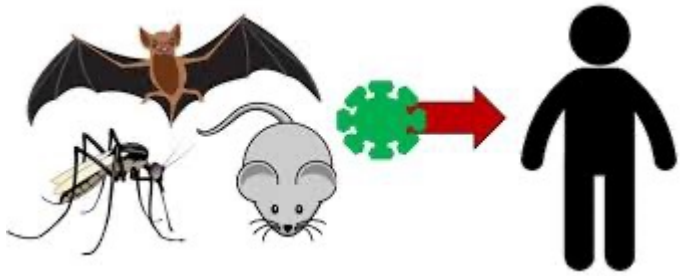
Public Health Approach to Detection and Surveillance of Emerging Zoonotic Diseases



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WHO Strategic Preparedness and Response Plan for COVID-19

1. Country-level coordination, planning, financing, and monitoring
2. Risk communication, community engagement and infodemic management
3. Surveillance, epidemiological investigation, contact tracing, public health and social measures
4. Points of entry, international travel and transport, and mass gatherings
5. Laboratories and diagnostics
6. Infection prevention and control, and protection of the health workforce
7. Case management, clinical operations, and therapeutics
8. Operations support and logistics, and supply chains
9. Maintaining essential health services and systems
10. Vaccination

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WHO Strategic Preparedness and Response Plan for COVID-19

- Public health measures by countries for preparedness and response to COVID-19 pandemic
- WHO encourages all countries to act uniformly to coordinate and contain the threat by pandemic – “one UN”
- This plan is aimed at stopping the chain of human-to-human transmission.
- Not concerned with animal-to-human transmission for zoonotic diseases

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Pakistan's COVID-19 Outbreak Preparedness and Response: A Situational Analysis

Nadia Noreen, Syed Atta Ur Rehman, Iram Naveed, Saeed Ullah Khan Niazi, and Irfan B. Furqan

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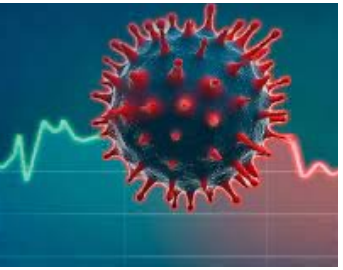
The COVID-19 pandemic continues to devastate countries around the world. Pakistan has had a largely successful control strategy with fewer hospitalizations and mortality than its neighboring countries of China, Iran, and India. The aim of our study was to assess Pakistan's state of preparedness for and response to the COVID-19 outbreak, including its multifaceted approach in surveillance, response, and diagnostic services. The study was a situational analysis based on the 2020 World Health Organization *COVID-19 Strategic Preparedness and Response Plan*. The authors collected national data from January to August 2020 from the government of Pakistan's COVID-19 website and Pakistan's Directorate of Central Health Establishments. We also conducted an extensive review of recently published articles on COVID-19, literature, news alerts, and publicly available data on COVID-19 in Pakistan. To address the COVID-19 pandemic, the country drafted a national action plan, developed mobile applications and the national 1166 helpline, conducted thermal screening and active case finding at all points of entry, and established and strengthened a surveillance system for contact tracing and case-based surveillance, with coordination at the federal and provincial levels. Additionally, a total of 134 laboratories have been designated in major cities for testing of COVID-19; 735 hospitals have been designated for the management of cases in isolation wards at federal, provincial, and regional levels; and dedicated quarantine places have been ensured. Despite being a resource-constrained country, the government of Pakistan has mounted a coordinated national effort using the best available resources. The government is rightly focusing on 4 major areas—surveillance, management, response, and coordination—in controlling the COVID-19 pandemic in Pakistan.

