "Rabies" OR "Acute Neurological Syndrome" OR "Encephalomyelitis" OR "Dysphagia" OR "Hydrophobia" OR "Convulsions" OR "Virus*" OR "Viral Antigen" OR "Influenza Virus" OR "Acute Contagious Viral Respiratory Disease" OR "Immune System" OR "Antimicrobial resistance" OR "Meliodosis" OR "Leptospirosis" OR "Viral Haemorrhagic fever" OR "Ebola" OR "Marburg" OR "Lassa fever" OR "Crimean Congo Haemorrhagic fever" OR "Rift Valley fever" OR "None-dengue Arthropod-borne viruses" OR "Chikungunya" OR "Yellow fever" OR "Zika"

AND

"Programme" OR "Government Regulation" OR "Legal*" OR "Legislation" OR "Enforcement" OR "Policy*" OR "Collaboration" OR "Social Cost" OR "Economic" OR "Cost Effective" OR "Behaviour*" OR "Outbreak" OR "Direct Contact" OR "Indirect Contact" OR "Sexually Transmitted Disease*" OR "STDs" OR "Airborne Transmission" OR "Contaminated Object" OR "Contaminated Food" OR "Contaminated Water" OR "Insect Bites" OR "Vector-Borne Disease" OR "Affect" OR "Infect*" OR "Acute Infection" OR "Screen*" OR "Assess*" OR "Exam*" OR "Symptom*" OR "Epidemiological" OR "Feature*" OR "Resurgence" OR "Diagnose*" OR "Detect*" OR "Isolate*" OR "Sign*" OR "Stage*" OR "Type*" OR "Cause*" OR "Risk Factor*" "Implementation" OR "Implication" OR "Progress*" OR "Complication" OR "Prevent*" OR "Treat*" OR "Cure*" OR "Therapy*" OR "Control*" OR "Control Measure" OR "Test*" OR "Strategy*" OR "Adaptation Behaviour" OR "Risk Factor" OR "Vaccine" OR "Vaccine Uptake" OR "Vaccine Refusal" OR "Vaccine Potency Test" OR "Drug Resistant" OR "Immune Cell*" OR "Antigen" OR "Antigen Test" OR "Immune*" OR "Viral Culture" OR "Clinical" OR "Medicine*" OR "Antibiotic" OR "Immunization Program" OR "Anti-Vaccine" OR "Subsidise Vaccine*" OR "Vaccine Refusal" OR "Vaccine Hesitancy" OR "Influenza Vaccination" OR "Affordable Vaccine"

AND

"Malaysia" OR "Malaysian*"

AREA 3: Non-Communicable Disease

"Non-Communicable Diseases" OR "NCDs" OR "Cancer" OR "Cancerous" OR "Malignancy" OR "Malignancies" OR "Metastasis" OR "Metastases" OR "Carcinoma" OR "Sarcoma" OR "Melanoma" OR "Brain Cancer" OR "Brain Neoplasms" OR "Nervous System Cancer" OR "Lymphoma" OR "Leukemia" OR "Leukaemia" OR "Cervical Cancer" OR "Uterine Cervical Neoplasms" OR "Uterus Cancer" OR "Uterine Neoplasms" OR "Uterine Cancer" OR "Endometrial Cancer" OR "Endometrial Neoplasms" OR "Endometrial Carcinoma" OR "Vaginal Cancer" OR "Vaginal Neoplasms" OR "Colorectal Cancer" OR "Colorectal Neoplasms" OR "Colorectal Carcinoma" OR "Corpus Uteri Cancer" OR "Lymphoma" OR "Hematological Malignancy" OR "Haematological Malignancy" OR "Hematologic Neoplasms" OR "Blood Cancer" OR "Multiple Myeloma*" OR "Plasma Cell Myeloma*" OR "Liver Cancer" OR "Liver Neoplasms" OR "Hepatocellular Carcinoma" OR "Carcinoma, Hepatocellular" OR "Hepatoma" OR "Cholangiocarcinoma" OR "Nasopharyngeal Carcinoma" OR "NPC" OR "Nasopharynx Cancer" OR "Nasopharyngeal Neoplasms" OR "Ovarian Cancer" OR "Ovarian Neoplasms" OR "Prostate Cancer" OR "Prostatic Neoplasms" OR "Cancer of The Prostate" OR "Skin Cancer" OR "Skin Neoplasms" OR "Basal Cell Carcinoma" OR "Carcinoma, Basal cell" OR "Recurrent Basal Cell Carcinoma" OR "Squamous Cell Carcinoma" OR "Carcinoma, Squamous Cell" OR "Melanoma" OR "Merkel Cell Carcinoma" OR "Carcinoma, Merkel cell" OR "Thyroid Cancer" OR "Thyroid Neoplasms" OR "Breast Cancer" OR "Breast Neoplasm" OR "Invasive Ductal Carcinoma" OR "Invasive Lobular Carcinoma" OR "Lung Cancer" OR "Lung Carcinoma" OR "Squamous Cell Carcinoma" OR "Adenocarcinoma" OR "Large Cell Carcinoma" OR Small Cell Lung Cancer" OR "Stomach Cancer" OR "Gastric Cancer" OR

