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Development of a Framework for Health, Social, and Economic Vulnerabilities (FEVR) and Risks from Pandemics

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European Investment Bank

This is a Report developed for G20 Joint Finance Health Ministerial Meeting (JFHMM), 19 August 2023. Developed by the World Health Organization (WHO), World Bank (WB), International Monetary Fund (IMF), and European Investment Bank (EIB).

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Executive Summary

A. This Report has been prepared by World Health Organization, World Bank, International Monetary Fund and European Investment Bank pursuant to a request by the G20 Joint Finance and Health Task Force (JFHTF) to better understand **health and economic vulnerabilities, and their resulting risks, caused by pandemics.**

B. Economic vulnerabilities and risks from pandemics extend well beyond the domain of healthcare and can be both **unpredictable and vast** – however the COVID-19 crisis has provided a high degree of evidence on these vulnerabilities and their relationships.

C. To date a **framework to explicitly bring together health, social, and economic considerations** for pandemic preparedness and response does not exist, and the FEVR aims to add value by filling this gap.

D. The key questions the framework for health, social, and economic vulnerabilities and risks (FEVR) aims to answer are:

- What are the **current risks, vulnerabilities** and impacts for future pandemics scenarios, and **where are policy actions to strengthen institutional capacity, coordination, and legislation, and investments required to maximise preparedness and resilience** to minimize the health, social and economic impact?
- In the context of a response to future pandemic scenarios, what are the **types of policy responses and associated costs** required as well as the **differential health, social and economic outcomes** of different mitigation measures?

E. Preliminary univariate analysis for the FEVR identified 35 candidate indicators – from a list of 69 identified by an initial scoping – for inclusion across the domains of health system resilience and response capacity, macroeconomic stability, and social and economic protection. Of these, **16 indicators were strongly correlated with GDP per capita (PPP $), and GDP change** between 2019-2020 driven by the COVID-19 pandemic, the only past pandemic for which we have adequate data to explore this relationship.

F. **Vulnerabilities and impacts will differ under different health emergency scenarios**, for example pandemic vs. regional epidemic; respiratory vs. other disease outbreaks with epidemic/pandemic potential, thus the **framework is intended to be flexible** and responsive to different scenarios. This is demonstrated using a proof-of-concept model showing the differential health, social and economic impacts of possible pandemic scenarios.

G. The next steps required to develop a next iteration of the FEVR by the 3rd quarter 2023, and a report on health, social and economic vulnerabilities are:

- Undertake a systematic review of evidence and existing modelling efforts to ensure a complete scoping of potential indicators for inclusion
- Analyze relationships between indicators and longer-term economic rebound and expand the relationships to consider other pandemic impacts across health and social protection domains
- Strengthen the statistical analysis including methods such as signaling approach, multivariate regression, factor analysis, or principle component analysis to finalize the selection of indicators for the framework
- Explicitly link the indicators to the epidemiological-economic model to inform the analysis of mitigation strategies in the context of a future pandemic
- Consider global transmission dynamics
- Consider global production interconnectedness
- Consider long term scarring effects

H. Discussion points for the JFHTF:

- Do you agree that the unique value add of the FEVR is to bring together health, social, and economic considerations related to pandemic preparedness and response?
- Is there general agreement with the key questions the FEVR is aiming to answer?

A | Context: COVID-19 pandemic and the global economy

A1. The COVID-19 Pandemic caused significant health, social and economic impacts

The COVID-19 pandemic caused significant health, social and economic impacts, including:

- health losses: morbidity, mortality and disability-adjusted life years (DALYs)
- stress on health systems
- strains on mental health, including loneliness, stress, anxiety
- increases in health, social and gender-based inequalities
- lower educational outcomes due to school/university closures and distant learning
- sharp GDP contractions or growth slowdowns
- collapse in demand in various economic sectors
- reduced job security, income losses for households and increases in global poverty rates
- increased public and private debt

The COVID-19 pandemic will not be the last pandemic but hopefully it will be the last of its kind if we can identify and reduce vulnerabilities and increase resilience and response capacities to health emergencies across all domains.

A2. Pandemic risks are a function of threats and vulnerabilities

Pandemic risk is the expected value of the impact of widespread infectious disease in humans on human health, economies, and communities[1]. It is a function of **threats** and **vulnerabilities**, and their interactions, which must be addressed to ensure a safer world.

Threats refer to new or emerging pathogens that can cause a pandemic, while **vulnerabilities** refer to gaps between the existing capabilities and the capacities needed to prevent the emergence, amplification, spread and impact of such threats (See Figure 1). Pandemic risks to global economies, socio-economic trends, and health are greatest in situations or areas with both substantial threats and vulnerabilities, making the risk of new outbreaks and international spread more likely.

[1] Olga B. Jonas, Pandemic risk; 2013, World Bank. Available here, accessed on January 25th 2023

Figure 1: Schematic to illustrate the relationship between pandemic risks, threats, and vulnerabilities

