KEY POINTS

- Major noncommunicable diseases, including mental health conditions, contribute to 74% of deaths globally every year, 69% of deaths in Southeast Asia, and 89% of deaths in the Western Pacific, thereby causing a high burden to the health systems and societal welfare.

- Strengthening primary health care with quality and affordable medicines and health technologies is crucial for achieving universal health coverage and Sustainable Development Goals. Integration of digital technology can also promote networks between primary care and specialist healthcare providers.

- Technology-driven initiatives at primary care broadly include screening and early detection, telemedicine, wearable devices for remote monitoring, electronic health records and health information exchange platforms, and technologies for health workforce training.

- This repository of health technologies is intended as a guide for developing member countries in Asia and the Pacific to identify potential solutions that can bridge gaps in the continuum of care in noncommunicable diseases and mental health management at the primary care level.

INTRODUCTION

The Global Health Estimates 2019 of the World Health Organization (WHO) indicates that noncommunicable diseases (NCDs), including mental health conditions, contribute about 63% to the overall disease burden, measured using the disability-adjusted life year. The global cost of lost productivity from the four major NCDs—cardiovascular diseases, cancer, diabetes, and chronic respiratory diseases—is estimated to be $30 trillion between 2011 and 2030, and increases to $47 trillion with the addition of mental health conditions.1 NCDs, including mental health conditions, account for 74% of the world’s deaths;2 69% of deaths in Southeast Asia, and 89% in the Western Pacific.

The burden from NCDs and mental health is rising rapidly in the Asia and Pacific region. A strengthened, technology-enabled, and comprehensive primary health care (PHC) system is a cornerstone in providing cost-effective quality of care in resource-limited settings and in achieving universal health coverage (UHC) and Sustainable Development Goals.

This brief provides insight into the technological solutions available in the region in the delivery of PHC services for NCDs and mental health conditions. It highlights the key challenges in the provision of these services for NCDs and mental health conditions, and outlines the range of technology-driven solutions deployed to address them.

### NONCOMMUNICABLE DISEASES IN ASIA AND THE PACIFIC

In Asia and the Pacific, NCDs cause more than half of all deaths in each of the region’s countries and represent a key public health challenge (Figure).³

#### MENTAL HEALTH IN ASIA AND THE PACIFIC

The prevalence of mental health disorders has witnessed an exponential surge from 1990 to 2019, now representing approximately 5% of the entire disease burden globally. WHO identifies depression as one of the leading causes of disability, with suicide ranking as the fourth principal cause of death among individuals aged 15 to 29. In Asia and the Pacific, the age-standardized prevalence of mental disorders is high: 13,106 per 100,000 population in South Asia; and 10,520 per 100,000 population in East Asia, Southeast Asia, and Oceania.⁵

A key factor contributing to the high treatment gaps for mental disorders is the lack of availability of trained human resources for mental health. However, this varies considerably across the countries in the Asia and Pacific region—for instance, New Zealand has 20.0 psychiatrists per 100,000 population and Australia has 18.0; while, Pakistan (0.1), Papua New Guinea (0.1), Bangladesh (0.2), Myanmar (0.2), the Philippines (0.2), Cambodia (0.3), Solomon Islands (0.3), Indonesia (0.4), Fiji (0.6), and Sri Lanka (0.6) have among the lowest numbers of psychiatrists per 100,000 population.⁶

Integration of mental health within the PHC system is one of the strategies to improve access and availability of mental health services closer to the communities. This encompasses identification and management of mental disorders most common in the communities through health personnel and teams involved in providing general health services using simplified and concise evidence-based modules.⁷ However, across Asia and the Pacific, there are considerable variations in the development and provision of mental health care at the PHC and community levels. For example, only one country (13%) in Southeast Asia had pharmacological treatment available in more than 75% of its primary health centers, as compared with nine countries (41%) in the Western Pacific.⁸

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#### Figure: Percentage of Noncommunicable Disease Deaths as a Proportion of All Deaths in Asia and the Pacific, 2000 and 2019