Keywords: COVID-19, Public health preparedness/response, Epidemic management/response, Points of entry, Surveillance, Coordinated efforts



Country-level coordination, planning, financing, and monitoring

In co-ordination with government agencies and ministries the following should be done:

- National public health emergency management plan and mechanisms should be activated – Emergency Operations Centre
- Country-specific operational plan with capacity assessment, risk analysis, resource requirements - Operational planning guidelines to support country planning
- Policy framework for federal, provincial and regional stakeholders to prevent, detect and respond to the confirmed cases of Covid-19.
- Regulatory requirements of public health measures
- Establish metrics and monitoring and evaluation systems

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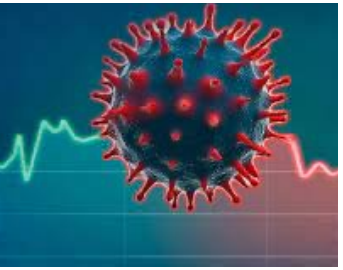

Country-level coordination, planning, financing, and monitoring

- Establish an incident management team within a public health command and control center
- Mapping of vulnerable populations
- COVID-19 Partners Platform enables countries to work with WHO, UN partners, implementing partners and donors to plan, coordinate, and finance activities collaboratively in real time
- Monitor implementation of Preparedness and Response Plan and Conduct regular operational review based on KPIs and epidemiological estimates
- Produce regular situation analysis and report
- Advisory/alerts continuously issued to all relevant stakeholders

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Risk communication, community engagement (RCCE) and infodemic management

- Communities are integral in preventing and controlling epidemics
- Address demand-side barriers to health service utilization
- Inform measures to mitigate the socio-economic impact of COVID-19 control interventions.

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Coronavirus pandemic in the Nordic countries: Health policy and economy trade-off

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Background Countries making up the Nordic region – Denmark, Finland, Iceland, Norway, and Sweden – have minimal socioeconomic, cultural, and geographical differences between them, allowing for a fair comparative analysis of the health policy and economy trade-off in their national approaches towards mitigating the impact of the COVID-19 pandemic.

Methods This study utilized publicly available COVID-19 data of the Nordic countries from January 2020 to January 3, 2021. COVID-19 epidemiology, public health and health policy, health system capacity, and macroeconomic data were analysed for each Nordic country. Joinpoint regression analysis was performed to identify changes in temporal trends using average monthly percent change (AMPC) and average weekly percent change (AWPC).

Results Sweden's health policy, being by far the most relaxed response to COVID-19, was found to have the largest COVID-19 incidence and mortality, and the highest AWPC increases for both indicators (13.5, 95% CI = 5.6, 22.0, $P<0.001$; 6.3, 95% CI = 3.5, 9.1, $P<0.001$). Denmark had the highest number of COVID-19 tests per capita, consistent with their approach of increased testing as a preventive strategy for disease transmission. Iceland had the second-highest number of tests per capita due to their mass-testing, contact tracing, quarantine and isolation response. Only Norway had a significant increase in unemployment (AMPC = 2.8%, 95% CI = 0.7-4.9, $P<0.009$) while the percentage change in real Gross Domestic Product (GDP) was insignificant for all countries.

Conclusions There was no trade-off between public health policy and economy during the COVID-19 pandemic in the Nordic region. Sweden's relaxed and delayed COVID-19 health policy response did not benefit the economy in the short term, while leading to disproportionate COVID-19 hospitalizations and mortality.

Risk communication, community engagement (RCCE) and infodemic management

Communication with the public is critical about the zoonotic disease:

- what is known about it
- how it is transmitted and precautions to prevent transmission
- government actions including preparedness and public health response measures
- future course of action

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Risk communication, community engagement (RCCE) and infodemic management

- Conduct rapid behavior assessment – to understand target audience, perceptions, concerns, influencers and preferred communication channels
- Engagement with communities via community-based and civil society organizations at the grassroots level
- Prepare local messages and pre-test through a participatory process
- Timely, responsive, empathic, transparent and consistent messaging in local languages
- Channels of communication - community-based networks & key influencers
- Trust building, and engagement of communities becomes even more critical with vaccines and new therapeutics.

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Risk communication, community engagement (RCCE) and infodemic management

- Utilize two-way channels for community and public information e.g., hotline
- Community feedback to respond to concerns and avoid misinformation
- Community engagement for social and behavior change approaches to ensure preventive public health and hygiene practices
- Launch of National health helpline, online platform/ interactive mobile application as an online health portal for awareness of COVID-19
- Dissemination of infection control and prevention materials guided by Risk communication strategy for public awareness through print, social and electronic media

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Surveillance, epidemiological investigation, contact tracing, public health and social measures

