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Comparative Research on Artificial Intelligence and a Various Role of Algorithms in Medicine for Emergency Dealing with the SARS-CoV Pandemic in Asia, USA, and EU

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Abstract:

Purpose: *This research intends to compare the application of AI and ML by the USA, Asia, and EU as a powerful method in screening, detecting, calculating, tracing contact as well as developing drugs for infection.*
Design/methodology/approach: *This article assessment was conducted on the databanks correlated to the implementation of ML and AI techniques on SARS-CoV-2. The research focuses on the latest studies utilising ML and AI technology to augment scientists on multiple approaches. It also tackles a few gaps while applying the algorithms to actual difficulties from a health law perspective.*
Findings: *The pandemic profoundly altered the way of living and conducting daily activities and vividly enhanced the implementation of AI in the medical field. Despite AI's various and indisputable contributions, medical trials and human expertise are still necessary. In the latest global urgency, researchers and healthcare experts worldwide keep examining a novel technology to support confronting the SARS-CoV-2 outbreak. The study also deliberates recommendations by scholars on model strategy, clinical specialists, and policymakers in contemporary circumstances when battling viral infection in the future.*
Practical implementations: *Biological disasters like the SARS-CoV-2 pandemic are out of the scope and power of human beings even though much can be done to reduce the loss of lives. Artificial intelligence in the medical sector is a worthwhile option to potentially curb the massive fatalities, not to mention to make rescue attempts effortless and highly effective. Various studies on AI tools to assess the progress of the virus were also conducted.*
Originality value: *The current improvements in AI and ML have considerably enriched cure, medicine, detection, estimation, contact tracing, and the discovery of vaccine for the SARS-CoV-2 pandemic and minimised human mediation in medical practice. The pandemic exposed vital hindrances for law enforcement, resource administration, the execution of public health limits, and variations in crime and service patterns.*

Keywords: *eHealth, machine learning algorithms, artificial intelligence, SARS-CoV-2, USA, Asia, EU.*

Paper type: *Research article.*

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1. Introduction

Artificial Intelligence algorithms in the situation of a global health emergency played an extraordinary role. This research followed a Boolean search strategy of the literature review of the latest articles on artificial intelligence and machine learning amidst the COVID-19 outbreak and its impact on health law. The outcome of this review was aimed at saving lives by availing deep insights into the pandemic, current medical diagnostic methods and recommended solutions.

Duplicated articles were eliminated from the study, and the appropriate ones were subjected to thorough reading practice to gather and extract investigation data. Law enforcement agencies in charge of operating with the administration and public health providers implemented plans to reduce the transmission of COVID-19, attend to the community and uphold public order. The current improvements in AI and ML have considerably enriched cure, medicine, detection, estimation, contact tracing, and vaccine discovery for the SARS-CoV-2 pandemic and minimised human mediation in medical practice.

Personnel were reassigned to high-traffic regions, hanging up training and restraining admission to department facilities. Constant efforts have been made to improve novel diagnostic methodologies using ML algorithms. For instance, ML-focused diagnosis of SARS-CoV-2 test designs applying a CRISPR - centred virus discovery framework was validated with great sensitivity and speed. SARS-COV-2 patients can be automatically detected and monitored using a deep learning-focused analysis of thoracic CT images. The rapid advancement of automated diagnostic systems centred on AI and ML contributes to improved screening accuracy and promptness. Also, it protects healthcare personnel by lessening their contact with SARS-CoV-2 patients.

As AI and ML engineers eagerly search for real-time data created by the global pandemic, timely data delivery on physiological features and therapeutic outcomes of SARS-CoV-2 patients and data transformation for easy admission remain incredibly vital yet challenging.

A great exemplification is "https://ourworldindata.org/coronavirus-data"> Our World in Data by University of Oxford, UK. Artificial Neural Network was developed to calculate the impact of the pandemic outbreak in Qatar, Spain, and Italy (Shawaqfah and Almomani, 2021). WorldAI does not replace human interactions but offers support decisions by healthcare experts on what they are demonstrated for clinical characteristics of SARS-CoV-2.