"Stomach Carcinoma" OR Gastric Carcinoma" OR "Chronic Respiratory Syndrome" OR "Asthma" OR "Respiratory Allergy" OR "Chronic Abstructive Pulmonary Disease" OR "Hyperlipidemia" OR "Hyperlipidaemia" OR "Hypercholesterolemia" OR "Hypercholesterolaemia" OR "Hypertension" OR "High Blood Pressure" "Obesity" OR "Obese" OR "Overweight OR "Stroke" OR "Brain Attack" OR "Cerebrovascular Accident" OR "Congenital Heart Disease" OR "Diabetes" OR "Diabetes Mellitus" OR "Diabetes Insipidus" OR "Diabetic" OR Mental Health" OR "Mental" OR "Postnatal" OR "Physical Injury*" OR "Intentional Injury" OR "Unintentional Injury*" OR "Road Traffic Accident" OR "Self-harm" OR "Tobacco" OR "Smoke*" OR "E-cigarette"

AND

"Screen*" OR "Assess*" OR "Exam*" OR "Symptom*" OR "Diagnose*" OR "Sign*" OR "Stage*" OR "Type*" OR "Cause*" OR "Risk Factor*" OR "Behavioural Risk Factor" OR "Genetic Factor" OR "Genetic Risk" OR "Genomic" OR "Prognosis" OR "Behaviour*" OR "Prevent*" OR "Protect" OR "Restrain" OR "Resist" OR "Suppress" OR "Treat*" OR "Drug Therapy*" OR "Therapy*" OR "Pharmacotherapy" OR "Medical Treatment" OR "Support*" OR "Encourage" OR "Care" OR "Strategy*" OR "Economic" OR "Intervention" OR "Control Measure" OR "Advanced Technology*" OR "Epidemiological Study*" OR "Metabolic Syndrome" OR "Unhealthy diet*" OR "Poor Diets" OR "Inactive lifestyle" OR "Physical Inactivity" OR "Bedridden" OR "Smoking" OR "Second-hand Smoke" OR "Tobacco Use" OR "Alcohol Use" OR "Excessive Alcohol Intake" OR "Blood Pressure" OR "Blood Glucose" OR "Blood Lipids" OR "Socio-economic Status*" OR "Gender*" OR "Ethnicities" OR "Environmental Factors" OR "Lifestyle Modification" OR "Lifestyle Change"

AND

"Malaysia" OR "Malaysian*"

AREA 4: Older People

"Elderly" OR "Older People" OR "Senior Citizen" OR "Aged People" OR Retired OR "Older Adult" OR "Old Age" OR Pensioner OR Age* OR "Geriatric" OR "Non-Independent Older Adult"

AND

"Living Environment" OR "Specialist Nursing" OR "Homecare" OR "Homebased Care" OR "Personalize Care" OR "Supportive Care" OR "Rehabilitation" OR "Risk Factor" OR "Exposure" OR "Retirement Home" OR "Retirement Care Home" OR "Hospital Care" OR "Homecare Services" OR "Healthcare Policy" OR "Quality of Care" OR "Health Access" OR "Specific Care" OR "Nutrition" OR "Diet"

AND

"Health Issues" OR "Healthy Aging" OR "Active Aging" OR "Disease*" OR "Disable*" OR "Frail*" OR "Fall*" OR "Incontinent" OR "Mental Health" OR "Alzheimer" OR "Abuse" OR "Violence" OR "Neglect" OR "Ill-treat" OR "Maltreat" OR "Mistreat" OR "Dementia" OR "Schizophrenia" OR "Depression" OR "Non-communicable Disease" OR "Osteoporosis" OR "Hypercholesterolemia" OR "Comorbidity" OR "Fatty Liver" OR "Stroke" OR "Prostate Problem" OR "Obesity" OR "Diabetes" OR "Heart Disease" OR "Urinary Incontinent" OR "Hypertension" OR "Cardiovascular Disease" OR "Cardiovascular Accident" OR "Cerebrovascular Disease" OR "Chronic Kidney Disease" OR "Benign Prostatic Hyperplasia" OR Communicable Disease" OR "Malnutrition"