- Surveillance objectives:
  - Identify, isolate and treat cases
  - Trace and quarantine contacts
  - Monitoring of COVID-19 transmission: transmission intensity and disease trends
  - Undertake case-based reporting to WHO within 24 hours under IHR (2005)
  - Train rapid response teams to investigate cases and conduct contact tracing within 24 hrs
  - Produce weekly epidemiological and social science reports
  - Implement and adjust public health and social measures

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Surveillance, epidemiological investigation, contact tracing, public health and social measures

- Identify, isolate and treat cases,
- Trace and quarantine contacts and monitoring
- National strategy e.g., test, trace and quarantine (TTQ)
- Testing capacity strengthened at all levels
- The test, trace and quarantine strategy objectives were to identify spread, focused clusters and hotspots to enable targeted lockdowns and need-driven resource optimization at all levels
- Plan chalked out by federal and provincial governments for imposition of smart lockdown based on ‘tracking-tracing-screening’ owing to the drastic effects of complete lockdown on the economy and an impoverished workforce.
- Disease surveillance & Response Units strengthened at district level and collaborated with Emergency Operations Centers at provincial level.

Points of entry, international travel and transport, and mass gatherings

- Points of Entry (POE) should support surveillance and risk communication activities:
  - Develop and implement a POE public health emergency plan
  - Train POE staff and equip them to manage ill passengers
  - Surveillance and case management at the point of entry and across borders
  - Capacities and procedures for international contact tracing
  - Prepare rapid health assessment/isolation facilities to manage ill patients and safely transport them to designated health facilities
  - Communicate COVID-19 information to travelers, including for self-monitoring of signs and symptoms

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Points of entry, international travel and transport, and mass gatherings

- Risk mitigation measures
  - Exit and entry screening for signs and symptoms
  - Closure of borders
  - National action plan issued guidelines/Standard Operating Procedures (SOPs) for inbound international flights for authorities and health officials
  - Targeted testing - Thermal screening and active case finding undertaken at international airports and seaports
  - Quarantine for international travelers
  - Selective travel restrictions

Points of entry, international travel and transport, and mass gatherings

- Contingency plans and SOPs for referral of suspected cases to designated hospitals and follow up were strictly followed.
- Trained Rapid Response Teams (RRTs) with an ambulance should be available 24/7 for shifting suspected cases from Point of entry to designated hospitals at the district level across the country.
- Training of Human resource on screening, data collection and data management.
- Frequent on-going refresher training of the POE staff for early detection and management of suspected COVID-19.
- Digitalization of all POEs with maintenance of data in travelers surveillance management information system

Laboratories and diagnostics

- Testing and increasing testing capacity is critical to prevent transmission
- Strengthening subnational and decentralized testing capacity
- Establish and disseminate SOPs for specimen collection, management and transportation for COVID-19 diagnostic testing
- Identify hazards and conduct biosafety risk assessment at participating labs
- Establish standardized systems for molecular testing, with access to reagents/kits
- Operational and logistical support for laboratory supply chains should be sustained (e.g., rapid antigen detecting tests (Ag-RDTs) and PCR tests)

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Laboratories and diagnostics

- Establish linkages to lab data with epidemiological data for timely reporting and analysis
- Develop surge plans to handle to manage increased demand for testing
- Monitor and evaluate diagnostics and testing mechanisms, data quality and staff
- Establish quality assurance mechanisms from point-of-care testing including quality indicators

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Laboratories and diagnostics

- Access to international COVID-19 reference lab
- Increase sequencing of SARS-CoV-2 viruses within surveillance activities
- Monitor for the emergence of variants
- Transparent and timely sharing of information and virus genetic sequence data according to established protocols
- Global Influenza Surveillance and Response System (GISRS) currently comprises institutions in 124 WHO Member States:
  - National Influenza Centers
  - WHO Collaborating Centers
  - WHO H5 Reference Labs
  - WHO Essential Regulatory Labs
- Genomic Surveillance Regional Networks

Infection prevention and control, and protection of the health workforce

- Infection prevention and control (IPC) measures are important at both levels, health facilities and community, to prevent transmission
- Assess Infection prevention and control (IPC) at all levels of healthcare system; trained staff, and sufficient IPC materials (PPE and WASH services/hand hygiene stations).
- Assess IPC capacity and support access to WASH services in public places
- Review and update national IPC guidance
- Develop a plan for monitoring of healthcare personnel exposed to COVID-19
- Develop a national plan for PPE supply and to identify IPC surge capacity