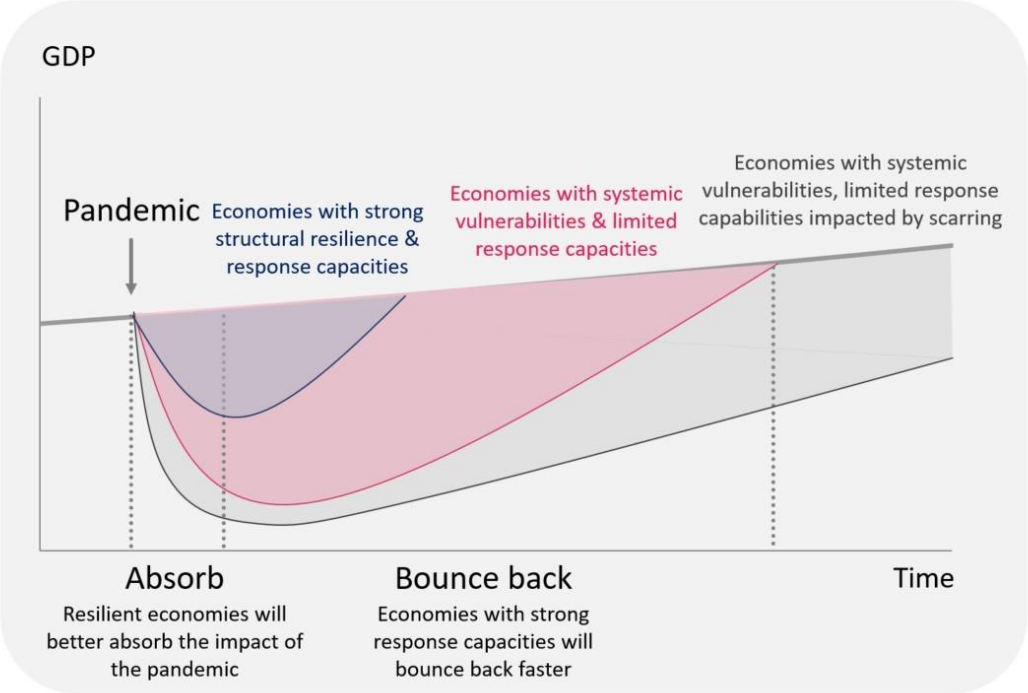
A3. COVID-19 has shown variation in economic vulnerabilities and risks of pandemics, requiring a structured approach to their identification

During a pandemic, as demonstrated by the recent COVID-19 pandemic, countries experience significant economic impacts with different levels of severity. These differing impacts reflect their economic vulnerabilities and their exposure to the pandemic. Economic vulnerability is the likelihood of a country's economy to be hindered by an exogenous shock and, in this analysis, it will be addressed through the following two broad dimensions:

- First, the relative ability of a country or system to **'absorb' a pandemic shock**, or in other words, the intrinsic exposure & **resilience** to pandemics' economic and social effects (e.g., different exposure to international trade or tourism). This is reflected by the magnitude of the downward inflection in **Figure 2**.
- Second, the ability of the system to **'bounce-back'**, i.e. **the capacity of the system to respond to the pandemic shock**, reflecting the differing ability to respond to a pandemic (e.g., divergent levels of informal economy or digitalization with contrasted ability to implement lockdowns), fiscal response capacity (to compensate for an economic shock e.g. through increased public investment, subsidies or fiscal capacities to economically endure a prolonged economic lockdown and the resulting loss in fiscal revenues, helping to mitigate the impact and speed up the recovery) as well as different health systems' capacities. This is reflected in the gradient of the upward inflection in **Figure 2**.

Regardless of resilience and response capacities, a pandemic shock can have a lasting adverse impact on output such that longer-term output levels are diminished relative to pre-pandemic projections. This concept is known as scarring and is reflected in **Figure 2**.

Figure 2: Graphical representation of differing GDP trajectories resulting from different levels of resilience and response capacity to a pandemic



B | Developing a framework for health, social, and economic vulnerabilities and risks

B1. A framework for health, social, and economic vulnerabilities and risks can help identify systemic weaknesses and guide policy decisions and investments

The key questions the framework for health, social, and economic vulnerabilities and risks (FEVR) aims to answer are:

1. What are the current risks, vulnerabilities, and impacts for future pandemic scenarios, and where are policy actions to strengthen institutional capacity, coordination, and legislation, and investments required to maximize preparedness and resilience to minimize the health, social and economic impact?
2. In the context of a response to future pandemic scenarios, what are the types of policy responses and associated costs required as well as the differential health, social and economic outcomes of different mitigation measures?

Answering these questions requires a robust understanding of (1) the health, social and economic vulnerabilities that are specific to, or are influenced by, pandemics, and (2) the health, social and economic policies and actions that can be taken to reduce risks and improve outcomes.

Investments in preparedness and resilience, as well as an understanding of the costs of policy actions which will address vulnerabilities and mitigate impacts of an outbreak,

could be informed by the FEVR. When denoting the possible policies and actions taken during a pandemic, we refer to costs related to:

- The national health response including collaborative surveillance, community protection, safe and scalable emergency care whilst maintaining essential health services, access to medical countermeasures, and emergency coordination at global, regional, national and sub-national levels. This includes the costs of public health and social measures and other response measures.
- The social response and economic response to protect livelihoods, jobs, and businesses including, but not limited to, the scaling of social protection schemes and the exceptional support to business to mitigate the impact of non-pharmaceutical interventions.
- Macroeconomic interventions including bolstering fiscal spending on public health and affected sectors, alongside implementing monetary easing, and liquidity provisions to ensure financial stability.

When considering policy decisions and investments, it is important to note that there are broader considerations than what are included in this framework, such as the comparative financial costs of different strategies. What this framework aims to do is to provide a tool that can monitor progress in reducing key health, socio-, and macro-economic vulnerabilities and their likely economic impact, to inform investments and policies at national level.

This Report proposes a preliminary framework for measuring economic vulnerabilities and risks from pandemics that supports these goals, and the accompanying Report 2 provides some preliminary findings on global vulnerabilities by domain, region and income group using the preliminary framework. It is expected that the FEVR will evolve to include a broader set of indicators, considering a wider range of pandemic related impacts, and explicitly link to the policy considerations for mitigation measures in future iterations.

B2. A framework for health, social, and economic vulnerabilities and risks should add value to existing measurement and monitoring frameworks

A framework to map different vulnerabilities and risks, to identify investment needs and to categorize trade-offs could be a valuable tool to inform national and international strategies and investment priorities for pandemic prevention, preparedness, and response.