AND

"Malaysia" OR "Malaysian*"

AREA 5: Mental Health

"Teen*" OR "Adolescent" OR "Youth" OR "Young*" OR "High School Student*" OR "Young People" OR "Adult" OR "Man" OR "Women" OR "Mature Person" OR "Full-grown" OR "Grown" OR "Pregnant Mother" OR "Elder*" OR "Old*" OR "Senior Citizen" OR "Aged People" OR "Age*"

AND

"Drug" OR "Illicit Drug" OR "Methamphetamine" OR "Opioids" OR "Drug Abuse" OR "Substance Use Abuse" OR "Narcotic Abuse" OR "Drug Use" OR "Drug Dependent" OR "Chemical Abuse" OR "Alcoholism" OR "Alcohol Abuse" OR "Addiction OR D"Internet Addiction" OR "Gaming Addiction" OR "Gaming Disorder" OR "Cyberbully*" OR "Pornographic Addiction" OR "Psychiatry*" OR "Mental Health" "Mental Disorder" OR "Mental Illness" OR "Psychiatric Disorder" OR "Mental Breakdown" OR "Sadness" OR "Anxiety Disorder" OR "Paranoia" OR "Psychosis" OR "Mood Disorder" OR "Personality Disorder" OR "Psychotic Disorders" OR "Harm" OR "Abuse" OR "Violence" OR "Physical Violence" OR "Sexual Violence" OR "Emotional Violence" OR "Neglect" OR "Ill-treat" OR "Maltreat" OR "Mistreat" OR "Exploit" OR "Assault" OR "Crime" OR "Bully" OR "Aggressi*" OR "Coerc*" OR "Extort*" OR "Stigmati*" OR "Ostraci*" OR "Eating Disorder" OR "Neurodevelopmental Disorder" OR "Impulse Control Disorder" OR "Sleep Disorder" OR "Sexuality Related" OR "Development Disorder" OR "Personality Treat" OR "Abortion" and "Postnatal Issue*"

AND

"Psychological Health" OR "Emotional Health" OR "Emotional Wellbeing" OR "Psychological Condition" OR "Alzheimer" OR "Dementia" OR "Schizophrenia" OR "Depression" OR "Bipolar Disorder" OR "Psychoses" OR "Developmental Disorder" OR "Autism" OR "Intellectual Disorder" OR "Intellectual Disability" OR "Cognitive Impairment" OR "Social Problems" OR "Suicide" OR "Insomnia" OR "Post-traumatic Stress Disorder" OR "Treat*" OR "Prevent*" OR "Rehab*" OR "Complimentary" OR "Monitor*" OR "Evaluate*" OR "Level of Toxicity" Or "Interventional Strategy*" OR "Digital Area"

AND

"Malaysia" OR "Malaysian*"

AREA 6: Environment and Disaster Risk

"Environment*" OR "Environmental Health" OR Environmental Safe*" OR "Disaster" OR "Health Risk" OR "Man-Made Disaster" OR "Industrial Risk" OR "Industrial Disaster" OR "Occupational Health" OR "Human Health" OR "Nature Conservation" OR "Animal Conservation" OR "Deforestation" OR "Environmental Degradation" OR "Global Environmental Issue*" OR "Habitat Loss" OR "Intensive Farming" OR "Bio intensive Farming" OR "Land Degradation" OR "Ocean Acidification" OR "Over-exploitation" OR "Pollution" OR "Whaling" OR "Deforestation"

AND

"Living Environment" OR "Habitat*" OR "Land Use" OR "Natural Resource*" OR "Weather" OR "Air Quality" OR "Air Pollution" OR "Ozone Pollution" OR "Biodiversity" OR "Climate Change" Or "Global Warming" OR "Greenhouse Effect" OR "Illegal Logging" OR "Destruction" OR "Occupational Health" OR "Intentional Injury*" OR "Unintentional Injury*" OR "Road Traffic Accident" OR "RTA" OR "Self-harm" OR "Rural" OR "Urbanization" OR "Rural and Urbanization" OR "Disaster Preparedness" OR "Flora" OR "Fauna" OR "Risk Communication" OR "Bio-accumulation" OR "Poisoning" OR "Genetically Modified Organism" OR "Genetic Engineering" OR "Genetic Modification" OR "Global Warming" Or "Destruction" OR "Fragmentation" OR "Soil Conservation" OR "Soil Erosion" OR "Contamination" OR "Toxic Chemicals" OR "Water Pollution" OR