The universal SARS-CoV-2 signs include elevated temperature, cough, and fatigue (Jiang *et al.*, 2020).[2] Additional gastrointestinal indications in the infected person are

[2] *Acute symptoms of patients infected with SARS-COV-2.*

diarrhoea, nausea, and appetite loss. Similarly, asymptomatic individuals are a probable source for transmitting the virus. Thus, strict observance of surroundings, hand sanitation, and contact quarantine are necessary for viral control. SARS-CoV-2 applies cell receptor ACE2 in regulating cardiac physiology as it facilitates the entry of viral RNA in the lungs and intestinal inflammation.

2. Research Findings and Discussion

2.1 Examination

Radiological screening depends on imaging information responsive to deep-learning methods (Kirchberg *et al.,* 2020).[3] SARS-COV-2 features observable on computed tomography images, a fully automatic 3D deep-learning basis to detect the virus and extract essential data from CT scan images to create a chance mark to discriminate SARS-CoV-2 infected patients against those with community-acquired pneumonia (Bokolo, 2021). An alternative AI system identifies infection features in subjects' scans portraying false-negative outcomes (Picard *et al.,* 2020). With essential chest radiography, a deep learning technique could progress the analysis of pneumonia by enhancing images with pigment possibility.

The commonly used technique is the reverse-transcription polymerase chain reaction, a biochemical reaction that applies RNA as the leading template in generating a complementary single-stranded DNA.[4] (Yoon *et al.,* 2017). The DNA strand is then transformed into a DNA double-strand for a PCR reaction. Though numerous attempts have been made to make the most of the cycles of PCR tests per day, the method has some boundaries of false-negative results, a limited supply of PCR reagents and equipment, and an extended period of processing the test samples calling for more accurate techniques for diagnosing SARS-CoV-2. Imaging procedures play a significant part in classifying subjects carefully chosen by the emergency department and categorising pulmonary association.

Chest X-ray: The technique is more readily available for detecting viruses than the CT method. In some nations, like Spain, it is the initial imaging concept utilised in diagnosing patients alleged to have a viral infection. The CXR findings of an infected individual are characterised by radiographic images of ground glass opaqueness, pulmonary swellings, and interstitial alterations due to increased expression of ACE2 (Yoon *et al.,* 2017). The finding highlighted the reduced specificity of CXR compared to CT, supporting the postulate that radiological outcomes of the virus correlate with the extent of the disease. Hence, owing to the augmented level of suspected cases, the application of the diagnostic tool may take a particular part and avert the necessity for CT diagnosis, mainly in nations with

[3] *eHealth Literacy of German Physicians in the Pre–SARS-COV-2.*
[4] *Large-scale machine learning of media outlets.*

inadequate availability of RT-PCR equipment. The procedure is easy to conduct at the patient's bed for follow-up purposes.

Chest computed tomography (CT): Based on the latest medical experience, CT is the most excellent diagnostic tool in terms of accuracy, since its images offer additional confirmation of viral advancement and are highly recommended for infected patients whose nucleic acid analysis gives negative results. The CT diagnosis has better sensitivity than RT-PCR in identifying viral infection (Chen and See, 2020).

According to Chen and See, a CT of an infected patient indicated an initial link in the more significant left part and a reticular configuration overlaid on the glass ground opacity, an indication of a crazy paving pattern, and three days after admittance, a follow-up screening indicated deteriorating condition characterised by widespread interlobular congealing. Despite the critical recognition of the infection and follow-up, the nonspecific scan displays make it difficult to isolate severe pneumonia illnesses like SARS and MERS. As a result, CT imaging outcomes and epidemiological accounts are necessary to advance the diagnosis and to regulate the pandemic.

Thoracic Ultrasound Imaging: Chest X-ray is applicable in identifying the virus and its outcomes resemble CT scans (Peng *et al.*, 2020). The scanning of lung infection is centred on analysing artefacts climbing from their pleural exterior and the rib wall. The artefact is highly used in the discriminative diagnosis of pulmonary infections, as the pleural lines display unevenness, incoherence, and augmented viscosity. The technique is readily available and cost-friendly, hence helpful in detecting the presence of a new viral infection. However, due to its limited in-depth lung examination, the chest ultrasound is set aside to screen for peripheral pulmonary abnormalities.