The primary users of such a framework are expected to be the **Ministries of Finance, Social Affairs,** and **Health**, to inform policy discussions by highlighting the health, social, and economic vulnerabilities, along with the trade-offs between health, social and economic outcomes of investments in preparedness and pandemic countermeasures. In addition, the FEVR could be a reference tool for other ministries (e.g. education) facing significant impacts due to a future pandemic event, and by regional bodies to inform joint planning and investment.

It is critically important for any new framework on economic vulnerabilities and risks to add value to the existing range of resources already available, to internalize the lessons learnt from the COVID-19 experience, and to correspond to the specific use case of contributing to decision making around preparedness investments and implementation of countermeasures at the nexus of health and finance. Explicitly, the goal of this framework should be the link between pandemics and the economy, avoiding a broad focus on vulnerabilities due to general economic slowdown.

When finalized, the FEVR aims to add value in a number of ways:

- By establishing, at the global level, a consistent framework for regularly assessing health, social and economic vulnerabilities linked to pandemics
- Using this framework to provide a high-level analysis of global vulnerabilities, and to highlight options to address these through investments
- When regularly updated, will provide an understanding of the changing global landscape of vulnerabilities
- At the regional and country level, will allow a deep dive into the respective vulnerabilities and eventually serve to support investment planning

The framework will not provide a global ranking or country comparison, nor a prescriptive analysis of investment needs.

C | Methods for the development of a framework for health, social, and economic vulnerabilities

C1. The framework for health, social, and economic vulnerabilities and risks will identify critical indicators and present the differential impacts of potential investments and policies

The FEVR comprises 2 components:

1. Key health, social and economic **indicators** that are relevant to pandemics and are policy responsive, and therefore should be monitored to mitigate risks and shocks.
2. A presentation of the **differential impact** on health, social, and economic outcomes of different policy and investment possibilities to inform decision making.

In the previous scoping paper presented to the G20 JFHTF on March 20th, 2023, the FEVR method proposed 4 domains of indicators, namely health system resilience, health system response, economic & financial resilience, economic & financial response. Upon receiving feedback from G20 taskforce members, it was considered that the differentiation between resilience and response indicators was artificial and uninformative. As such, the framework has been restructured to consider three interconnected domains:

- Health system resilience and response capacity
- Social protection
- Macroeconomic stability

These three domains provide a stronger structure to answer the key questions identified in section B1.

The same methodological process, as agreed in the March 20th meeting, is being followed for the three domains:

1. Identify key domains for health system, social and economic vulnerabilities;
2. Identify specific indicators within each domain;
3. Establish the relationship between each of these domains and pandemic threats;
4. Characterize mitigation measures to reduce economic risks & consider differential impacts between health, social and economic outcomes.

Vulnerabilities and impacts will differ under different health emergency scenarios, for example pandemic vs. regional epidemic; respiratory vs. other disease outbreaks with epidemic/pandemic potential, thus the framework is intended to be flexible and responsive to different scenarios.

Importantly, the framework presented is preliminary and should be considered only insofar as it indicates the direction such a framework could take. There is significant additional analysis required to finalize the framework and ensure it accurately informs decision making around reducing vulnerabilities before and impacts during a pandemic.

C2. Identification of health, social, and economic indicators which may explain economic losses associated with the COVID-19 pandemic

A broad scoping of the literature covering existing measurement frameworks for health, social, and economic indicators related to pandemic preparedness, response and resilience has been undertaken to identify a long list of indicators.

This scoping included The European Investment Bank (EIB) COVID-19 Economic Vulnerability Index2, the Supporting Economic Transformation (SET) Economic Risks & Vulnerabilities to Health Pandemics3, Diop et al. COVID-19 Economic Vulnerability & Resilience Indexes4, the Global Preparedness Monitoring Board Monitoring Framework for Preparedness (GPMB) 5, the WHO health emergency prevention, preparedness, response, and resilience (HEPR) framework6, the WHO

[2] The European Investment Bank COVID-19 Economic Vulnerability Index, August 2020; Link available here
[3] Economic vulnerabilities to health pandemics: Which countries are most vulnerable to the impact of coronavirus, February 2020; Link available here
[4] Diop, S., Asongu, S.A. and Nnanna, J. (2021), COVID-19 economic vulnerability and resilience indexes: Global evidence. International Social Science Journal, 71: 37-50. https://doi.org/10.1111/issj.12276
[5] GPMB MONITORING FR AMEWORK FOR PREPAREDNESS Technical Framework and Methodology, Link available here
[6] https://www.who.int/publications/m/item/strengthening-the-global-architecture-for-health-emergency-prevention--preparedness--response-and-resilience/

decision framework for sustaining lives and livelihoods during the COVID-19 pandemic7, A UN framework for the immediate socio-economic response to COVID-198, and the Report for the G20 High Level Independent Panel on Financing the Global Commons for Pandemic Preparedness and Response.

A critical added value of the FEVR should be to specify the unique relationship between pandemics and the health, social, and economic outcomes caused by the pandemic. In addition, not all of these vulnerabilities can be directly mitigated, therefore in the development of the framework non-preventable risks should be clearly stated. This will be more explicitly highlighted in the further development of FEVR.

Essential for inclusion of indicators in the initial scoping for the FEVR framework is the existence of a dataset that can be used to establish an analytical relationship. This requires a dataset which covers at least 100 countries, is regularly and recently updated, and provides sufficient details. Breadth of country coverage is particularly important but results in a narrower number of indicators. The initial scoping of these frameworks identified 69 potential indicators for inclusion. For 35 of these indicators, a global database with a high coverage of countries, and recent data reflective of the pandemic period was available. Annex 1 provides a long list of the 69 indicators considered for inclusion, and reasons for exclusion if relevant. While many members made suggestions for indicators that may be relevant, the availability of high-quality datasets is a key limitation to include many of those indicators.

A key limitation with this scoping is that the body of work in this area is still nascent, and thus there may be critical gaps. Importantly, many of these indicators identified in the scoping exercise are vulnerable to any economic shock and are not specific to pandemics.