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Infection prevention and control, and protection of the health workforce

- Record, report, and investigate all cases of healthcare-associated infections
- Disseminate IPC guidance for home and community care providers
- Implement triage, early detection and infectious-source controls, visual alerts (educational material in local language)
- Monitor IPC and WASH implementation in healthcare facilities and public space

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Case management, clinical operations, and therapeutics

- Map vulnerable populations and public and private health facilities
- Identify alternative health facilities and ICU capacity
- Monitor burden and health system capacity
- Ensure guidance is available on self-care of patients with mild COVID-19 symptoms and when referral to healthcare facilities is recommended
- Disseminate COVID-19-specific protocols and regularly updated information and training on management of severe acute respiratory infections.
- Establish triage and screening areas at all healthcare facilities
- Establish and equipped teams/ambulances to transport suspected and confirmed cases, and referral mechanisms

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Predicting mortality in SARS-COV-2 (COVID-19) positive patients in the inpatient setting using a novel deep neural network

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ABSTRACT

Background: The nextwave of COVID-19 pandemic is anticipated to be worse than the initial one and will strain the healthcare systems even more during the winter months. Our aim was to develop a novel machine learning-based model to predict mortality using the deep learning Neo-V framework. We hypothesized this novel machine learning approach could be applied to COVID-19 patients to predict mortality successfully with high accuracy.
Methods: We collected clinical and laboratory data prospectively on all adult patients (≥18 years of age) that were admitted in the inpatient setting at Aga Khan University Hospital between February 2020 and September 2020 with a clinical diagnosis of COVID-19 infection. Only patients with a RT-PCR (reverse polymerase chain reaction) proven COVID-19 infection and complete medical records were included in this study. A Novel 3-phase machine learning framework was developed to predict mortality in the inpatients setting. Phase 1 included variable selection that was done using univariate and multivariate Cox-regression analysis; all variables that failed the regression analysis were excluded from the machine learning phase of the study. Phase 2 involved new-variables creation and selection. Phase 3 and final phase applied deep neural networks and other traditional machine learning models like Decision Tree Model, k-nearest neighbor models, etc. The accuracy of these models were evaluated using test-set accuracy, sensitivity, specificity, positive predictive values, negative predictive values and area under the receiver-operating curves.
Results: After application of inclusion and exclusion criteria (n=)1214 patients were selected from a total of 1228 admitted patients. We observed that several clinical and laboratory-based variables were statistically significant for both univariate and multivariate analyses while others were not. With most significant being septic shock (hazard ratio [HR], 4.30; 95% confidence interval [CI], 2.91–6.37), supportive treatment (HR, 3.51; 95% CI, 2.01–6.14), abnormal international normalized ratio (INR) (HR, 3.24; 95% CI, 2.28–4.63), admission to the intensive care unit (ICU) (HR, 3.24; 95% CI, 2.22–4.74), treatment with invasive ventilation (HR, 3.21; 95% CI, 2.15–4.79) and laboratory lymphocytic derangement (HR, 2.79; 95% CI, 1.6–4.86). Machine learning results showed our deep neural network (DNN) (Neo-V) model outperformed all conventional machine learning models with test set accuracy of 99.53%, sensitivity of 89.87%, and specificity of 95.63%; positive predictive value, 50.00%; negative predictive value, 91.05%; and area under the receiver-operator curve of 88.5.
Conclusion: Our novel Deep-Neo-V model outperformed all other machine learning models. The model is easy to implement, user friendly and with high accuracy.

Case management, (Quarantine)

- Dedicated quarantine places ensured at federal, provincial and regional levels with properly trained support staff with medical support.
- Policy formulated for stranded citizens traveling back
- Strict implementation of all standard operating procedures (SOPs) including a mandatory (e.g., 48-hour) state-monitored quarantine period in government quarantine centers or paid hotel facility by choice of passengers.