While most countries adopted isolation to battle the SARS-CoV-2 pandemic, emergency room visits and hospitalisation were only necessary for subjects suffering from lung failure, cardiac damage, and severe pneumonia. As a result, medical imaging methods and artificial intelligence provide a speedy and timely diagnostic instrument for individuals battling severe illnesses. Moreover, AI could recognise the critical risk aspects linked to the rapid progress of severe complications among individuals suffering from SARS-CoV-2 to optimise the cure strategy.

Certain studies have been conducted on intelligent scanning to detect the virus and evaluate the progress through numerous clinical imaging practices. Numerous ML algorithms, particularly those founded on deep learning, have proven effective in classifying, dissection, and quantifying respiratory infections. Deep learning methodologies are used to identify lung anomalies, including the assortment of the lung, mining image characteristics from the intended section, and applying the deep learning ideal to identify lung infection.

To overcome the challenges of detecting SARS-CoV-2 infection over CXR, Generative Adversarial Network (GAN) in association with other deep learning concepts were used. The GAN algorithm is a data amplification methodology that escalates the training images, including situations with inadequate data. After assessing clinical blood samples from Wuhan, the outbreak's epicentre, researchers discovered eleven pertinent indices to function as a discriminatory tool for SARS-CoV-2 for prompt diagnosis (Chen *et al.*, 2020).

The Random Forest algorithm is comprised of high accuracy and specificity. The application of the expert system in designing fast diagnosis enabled augmented accuracy to reduce further infection transmission and the level of medical expenditure. Nevertheless, most countries utilise a single category of the algorithm on separate data instead of a hybrid approach to representing the actual characteristics of the infected individuals and the distribution of the procedure in the current situation.

Contact Tracing: If an individual's diagnosis tests positive for the virus, the next vital phase is contact tracing to prevent the further transmission of the infection as it spreads through saliva or nasal discharges over contact. To break the chain of transmission, different infected countries use a technological contact tracing method with mobile apps, exploiting Bluetooth, GPS, and network-based API, which is timely and faster. The digital apps gather personal information, which is in turn examined by ML and AI tools to locate an individual vulnerable to the virus owing to their latest contact chain.

Table 1. *Countries Utilising Contact Tracing Application To Curb Sars-Cov Pandemic.*

Country	**App**	**Location Tracking**
Australia	COVIDSafe	BlueTrace protocol: Bluetooth
Austria	Stopp Corona	Bluetooth, Google/Apple
Bulgaria	ViruSafe	GSM
China	Alipay	GPS, history of credit card transaction
Poland	ProteGO	Bluetooth
UAE	TraceCovid	Bluetooth
UK	NHS SARS-CoV-2 App	Bluetooth

Source: *Own study.*

The application of ML and AI in contact tracing augmented the breakup of the transmission chain. Conversely, some countries encountered challenges with privacy sustenance, data control, and a security breach of contact tracing apps.

e-Health and Artificial Intelligence in Surgery in Asia, EU, and USA: This prompted a considerable link between eHealth, artificial intelligence, and digital inequalities to reach out to patients following a surgical procedure. After the pandemic outbreak, the need for artificial intelligence tools to predict surgical outcomes from the available data sets (Taha-Mehlitz *et al.*, 2021).[5] The application of eHealth and AI in surgery allows the origin of quality medications that cause excellent results in oncology cases. AI can be utilised to execute tasks like greeting patients during an outbreak, availing disinfectants, and issuing personal protective equipment internationally (Zemmar *et al.*, 2020). For instance, in Canada, the application of AI was apparent when a BlueDot company used AI to foresee the start of SARS-CoV-2 in Wuhan.

Moreover, AI can complement the surgical arena post-pandemic by substituting customary techniques with effective systems like self-reported investigation, the administration of drug infusions, and images (Ahuja and Nair, 2021)[6]. Moreover, AI algorithms possess a 95.2% accuracy rate analogous to humans, except that machines resolve complex affairs through enhanced judgment. For instance, a hospital in Cambridge, England, integrated artificial intelligence to calculate the oxygen requirements of different patients battling SARS-CoV-2 universally.

The pandemic is responsible for the increased adoption of e-health and AI in European surgery. For instance, the Society of European Robotic Gynaecological Surgery offered guiding principles to surgeons that encouraged the incorporation of robot-assisted surgeries to reduce the threats of infection from open surgical procedures (Bhaskar *et al.*, 2020). Similarly, the warning guidelines by the European Association of Urology to physicians in the administration of smoke diffusion in robotic surgery proved that the advancement of e-health and AI in surgery after the virus in Europe was unavoidable (Bhaskar *et al.*, 2020). Also, after the pandemic, the necessity for e-health and artificial intelligence in Italy upsurged.