Table 1,

Table 2 and ***Table 3*** outline the list of identified indicators for each of the domains, a hypothesis regarding the association with health or economic outcomes and the data source.

Table 1: Health systems resilience and response capacity indicators

Indicator	Reason for inclusion	Source
Number of physicians per 1,000 population	Higher number of physicians is expected to indicate stronger health system, greater response capacity	https://data.worldbank.org/indicator/SH.MED.PHYS.ZS (to update to WHO data)
Number of hospital beds per 1 000 people	Higher number of hospital beds is expected to indicate	https://data.worldbank.org/indicator/SH.MED.BEDS.ZS

[7] https://www.who.int/publications/i/item/9789240017948
[8] https://unsdg.un.org/resources/un-framework-immediate-socio-economic-response-covid-19

Indicator	Reason for inclusion	Source
	stronger health system, greater response capacity	
Logistics Performance Index	Stronger logistics performance associated with greater response capacity	https://lpi.worldbank.org/international/aggregated-ranking
UHC service coverage index (SDG 3.8.1)	Higher UHC SCI equates to stronger health system, greater resilience and response capacity	https://www.who.int/data/gho/data/indicators/indicator-details/GHO/uhc-index-of-service-coverage
Current health expenditure per capita	Greater expenditure equated to greater resilience and response capacity	Global Health Expenditure Database (who.int)
Health expenditure as % GDP	Greater expenditure (if used efficiently) equated to greater resilience and response capacity.	Global Health Expenditure Database (who.int)
Self-assessment annual reporting on the implementation of IHR	Higher IHR associated with stronger resilience/response, lower health and economic loss	https://extranet.who.int/e-spar/#capacity-score
Time to detect, notify and respond to health emergencies	Shorter time/meeting of 7-1-7 targets associated with more rapid response	https://www.who.int/data/gho/data/indicators
Universal health coverage: financial protection	High out of pocket expenditure equated with lower resilience of the health system	Indicators (who.int)
Vaccination coverage rates for high-priority pathogens	Higher coverage of vaccination for priority pathogens equates to higher health system resilience	Indicators (who.int)
Pharmaceutical exports	Demand for pharmaceuticals would rise, positive impact on resilience	https://stats.wto.org/dashboard/merchandise_en.html
Number of manufacturers by country listed in the	Ability to manufacture medical counter measures	https://datadashboard.fda.gov/ora/cd/impentry-table.htm

Indicator	Reason for inclusion	Source
imports entry database of the FDA for fiscal year 202	during response expected to limit economic loss	

Table 2: Social and economic protection indicators

Indicator	Reason for inclusion	Source
Social protection benefit	Higher proportion of expenditure on social protection leads to higher resilience to pandemic	ILO | Social Protection Platform (social-protection.org)
SDG Index	Greater progress toward SDG indicates greater potential for resilience and response	Sachs, J., Lafortune, G., Kroll, C., Fuller, G., Woelm, F., (2022). From Crisis to Sustainable Development: the SDGs as Roadmap to 2030 and Beyond. Sustainable Development Report 2022. Cambridge: Cambridge University Press.
Internet Access	Access to broadband allows for home-based work and schooling, therefore lowering social impact	SDG 9 C (Proportion of population covered by a mobile network, by technology) link used: https://unstats.un.org/sdgs/dataportal/database
Home-based workers	Higher proportion of home-based workers is correlated to stronger resilience	https://www.ilo.org/global/topics/non-standard-employment/publications/WCMS_743447/lang--en/index.htm
Food insecurity	Higher food insecurity expected to be indicative of higher social and economic impact of pandemic	2.1.2 Prevalence of moderate or severe food insecurity in the population, based on the Food Insecurity Experience Scale (FIES)

Indicator	Reason for inclusion	Source
Informal employment	Lack of social protection mechanism – more exposure to pandemic risks	ttps://www.worldbank.org/en/research/brief/informal-economy-database

Table 3: Macroeconomic stability indicators

Indicator	Reason for inclusion	Source
Central Bank Independence	Risk in banking industry – less capacity to respond, higher economic impact	https://academic.oup.com/economicpolicy/advance-article/doi/10.1093/epolic/eiac011/6516019
Domestic credit to private sector by banks (% of GDP)	Companies with ability to access credit will be more resilient to pandemic shocks	https://data.worldbank.org/indicator/FD.AST.PRVT.GD.ZS
Bank nonperforming loans to total gross loans (%)	High proportion of non-performing loans indicative of low resilience	https://data.worldbank.org/indicator/FB.AST.NPER.ZS
Population with savings in a financial institution	People with savings can continue to pay for general consumption and access to health services, indicative of stronger response	https://www.worldbank.org/en/publication/globalfindex
Population able to pay for health emergency	People with savings can pay for access to health services, indicative of stronger response	https://www.worldbank.org/en/publication/globalfindex
Population with emergency funds	People with savings can continue to pay for general consumption and access to health services, indicative of stronger response	https://www.worldbank.org/en/publication/globalfindex
Agriculture, forestry, and fishing value added (% of GDP)	High reliance on trade is a vulnerability to pandemic	https://data.worldbank.org/indicator/NV.AGR.TOTL.ZS?view=chart
International tourism receipts (US$) over GDP (current US$)	High reliance on tourism is a vulnerability to pandemic	https://data.worldbank.org/indicator/ST.INT.RCPT.CD