"Sustainability" OR "Recycle*" OR "Reinforce" OR "Environmental Management" OR "Disaster Prevention" OR "Disaster Assessment" OR Disaster Mitigation" OR "Environmental Rehabilitation" OR "Environmental Reconstruction" OR "Environmental Development"

AND

"Malaysia" OR "Malaysian*"

AREA 7: Nutrition, Food Safety and Quality

"Infants" OR "Baby" OR "New-born" OR "Toddler*" OR "Young Children" OR "Child*"OR "Kid" OR "Teen*" OR "Adolescent" OR "Youth" OR "Young*" OR "High School Student*" OR "Young People" OR "Adult" OR "Man" OR "Women" OR "Mature Person" OR "Full-grown" OR "Grown" OR "Pregnant Mother" OR "Elder*" OR "Old*" OR "Senior Citizen" OR "Aged People" OR "Age*" OR "Vegetarian"

AND

"Nutrition" OR "Food" OR "Nutrient" OR "Nutriment" OR "Diet*" OR "Safety" OR "Security" OR "Assurance" OR "Quality" OR "Food Safety" OR "Food Safety Status" OR "Food Quality" OR "Nutrition Education" OR "Nutrition Policy*" OR "Nutritional Status" OR "Healthy Diets" OR "Healthy Cafeteria" OR "Processed Food" OR "Halal" OR "Food Processing" OR "Food Labelling" OR "Fast Food Intake" OR "Food Wastage" OR Household Insecurity" OR "Breastfeeding" OR "New Food" OR "Food Preparation" OR "Food Production" OR "Genetic Modified Organism" OR "Allergen Study" OR "Food Safety culture" OR "Food Fraud" OR "Food Integrity" OR "Food Safety System" OR "New Advance Technology"

AND

"Disease*" OR "Malnutrition" OR "Protein Malnutrition" OR "Kwashiorkor" OR "Stunting" OR "Low Birth Weight" OR "Childhood Wasting" OR "Vitamin A Deficiency" OR "Non-communicable Disease" OR "Obesity" OR "Overweight" OR "Obese" OR "Body Mass Index" OR "BMI" OR "Diabetes Type 2" OR "Hypertension" OR "Cardiovascular Disease" OR "Anaemia" OR "Iodine Deficiency Disorders" OR "Cancer" OR "Stroke" OR "Cardiovascular Accident" OR "Osteoporosis" OR "Hypercholesterolemia" OR "High Blood Pressure" OR "Allergy" OR "Food Poisoning" OR "Food-Borne Illness" OR "Vomiting" OR "Diarrhoea" OR "Constipation" OR "Poor Maternal Weight Gain" OR "Gestational Diabetic Mellitus" OR "Mental Health" OR "Depression" OR "Eating Disorder" OR "Consumer" OR "Food Intervention" OR "Physical Activity" OR "Physically Active" OR "Bedridden" OR "Inactive" OR ""Food Hazard" OR "Food Microbial"

AND

"Malaysia" OR "Malaysian*"

AREA 8: Oral Health

"Oral Health" OR "Dental" OR "Oral Health Disease" OR "Oral Disease" OR "Dental Caries" OR "Dental Cavities" OR "Gingivitis" OR "Periodontitis" OR "Malocclusion" OR "Dental Service*" OR "Oral Cancer" OR "Dental Caries" OR "Periodontal Disease" OR "Periodontitis" OR "Tooth Loss" OR "Cavities" OR "Caries" OR "Tooth Decay" OR "Gum Disease" OR "Oro-Dental Trauma" OR "Dental Trauma" OR "Birth Defects" OR "Cleft Lip" OR "Cleft Palate" OR "Oral Hygiene" OR "Oral Condition" Or "Sensitive Teeth"

AND

"Detect*" OR "Early Detect*" OR "Risk" OR "Symptom*" OR "Infect*" OR "Asses*" OR "Type*" OR "Diag-

nose*" OR "Cause*" OR "Genetic" Or "Family History" OR "Treat*" OR "Prevent*" OR "Digital Technology*" OR "3D Modelling" OR "4D Modelling OR "Oral Care Treatment" OR "Proper Care" OR "Professional Cleaning" OR "Fluoride Treatment" OR "Fillings" OR "Crowns" OR "Sealants" OR "Root Canal" OR "Oral Surgery" OR "Flap Surgery" OR "Bone Grafting" OR "Tooth Extraction" OR "Dental Implant" OR "Artificial Tooth" OR "Dental Bridge" OR "Dental Examination" OR "Oral Health Programs"

AND

"Malaysia" OR "Malaysian*"

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