Numerous regional hospitals recognised the necessity to adopt AI since their failure to assimilate the idea led to more significant viral transmission among workers and inhabitants (Bernardi *et al.*, 2020). Germany used electronic health more during the SARS-CoV-2 pandemic, with physicians integrating medical applications into their phones (Kirchberg *et al.*, 2020).

In addition, the NHS presented video consultations in place of physical consultations with all subjects to minimise the flow of persons visiting the healthcare facility and the likelihood of spreading the infection (Bokolo, 2021). Although the increased use of e-Health and AI in surgery during the viral outburst, the execution rate was negligible in European countries; thus, Europe was likely to improve its implementation after the pandemic.

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[5] *The Electronic Health and Artificial Intelligence in Surgery.*

[6] *Application of telemedicine to the SARS-COV-2 pandemic.*

In Asia, artificial intelligence in surgery in Wuhan, Wuchang Hospital was evident, whereby robots were assigned cleaning, drug delivery, and taking the fever of surgical cases (Zemmar *et al.,* 2020). For patients suffering from glaucoma in China, the health division assimilated computer-generated consultation that condensed ocular injury caused by postponed attention during the pandemic (Husain *et al.*, 2020). In addition, AI and smartphone-cantered apps were highly used to alter the regulation of glaucoma with other health facilities in Wuhan, incorporating innovative health techniques and big data analytics supervised remotely through observation cameras in Beijing[7] (Boko, 2021). Accordingly, China established an emergency e-Health consultation scheme to manage and monitor patients' health with further development of the Kirkpatrick training approach in the emergency surgery unit.

South Korean administration utilises information from social media to gather suitable eHealth measures, from outlining the account of patients to generating programmed data for the inhabitants. South Korea further reduced health facility infections by instituting a triage-based management framework via a data connection that offers an automatic triage, assessing the SARS-CoV-2 risk of visiting patients by checking for any underlying illness and their present immigration records to foreign nations. Additionally, Korea applies artificial intelligence to calculate the survival rate of individuals infected with the virus (Sinha and Rathi, 2021). ML achieves this with hyper-parameter tuning, intense learning approaches, and an auto-encoder-based procedure for appreciating the impact of conflicting aspects on the infection array and estimating the prospects of survival for the quarantined individuals.

The internet made it unnecessary for people to travel in pursuit of medical attention and minimised congestion in hospitals (Sinha and Rathi, 2021)[8]. The negative impact of the pandemic in India (Damodaran *et al.,* 2020). India, a third-world country, is still evolving and encountering numerous healthcare disparities. Universal, the surgery unit in Asia, should invest in post-SARS-CoV-2 pandemic research focused on e-health and AI.

Screening and Scanning: In Brazil, a stacking collaborates with a sustenance vector regression algorithm on the cumulative positive SARS-CoV-2 subjects to enlighten the medical experts and the administration on handling the virus outbreak (Sinha and Rathi, 2021). The forecast model applied the decision rule to promptly detect infected individuals at the most significant risk, approve them for intensive care, and possibly lower the briefness rate. In Canada, a screening model exploiting a deep learning algorithm for the extended and briefly-lived-memory net was established to calculate the current pandemic's course.

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[7] *Application of telemedicine to the SARS-COV-2 pandemic.*
[8] *SARS-COV-2 prediction using AI analytics for South Korea.*

According to the data obtained from Hopkins University, the extrapolation was expected to be precise since recently ill patients had fallen rapidly, proving the system's applicability in detecting and calculating the recent pandemic outbreak via revealing vital aspects (Meier *et al.*, 2013).

The real-time forecasting approach combined the greatness of the wavelet-focused screening model and the autoregressive assimilated poignant average-centred time-series ideal (Hassounah *et al.*, 2020). The model resolves the challenge by creating temporary forecasts of the virus for nations like India, the UK, Canada, Korea, and France to aid clinicians and legislators as a primary alerting unit for every target country.