Indicator	Reason for inclusion	Source
Personal remittances	High reliance on personal remittances likely to indicate low level of resilience	https://data.worldbank.org/indicator/BX.TRF.PWKR.DT.GD.ZS
exports of goods and services as % of GDP	Lower economic activity --> lower demand for exports	https://data.worldbank.org/indicator/NE.EXP.GNFS.ZS
Raw materials exports	Lower economic activity --> lower demand for exports	https://wits.worldbank.org/CountryProfile/en/Country/WLD/Year/2019/TradeFlow/EXPIMP/Partner/All/Product/UNCTAD-SoP1#
GVC-related trade (% gross trade)	Lower economic activity --> lower demand for exports	https://wits.worldbank.org/gvc/gvc-trade-table.html
Number of partners from which a country imports over 1% of its products	More partners --> less vulnerability to a specific country reducing trade	https://stats.wto.org/dashboard/tradeconnectivity_en.html
General government gross debt (% of GDP)	Debt considered as indicative of lower potential to fund response activities, therefore higher economic impact	https://www.imf.org/en/Publications/WEO/weo-database/2022/October/download-entire-database
Foreign direct investment, net inflows (% of GDP)	Higher foreign investment linked to vulnerability to outflows and higher economic impact	https://data.worldbank.org/indicator/BX.KLT.DINV.WD.GD.ZS?view=chart
Tax revenue (% of GDP)	Greater capacity to pay for response measures leads to less economic impact	https://data.worldbank.org/indicator/GC.TAX.TOTL.GD.ZS
Country fiscal measures in response to the COVID-19 pandemic: above the line measures (% of GDP)	Higher response capacity leads to lower economic impact	https://www.imf.org/en/Topics/imf-and-covid19/Fiscal-Policies-Database-in-Response-to-COVID-19
liquidity support, including below the line measures and	Higher response capacity leads to lower economic impact	https://www.imf.org/en/Topics/imf-and-covid19/Fiscal-

Indicator	Reason for inclusion	Source
contingent liabilities (% of GDP)		Policies-Database-in-Response-to-COVID-19
capacity to implement fiscal stimulus	Greater capacity to pay for response measures	Fiscal Monitor, October 2022 (imf.org)

These indicators have been reviewed by the collaborating institutions for relevance to pandemics, and potential responsiveness to policies and investments. Importantly, the macroeconomic stability indicators are less likely to be as policy responsive as some other indicators, but they are also structural indicators that should be considered during discussion on vulnerabilities. Indicators meeting these criteria have then been analyzed for their relationship to loss of GDP and reduction in employment rates during the COVID-19 pandemic. This is the only relevant period for which we have data to test the relationship between indicators and economic impact of a pandemic. Assessing the framework's potential application to future scenarios with pathogens that show different characteristics to COVID-19 will be an important part of future development of the FEVR. Considered for inclusion were 12 health indicators, 19 economic indicators and five social protection indicators.

C3. 16 indicators across health, social, and economic dimensions have strong relationships with GDP outcomes

Initial analysis of the indicators aimed to identify those correlated with GDP per capita and GDP per capita change (measured as percentage change) during the first year of the COVID-19 pandemic. GDP was measured in two ways, both in current US$ using purchasing power parity (PPP) exchange rate, and secondly in constant local currency units. This analysis considers only economic outcomes at present. Future iterations of the FEVR will also consider outcomes on social protection indicators and health indicators, to ensure that vulnerabilities contributing to poor outcomes in all domains are considered.

Preliminary analysis of Pearson's correlation coefficient (r) was conducted for the 194 countries between their GDP per capita (current US$ in PPP, 2019) and change in GDP per capita (current US$ PPP, measured in %) between 2020 and 2019, with the 35 indicators across the domains of health system resilience and response capacity, social and economic protection and macroeconomic stability (Table 4). This initial analysis shows the relationship between the indicators, GDP per capita and short-term GDP loss during the first year of the pandemic. The use of Pearson's correlation is based on the assumption that relationships are linear, however this will be further explored in future iterations of the FEVR.

Table 4 presents the results of correlations of the 35 indicators, against the four GDP-based outcome measures noted above. These results are sorted by strength of correlation with GDP per capita as measured in PPP US$.

As shown in table 4, there are strong correlations between some indicators and GDP per capita as measured in PPP US$ and much lower correlations between change in GDP per capita. The use of local currency units was intended to remove distortion effects from currency exchange rates. However, as we see from the table, the variation in valuation of local currency units results in much lower correlations. Rankings of indicators also vary significantly depending on the choice of outcome variable. This initial analysis will require further exploration in the next version of the Report.

Given the current status of analysis, the Report will focus on a selection of 16 indicators showing strong correlations with GDP per capita or change in GDP per capita measured in PPP and explore further opportunities to use local currency units in future iterations.

Table 4: Preliminary analysis of Pearson's correlation coefficient showing relationship between selected indicators, GDP per capita and change in GDP per capita between 2019 and 2020 in PPP and local currency units. Colour coding represents strength of correlation with green representing the most highly correlated and red representing the least correlated.

Indicator	Domain	GDP per capita, PPP % change 2020-2019	GDP per capita, PPP (2020)	GDP per capita, LCU (2020)	GDP per capita, LCU % change 2020-2019
Population with bank savings	Macroeconomic	-0.22	0.81	-0.02	0.08
Pop. With emergency funds	Macroeconomic	-0.25	0.80	-0.04	0.08
Health exp./capita	Health System	-0.26	0.79	-0.04	-0.01
Pop. Able to pay for health	Macroeconomic	-0.27	0.79	-0.07	0.05
Logistics performance index	Health System	-0.20	0.78	0.03	0.05
UHC	Health System	-0.32	0.72	0.06	-0.14
Food insecurity	Social protection	0.30	-0.69	-0.03	0.09
Informal economy	Social protection	-0.15	0.66	0.15	0.08
Social protection benefit	Social protection	-0.14	0.65	-0.05	0.05
SDG Index	Social protection	-0.29	0.65	0.03	-0.11
Physicians	Health System	-0.30	0.63	-0.04	-0.11
Credit to priv. sector	Macroeconomic	-0.29	0.62	0.07	-0.13