Case management, (Isolation wards)

- Isolation wards should be established in the major designated hospitals across the country in the public and private sectors for case management.
- Emergency Response Teams should be identified, trained and equipped with ambulances to transport suspected cases to hospitals
- Ambulance services by relevant hospitals
- Case Definitions for suspected, probable and confirmed cases should be adopted from WHO standard case definition
- Hospitals designated for the management of cases with COVID-19
- The total number of beds allocated for the management of COVID-19 cases in hospitals are expanded
- ICU beds and Ventilators are available for COVID-19 patients expanded

Operational support and logistics, and supply chains

- Logistical and operational capacities at national level - surging staff deployments, the procurement, safe storage and distribution of correctly specified essential supplies, and staff payments.
- Map available resources and supply systems; conduct in-country inventory review
- Develop a central stock reserve for COVID-19 case management
- Review supply chain control and management system (stockpiling, storage, security, transportation and distribution arrangements)
- Review procurement processes (including importation and customs) for medical and other essential supplies

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Operational support and logistics, and supply chains

- Strengthen capacity to meet specialized supply chain needs, including for PPE and oxygen
- Assess the capacity of local market to meet increased demand for medical supplies
- Coordinate international request of supplies through regional and global procurement mechanisms
- Prepare staff surge capacity and deployment mechanisms; health advisories (guidelines and SOPs); pre- and post-deployment package
- For COVID-19 vaccines - cold chain support for storage and safe distribution

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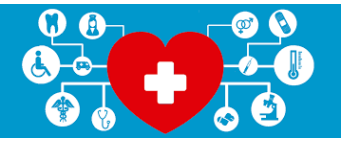

Maintaining essential health services and systems

- Challenges are handling the COVID-19 patients surge while simultaneously ensuring delivery of essential health services
- Misinformation has led to changes in health-seeking behavior and reduced demand for health services
- Opportunity to invest in long-term health systems strengthening efforts, including essential public health functions, health systems' governance, primary healthcare, health information systems, health financing, human resources, and health products and essential medicines

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Vaccination

- Safe and effective vaccines for COVID-19 are available
- Their availability, accessibility, and deployment are the highest health, social, economic, and political priorities
- Since April 2020 WHO has worked through the COVAX facility of ACT-Accelerator, to coordinate and accelerate the research and development, manufacture, regulatory evaluation/in-country authorization, allocation, and country readiness to deploy vaccines at a scale
- WHO's Partner Platform is operational for countries to upload their National Vaccine Deployment Plan, as well as their needs for technical assistance and funding gaps for the delivery of COVID-19 vaccines

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RESEARCH ARTICLE

COVID-19 vaccine hesitancy among non-refugees and refugees in Kenya

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Abstract

Factors associated with COVID-19 vaccine hesitancy (which we define as refusal to be vaccinated when asked, resulting in delayed or non- vaccination) are poorly studied in sub-Saharan Africa and among refugees, particularly in Kenya. Using survey data from wave five (March to June 2021) of the Kenya Rapid Response Phone Survey (RRPS), a household survey representative of the population of Kenya, we estimated the self-reported rates and factors associated with vaccine hesitancy among non-refugees and refugees in Kenya. Non-refugee households were recruited through sampling of the 2015/16 Kenya Household Budget Survey and random digit dialing. Refugee households were recruited through random sampling of registered refugees. Binary response questions on misinformation and information were transformed into a scale. We performed a weighted (to be representative of the overall population of Kenya) multivariable logistic regression including interactions for refugee status, with the main outcome being if the respondent self-reported that they would not take the COVID-19 vaccine if available at no cost. We calculated the marginal effects of the various factors in the model. The weighted univariate analysis estimated that 18.0% of non-refugees and 7.0% of refugees surveyed in Kenya would not take the COVID-19 vaccine if offered at no cost. Adjusted, refugee status was associated with a -13.1[95%CI:-17.5,-8.7] percentage point difference (ppd) in vaccine hesitancy. For the both refugees and non-refugees, having education beyond the primary level, having symptoms of COVID-19, avoiding handshakes, and washing hands more often were also associated with a reduction in vaccine hesitancy. Also for both, having used the internet in the past three months was associated with a 8.1[1.4,14.7] ppd increase in vaccine hesitancy; and disagreeing that the government could be trusted in responding to COVID-19 was associated with a 25.9 [14.2,37.5]ppd increase in vaccine hesitancy. There were significant interactions between refugee status and some variables (geography, food security, trust in the Kenyan

THANK YOU