Local Law Enforcement Responses to COVID-19: Local authorities highlighted different best performances for battling COVID-19 from police sections within. For instance, the Los Angeles Police moved several detectives to daily patrol and specialised units to operate in crowded public regions to the maintenance of public order [9] (Winton and Tcheckmedyian, 2020). To promote minimal interaction with the public, the Police created a program to tackle non-emergency cases over the telephone (NPF, 2020; Osborne, 2020). This ledin a substantial decline in the arrests made by several inmates in correctional facilities in the USA (Poston, 2020).

Additionally, some police departments in California use drones to keep guard and impose social distancing (Kucher, 2020). Dispatchers asked the 911 callers regarding likely COVID-19 signs to minimise initial responder exposure (Whitlow, 2020). For symptomatic callers, the responder officer maintains distance and properly uses their PPE.

3. Impact on Health Law

Communication: Obstacles to communication and collaboration in reactions of law enforcement in the initial phases of the outbreak were experienced. The public health sector was expected to take charge of the actual response to the infection, while the law enforcement agencies were expected to exercise authority to ensure tranquil and guidance. The police in charge of communicating voluntary actions like social distancing, quarantines, mandatory lockdowns, and the consequences for violations were reassigned to tasks of public health officials.

The messaging of the value of obedience of the set guidelines and supporting anxious citizens should be established in partnership with native hospitals and public agencies to safeguard reliability and updated information[10] (Barr, 2020). It was imperative to promote voluntary compliance, optimistic police-community relations, and public faith, which were made impossible by the pandemic.

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[9] *detectives to daily patrol in crowded regions*

[11] *Communication obstacles*

Resource Management: The police agencies encountered obstacles in managing departmental resources like finances, personnel, and equipment owing to the massive impact of the pandemic (Bates, 2020; Schuppe, 2020). Since the infected law enforcers could not report to work, paid sick leave was limited, and a precautionary leave was not feasible.

Public Health Restrictions Enforcement: The police agencies were assigned to enforce public health orders entailing prohibited activities and punishments for citizen destructions. Certain republics sanctioned the constabularies to apprehend and even shoot those violating orders (Cave and Dahir, 2020). Based on the scope and brutality of such orders, the measures required setting up check-points and establishing permissible penalties for violators. For voluntary restrictions like social distancing, the police were limited in the enforcement measures increasing the number of calls received by police divisions about reports of violations and ordinary activities initiated an intervention by the authorities.

Violation of quarantine and travel restrictions were brutal to enforce since the officers were instructed to respond less and ignore arrests for misdemeanours. The officers also felt uncomfortable having close interaction with those violating confinement and social restraints, mainly due to insufficient PPE and preparation for disease control out of concern for their well-being (Rothstein, 2015). Even so, the orders must be effectively conversed by regional and state officials, the police, and health officials for consistent execution and effective voluntary adherence.

Alterations to Law-breaking and Service Patterns: Isolation and quarantine hindered law enforcement due to crime and service design variations. Reassigning the police officers to densely populated parts of the city left rural areas more susceptible to crime. Implementation of stay-indoors orders during the outbreak's peak amplified personal and monetary stress related to the pandemic and the public health guidelines, and news of physical attack and domestic vehemence enlarged significantly.[11] (Poston, 2020). Considering the possibly unstable and precarious nature of domestic aggression, the increase became a severe concern for police departments across the US as the duration of the pandemic's impact on law administration extended.

4. Public Health

AI has helped describe the prototype spread of the infection, including its initial phases. The use of AI in public health is beneficial to policymakers. For instance, BlueDot revealed its efficacy in forecasting and monitoring SARS-CoV-2. Yang et al. established an AI-focused model that utilised a regular neural network for epidemiological moulding (2020). The concept incorporates the epidemiological

[11] *Variations in service and crime patterns.*

factors of SARS-CoV-2 and community health medications, such as the lockdown of Hubei province.

The concept helped predict how the cases in Hubei would escalate within a specified period from various data sources. Classifier calculation models for subject results in Korea were built from an artificial neural (Alimadadi *et al.*, 2020)[12]. The patient features such as age and gender were mined from the independent indicators and categorised SARS-CoV-2 patients into either dead or recuperated groups to assist the policymakers in targeting the most susceptible subjects, channeling focus and resources to their care.