Indicator	Domain	GDP per capita, PPP % change 2020-2019	GDP per capita, PPP (2020)	GDP per capita, LCU (2020)	GDP per capita, LCU % change 2020-2019
Exports	Macroeconomic	0.09	-0.62	0.07	-0.10
Global value chain	Macroeconomic	0.10	-0.54	0.04	-0.09
International Health Regulations (2005)	Health System	-0.06	0.55	0.10	0.12
Agr & tourism	Macroeconomic	-0.09	0.52	0.03	0.05
Internet Access	Social protection	-0.25	0.45	0.01	-0.10
Central gov. debt	Macroeconomic	0.30	-0.10	0.07	0.32
Pharma exports	Health System	-0.01	0.46	-0.05	0.06
Hospital beds	Health System	-0.09	0.38	-0.01	-0.01
Remittances	Macroeconomic	-0.14	0.37	0.07	0.01
C19 liquidity support	Macroeconomic	-0.26	0.32	-0.08	-0.18
C19 above the line measures	Macroeconomic	0.31	0.31	-0.03	0.29
FDI inflows	Macroeconomic	-0.01	-0.24	0.01	-0.06
Health exp./GDP	Health System	-0.13	0.22	-0.03	-0.05
Tax revenue	Macroeconomic	-0.06	0.20	-0.15	-0.04
Non-performing loans	Macroeconomic	0.07	0.19	0.09	0.11
Listed pharma corps	Health System	-0.05	0.18	-0.02	0.02
Detect, Notify, Respond	Health System	-0.06	0.15	-0.06	0.01
Central bank independence	Macroeconomic	0.14	0.14	-0.16	0.19
Home-based workers	Social protection	0.05	-0.14	0.10	0.10
Financial Hardship	Health System	0.05	-0.12	0.05	0.00

Indicator	Domain	GDP per capita, PPP % change 2020-2019	GDP per capita, PPP (2020)	GDP per capita, LCU (2020)	GDP per capita, LCU % change 2020-2019
Import partners	Macroeconomic	0.16	-0.10	0.06	-0.01
Manufacturers	Health System	-0.01	0.07	-0.02	0.00
Raw materials	Macroeconomic	0.05	0.00	-0.08	0.15

In the previous version of this Report, 14 indicators with the strongest correlations to GDP per capita measured in PPP were included. In this version, two indicators were added that showed high correlations to GDP per capita PPP change in the first year of COVID-19: **central government debt and internet access**. Population with bank funds, population with emergency savings and population able to pay for health care are highly inter-correlated, therefore only one indicator, population with bank funds, is included in the analysis.

Two additional indicators, COVID-19 above the line measures and COVID-19 liquidity measures, show some relationship with change in GDP per capita. These have been excluded from the analysis as they were considered a response measure, rather than indicative of a vulnerability. Further consideration of how to reflect these data in the FEVR will be needed in the next round.

Future work to strengthen the framework will consider gaps in the indicator lists, look at longer term impacts, including economic rebound, consider relationships over longer periods of time, and use additional statistical methods to move from correlation to causation analysis. In addition, testing of the framework for other types of pandemic scenarios beyond COVID-19 will be necessary.

C4. Modelling of differential impacts of key health, social and economic outcomes associated with pandemic scenarios can inform policy decisions, including spending, during a pandemic

Economic shocks such as a pandemic can significantly alter growth trajectories, financial and economic deprivation rates, and other economic outcomes within all countries, on top of the human toll and social impact they cause. The magnitude of such an impact is related to multiple characteristics of the pandemic, including the type and speed of spread, magnitude of associated morbidity and mortality, and rapidity and scale of response.

Social and movement measures implemented to mitigate the health impacts of a pandemic, such as physical distancing measures, lockdowns, and travel restrictions, may have unintended consequences on health and exacerbate economic slowdowns. Secondary health impacts occur if measures disrupt access to care and delay diagnosis

and treatment, adversely affect mental health, or increase exposure to harmful behaviors such as intimate partner violence. In addition, these measures can increase socioeconomic inequality, disproportionally harming workers with jobs that cannot be undertaken from home or economies with lower proportion of home-based work and economies with lower access to internet services, those with precarious employment conditions and those with limited or no access to social protection. In addition, school closures have disproportionate impacts in countries with lower readiness for home-based learning.

Policymakers are faced with complex decisions to sustain both the lives and livelihoods of the population, and to protect the most vulnerable in both the short and the long term. In order to best inform mitigation measures in the context of a pandemic, models combining health, social and economic impacts have been developed to explicitly quantify these trade-offs and costs.

To use the FEVR in the context of decision making around mitigation measures, a combined epidemiological-economic model, including all the indicators proposed in section C3 could be developed and utilized. In this iteration of the FEVR framework, a proof-of-concept model with a restricted list of health, social, and economic outcome measures is presented. At the present time, the model is not linked to the complete set of indicators in the FEVR.

D | Additional analysis can strengthen the linkages between indicators and impacts of pandemic scenarios, and consider global interconnectedness

The current FEVR identifies 16 indicators with strong relationships with GDP and change in GDP between 2019-2020 driven by the COVID-19 pandemic. To illustrate the type of analysis that the framework can support, once fully developed, a separate analysis, using data and modelling showing the differential health, social and economic impacts of possible pandemic scenarios has been developed.

Further development of the model will consider member comments related to indicator selection and analytics that require fuller analysis. As the analysis is developed further, this will be done in an inclusive and consultative manner, considering comments from members and working with key stakeholders including regional organizations as well as academics and other relevant organizations such as the quadripartite to ensure that the next steps include a process of validation and peer discussion.

At present, the FEVR has been developed using country-level indicators and provides an individual country lens. It does not reflect the impact of health, social and economic risks and vulnerabilities at a regional or global level through economic interconnectedness, which would provide a way to consider how the transmission dynamics of specific pathogens might impact economic activity in countries and how that might in turn affect the global economy.

Key next steps with the FEVR are to:

- Test the validity of the framework using a statistical analysis such as regressions or principal component analysis to finalize the selection of indicators for the framework and to establish causal as well as identify directional correlation relationships;
- **Incorporate global economic interconnectedness** by explicitly linking the indicators to the epidemiological-economic model to inform the analysis of impact of mitigation strategies in the context of a future pandemic;
- Incorporate **long term scarring effects** and therefore develop an understanding of the full impact on economies; and
- **Consider pathogen scenarios** that demonstrate the impact of different global transmission dynamics and economic relationships.

This Report has provided an initial selection of health, social and economic indicators and identified the relationship with GDP per capita and change in GDP per capita in the most recent pandemic. Given the pioneering and unique nature of this work, development of the FEVR will be an iterative process but this Report provides the initial version of such an analysis.

The framework is an essential tool to be able to identify key indicators across health, social and economic domains that have a linkage to economic vulnerabilities and risks related to pandemics. The framework and analyses can help to understand where future investments in pandemic prevention preparedness and response could be focused. It can also help identify vulnerabilities in a systematic and comparable approach, such as fiscal constraints and social protection indicators.

While the aim of the FEVR is to build an understanding of the global health, social and economic impacts, many health threats can have a severe impact at national and regional level. Using the FEVR on a global basis should be supplemented by work to understand the scale of impacts at regional level linked to differences in regional economies.

Finally, the FEVR can highlight areas to focus on, but further in-depth analysis would need to be done at country and subnational levels to understand the costs, benefits and expected effectiveness of specific policy interventions and investments. Further, some investments made by countries will also have wider beneficial effects which would also factor into cost-benefit analysis.

Annex 1: List of Indicators

1. Economic and Financial

Sr. No	Indicator	Status	Comment	Source
1	GDP per capita	excluded	is the measure of economic impact currently used	GDP per capita (current US$) | Data (worldbank.org)
2	Gini coefficient	excluded	considered as an impact indicator	Gini index | Data (worldbank.org)
3	(CURRENT) pharmaceutical exports	included		https://stats.wto.org/dashboard/merchandise_en.html
4	(CURRENT) Number of manufacturers by country listed in the imports entry database of the FDA for fiscal year 202	included		https://datadashboard.fda.gov/ora/cd/impentry-table.htm
5	(CURRENT) Central Bank Independence	included		https://academic.oup.com/economicpolicy/advance-article/doi/10.1093/epolic/eiac011/6516019
6	(CURRENT) Domestic credit to private sector by banks (% of GDP)	included		https://data.worldbank.org/indicator/FD.AST.PRVT.GD.ZS
7	(CURRENT) Bank nonperforming loans to total gross loans (%)	included		https://data.worldbank.org/indicator/FB.AST.NPER.ZS

Sr. No	Indicator	Status	Comment	Source
8	(CURRENT) Population with savings in a financial institution	included		https://www.worldbank.org/en/publication/globalfindex
9	(CURRENT) Population able to pay for health emergency	included	overlap with #9	https://www.worldbank.org/en/publication/globalfindex
10	(CURRENT) Population with emergency funds	included	overlap with #9	https://www.worldbank.org/en/publication/globalfindex
11	(CURRENT) Agriculture, forestry, and fishing value added (% of GDP)	included		https://data.worldbank.org/indicator/NV.AGR.TOTL.ZS?view=chart
12	(CURRENT) International tourism receipts (US$) over GDP (current US$)	included		https://data.worldbank.org/indicator/ST.INT.RCPT.CD
13	(CURRENT) Personal remittances	included		https://data.worldbank.org/indicator/BX.TRF.PWKR.DT.GD.ZS
14	(CURRENT) Exports of goods and services as % of GDP	included		https://data.worldbank.org/indicator/NE.EXP.GNFS.ZS

Sr. No	Indicator	Status	Comment	Source
15	(CURRENT) Raw materials exports	included		https://wits.worldbank.org/CountryProfile/en/Country/WLD/Year/2019/TradeFlow/EXPIMP/Partner/All/Product/UNCTAD-SoP1#
16	(CURRENT) GVC-related trade (% gross trade)	included		https://wits.worldbank.org/gvc/gvc-trade-table.html
17	(CURRENT) Number of partners from which a country imports over 1% of its products	included		https://stats.wto.org/dashboard/tradeconnectivity_en.html
18	(CURRENT) Proportion of workers home based	included		https://www.ilo.org/global/topics/non-standard-employment/publications/WCMS_743447/lang--en/index.htm
19	(CURRENT) Informal employment	included		ttps://www.worldbank.org/en/research/brief/informal-economy-database
20	(CURRENT) General government gross debt (% of GDP)	included		https://www.imf.org/en/Publications/WEO/weo-database/2022/October/download-entire-database
21	(CURRENT) S&P credit rating.	included		https://tradingeconomics.com/country-list/rating
22	(CURRENT) Foreign direct investment, net inflows (% of GDP)	included		https://data.worldbank.org/indicator/BX.KLT.DINV.WD.GD.ZS?view=chart

Sr. No	Indicator	Status	Comment	Source
23	(CURRENT) Tax revenue (% of GDP)	included		https://data.worldbank.org/indicator/GC.TAX.TOTL.GD.ZS
24	(CURRENT) Country fiscal measures in response to the COVID-19 pandemic: above the line measures (% of GDP)	included	excluded: response indicator	https://www.imf.org/en/Topics/imf-and-covid19/Fiscal-Policies-Database-in-Response-to-COVID-19
25	(CURRENT) Liquidity support, including below the line measures and contingent liabilities (% of GDP)	included	excluded: response indicator	https://www.imf.org/en/Topics/imf-and-covid19/Fiscal-Policies-Database-in-Response-to-COVID-19
26	Capacity to implement fiscal stimulus	excluded	overlap with #24	Fiscal Monitor, October 2022 (imf.org)
27	Unemployment rate	excluded	considered as an impact indicator	https://databank.worldbank.org/reports.aspx?source=2&series=SL.EMP.TOTL.SP.ZS&country=
28	People driven to extreme poverty	excluded	considered as an impact indicator	https://databank.worldbank.org/reports.aspx?source=2&series=SE.PRM.UNER&country=#
29	Trade volumes	excluded	considered as an impact indicator	https://stats.wto.org/
30	Commercial flights	excluded	interpretation unclear, to be considered next round	https://databank.worldbank.org/reports.aspx?source=2&series=IS.AIR.PSGR&country=#