Medical Decision Making: AI can aid in clinical decision-making concerning SARS-CoV-2 patients, counting triage judgments for optimal utilisation of inadequate hospital resources. Patients needing critical care can be identified using an AI-augmented scheme for essential chest radiographs that track and predict the pulmonic progression of SARS-COV-2 among admitted patients. Jiang *et al.* (2020) through multiple medical metrics, created an AI ideal to detect decline, including at the original presentation, with higher accuracy concerning logistic regression. Early recognition of high-risk circumstances can promote direct doctors to early mediation, which may lead to improved results.

Therapeutics: AI in silico scanning can help pinpoint therapeutic means amongst existing drugs, including Chinese herbal preparations. A deep learning technique is used to scan multiple composites from the ZINC15 collection for drug discovery (Peng et al., 2020).[13] Molecule transformer-drug target collaboration tool to detect binding affinity between antiviral medications accessible in the market and target proteins on SARS-CoV-2 led to the discovery of antiretroviral drugs against SARS-CoV-2.

5. Conclusion

Since the outburst of the pandemic, researchers and clinical industries have adopted ML and AI as promising approaches to fighting against the pandemic. The algorithms were helpful in rapid screening, detection, contact tracing, and discovery of a vaccine against the novel virus. The deep learning algorithm was found to have higher potential than the others.

Nevertheless, the present urgency necessitates an enhanced model constituting high-end presentation and specificity in scanning and predicting the virus with a distinct type of related infection by evaluating the medical, mammographic, and demographic data of suspected and infected patients. Identifying the viral indicators on clinical scans is a crucial phase in radiology to diagnose the novel virus.

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[13] *fighting SARS-COV-2 with repurposing drugs.*

The statistical data from the literature enabled the validation and assessment of the prediction model. The model sensitivity was evaluated to yield high accuracy of the projected correlation for the ill and dead cases for the considered dates. The verified and validated COVID-19 growth model for the chosen countries presented the impact of the measures by the government and medical divisions to alleviate the pandemic and ease the death rate. The modest and properly-structured ANN model was helpful for health managers and policymakers battling the pandemic.

The key indicators of the virus are displayed in scan images. Furthermore, the progress of algorithms is founded on the deep learning framework.[14]s has enlightened the detection of the virus through the analysis of clinical images. AI studies, such as robotics, vaccine discovery, prediction of the virus's protein structure, and molecular modelling, may help fight against the infection. Lastly, AI and ML can considerably advance drugs, scanning, detection, contact tracing, and vaccine discovery for the SARS-CoV-2 and minimise human mediation in clinical exercise. Even though most approaches are inadequate for real-world practice, they can still handle the pandemic.

5.1 Recommendations

Additional research is needed to help radiologists discriminate against SARS-CoV-2 and viral infections like SARS and MERS, which share similar signs. Therefore, other future works are recommended to mine the most pertinent aspects and functional signs to distinguish between diverse viruses. As much as vast, manually branded training data is necessary, extra attention should be channeled into predicting patient outcomes and monitoring disease evolution.

5.1.1 Protecting the Officers

Owing to the challenges affiliated with reacting to an outbreak, agencies must have a comprehensive plan for wide range of health emergencies among the public, including all measures to be considered during the initial phases of the pandemic. There should be a contingency plan for the stability of operations in times of a declined workforce due to moving personnel from non-essential roles to more serious duties. The most critical roles and the least number of staff needed should be established and training conducted for all personnel to practically complete the essential tasks. Policies should be formulated regarding remote work, employee sick leave, and danger compensation, among other resources, during an outbreak.

Law enforcement agencies should offer all workforces training on occupational well-being and safety precautions. The agencies should prepare for future pandemics through constant maintenance of inventories of PPE to warrant the items have not expired and are in adequate supply at all times. Alternative algorithms and artificial intelligence should be further adapted to reduce exposure for staff/officers during a pandemic.

5.1.2 Protecting the Community

Law administration agencies should create operational and significant partnerships with local health facilities and public health divisions to gather their knowledge and resources to foster training personnel and advance community education and public messaging. Agencies should precisely outline their code of behaviour and associated penalties in enforcing isolation, quarantine, and any additional health restraints among the public.

Police agencies ought to utilise problem-solving approaches to address the immediate needs of the local community. Responses to future pandemics, like issuing summons for non-violent offences and other plans, should be regularly revised and modernised to integrate novel statistics and lessons from previous experiences.

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