Sr. No	Indicator	Status	Comment	Source
31	Hotel bookings	excluded	no global data available	

2. Health

Sr. No	Indicator	Status	Comment	Source
1	(CURRENT) Number of physicians per 1,000 population	included		https://data.worldbank.org/indicator/SH.MED.PHYS.ZS (to update to WHO data)
2	(CURRENT) Number of hospital beds per 1 000 people	included		https://data.worldbank.org/indicator/SH.MED.BEDS.ZS
3	(CURRENT) Capacity of intensive care beds per 100 000 population	excluded	only available for 22 OECD countries	https://www.oecd.org/coronavirus/en/data-insights/intensive-care-beds-capacity
4	(CURRENT) Logistics Performance Index	included		https://lpi.worldbank.org/international/aggregated-ranking
5	(CURRENT) UHC service coverage index (SDG 3.8.1)	included		https://www.who.int/data/gho/data/indicators/indicator-details/GHO/uhc-index-of-service-coverage
6	(CURRENT) Current health expenditure per capita	included		GHED

Sr. No	Indicator	Status	Comment	Source
7	(CURRENT) Health expenditure as % GDP	included		GHED
8	(CURRENT) Self-assessment annual reporting on the implementation of IHR	included		https://extranet.who.int/e-spar/#capacity-score
9	Global mechanism for early warning and One Health surveillance	included		Detect, notify, respond indicator
10	Effectiveness of detection through early warning systems and rapid response	included	note, combined with 9	(as above)
11	Ability to deploy workforce in early response surge	excluded	no data available	GOARN (who.int)
12	Ability to coordinate deployable responsive workforce	excluded	no data available	Health workforce (who.int)
13	ODA for medical research and basic health sectors per	excluded	data available for 42 countries	Official development assistance ODA for medical research and basic health sectors per capita by recipient country (who.int)

Sr. No	Indicator	Status	Comment	Source
	capita, by recipient country			
14	Gross domestic R&D expenditure on health (health GERD) as a % of gross domestic product (GDP)	excluded	available for 86 countries	Gross domestic R&D expenditure on health (health GERD) as a percentage of GDP (who.int) alternate link - but blank dataset https://www.who.int/data/gho/data/indicators/indicator-details/GHO/existing-gho-indicator-(sdg-9-5-1)-gross-domestic-r-d-expenditure-on-health-(health-gerd)-as-a-of-gross-domestic-product-(gdp)
15	Speed of development of countermen-sures	excluded	suggested by GPMB, no data source available	
16	Universal health coverage financial protection	included		
17	Global supply chain pressure index	excluded	overlaps with indicator #4	Global Supply Chain Pressure Index (GSCPI) - FEDERAL RESERVE BANK of NEW YORK (newyorkfed.org)
18	Prevent Indicator, HEP billion	included		
19	Continuity of EHS in FCV	excluded	no agreed indicator to measure	
20	Morbidity	excluded	impact measure suggested by GPMB	

Sr. No	Indicator	Status	Comment	Source
21	Mortality	excluded	impact measure suggested by GPMB	
22	DALY lost	excluded	impact measure suggested by GPMB	
23	Access to SRH interventions	excluded	could be integrated, if agreement on indicator	
24	Suicide rates	excluded	WHO: most recent data are from 2015, therefore not relevant to pandemic changes WB: most recent data for 2019, pre-pandemic	https://databank.worldbank.org/reports.aspx?source=2&series=SH.STA.SUIC.P5&country=#
25	Domestic violence rate	excluded	WB: most recent data for 2018	https://databank.worldbank.org/source/gender-statistics/Type/TABLE/preview/on#

3. Social

Sr. No	Indicator	Status	Comment	Source
1	Individualism	excluded	data is a compound measure and interpretation was unclear	Country comparison tool (hofstede-insights.com)

Sr. No	Indicator	Status	Comment	Source
2	Inter- and intra-national mobility	excluded	data reports only on mobility change from baseline, not absolute mobility values	https://ourworldindata.org/covid-google-mobility-trends
3	Multi-dimensional poverty index	excluded	Compound indicator	Global Multidimensional Poverty Index | OPHI link used: https://ophi.org.uk/multidimensional-poverty-index/data-tables-do-files/
4	(CURRENT) proportion of workers home based	included		https://www.ilo.org/global/topics/non-standard-employment/publications/WCMS_743447/lang--en/index.htm
5	(CURRENT) informal employment	included		ttps://www.worldbank.org/en/research/brief/informal-economy-database
6	Continuity of school nutrition programmes	excluded	could not identify specific indicator	Wellcome Global Monitor 2020: Covid-19 | Wellcome
7	Do countries have adequate access to broadband internet?	included		SDG 9 C (Proportion of population covered by a mobile network, by technology) links used: https://unstats.un.org/sdgs/dataportal/database https://databank.worldbank.org/reports.aspx?source=2&series=IT.NET.USER.ZS&country=#
8	SDG Index	included		https://dashboards.sdgindex.org/downloads

Sr. No	Indicator	Status	Comment	Source
9	Remote learning readiness	excluded	available for 67 countries	Remote Learning Readiness Index dashboard - UNICEF DATA
10	Social protection benefit	included		
11	Food insecurity	included		
12	Number of children out of school	excluded	Could be included, data now identified	https://databank.worldbank.org/reports.aspx?source=2&series=SE.PRM.UNER&country=#
13	Trust levels	excluded	Representative global data not identified	