<table>
<thead>
<tr>
<th>Region</th>
<th>2000</th>
<th>2019</th>
</tr>
</thead>
<tbody>
<tr>
<td>Global</td>
<td>59.8</td>
<td>72.3</td>
</tr>
<tr>
<td>Southeast Asia</td>
<td>61.9</td>
<td>75.3</td>
</tr>
<tr>
<td>Western Pacific</td>
<td>60.8</td>
<td>73.6</td>
</tr>
<tr>
<td>Key: Male</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
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<tr>
<td>All</td>
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The probability of premature mortality (i.e., deaths under the age of 70 years) from NCDs (2019) is 22% for Southeast Asia (25% in males and 19% in females), with a variation across the countries ranging from 13% in Sri Lanka and 14% in Thailand to 27% in the Lao People’s Democratic Republic.⁴ In the Western Pacific region, the probability of premature deaths from NCDs is 16% (lower than the global probability of 18%) (footnote 4)—this is mainly driven by the lower rates of premature mortality among developed economies like Australia, Japan, and the Republic of Korea. However, the rates of premature mortality are reported to be high in Mongolia (35%), Papua New Guinea (36%), and even higher in the Pacific island countries (the highest is 51% in Kiribati). In the Central Asian region, the probability of premature deaths from NCDs is likewise high and varies considerably, from 15% in Iran to 35% in Afghanistan (footnote 4).
Mental health conditions, especially depression, are very common among individuals with chronic illnesses and disability. There is a bidirectional relationship between mental health conditions and NCDs, which brings the focus on person-centric services to identify and address the comorbidities at all levels of health care, including in nonhospital settings. Systematic reviews have shown this to be true for the Asia and Pacific region, with as many as 29% of patients with diabetes and 27% of patients with cancer having anxiety; and 40% of patients with diabetes, 38% of patients with hypertension, 39% of patients with stroke, 44% of patients with chronic obstructive pulmonary disease (COPD), and 37% of patients with cancer experiencing depression. Similar results have been reported across other countries, including the Pacific island countries. Person-centric services are therefore required to ensure that such comorbidities are identified early and addressed during routine health care services at PHC settings and in communities.

**CHALLENGES IN NONCOMMUNICABLE DISEASES AND MENTAL HEALTH MANAGEMENT AT PRIMARY CARE**

Understanding the challenges and barriers in the continuum of care of PHC management of NCDs can facilitate assessment of the suitability of existing interventions for a particular target setting and help identify the prerequisites or enablers for the development and introduction of new solutions.

**Inadequacy of infrastructure.** Infrastructure constraints at the PHC level include limited and disparate distribution of health facilities; unreliable energy and clean water supply; scarce human resources for health (particularly in isolated communities or rural areas); high cost of procurement, distribution, storage, and maintenance of the required health technologies, vaccines, and medicines; and disruptions in the supply chain and storage of consumables and other spares. These constraints limit the capacity of the health systems to prevent, diagnose, treat, and manage NCDs and mental health issues effectively at below hospital level. Addressing them requires appropriate and locally adaptable technologies that can function in low-resource field conditions, allow affordable mass screening, support efficient sample transport to a hub laboratory for diagnostic purposes, and enable energy-efficient storage and transportation of vaccines, drugs, and other cold chain-sensitive medical products. Digital technologies can significantly streamline the procurement of commodities, their supply chain, and laboratory information management.

**High cost.** NCDs and mental health conditions can cause substantial out-of-pocket expenditures, which can disproportionately influence health-seeking behavior and adversely impact health outcomes of the affected population. While there is a direct associated cost of diagnosing and managing the disease, additional indirect expenses are also incurred because of multiple visits, costs from the steady and cumulative nature of NCDs, and welfare loss to the households. Innovative technologies that enable affordable and rapid point-of-care testing in a single visit (i) allow for prompt referral, for cases requiring higher levels of care; and (ii) support monitoring and management at home, for cases needing long-term treatment and care. These technologies can bring down costs to the individual and the health systems.

**Scarcity of trained human resources.** Health-care workers in the low- and middle-income countries (LMICs) have historically been trained better in maternal, newborn, and child health services, but are limited in their expertise to diagnose and manage NCDs, in particular, mental health conditions. The LMICs of Asia and the Pacific have 1.1 doctors per 1,000 population; the upper-middle-income countries have slightly higher availability at 1.6 doctors per 1,000 population. This skewness is also observed in the current distribution of psychiatrists (fewer than 1.0 per 100,000 population) and mental health nurses (less than 5.0 per 100,000 population) in the LMICs of Asia and the Pacific.

According to WHO’s Global Strategy on Human Resources for Health: Workforce 2030, shortage of trained health-care workers in Southeast Asia is estimated to reach nearly 40% in 2030. Addressing this gap will require transformation at both institutional and instructional design levels. Along with system-level interventions, innovative technologies are one of the promising means to bridge the availability and skill gaps, minimize the training requirements, enable task-shifting to less skilled workers, and/or automate the workflows, especially at the primary care facilities. Digital solutions (e.g., e-training and telehealth provisions) are among the well-positioned tools to enhance health-care workforce and, at the same time, provide remote health services to the patients.

**Limited access to specialist care.** In most LMICs, including those in Asia and the Pacific, the PHC systems are characterized more by the presence of nonphysician health workers (e.g., nurses, midwives, community health workers) for the delivery of essential services than by the availability of specialist care. Even in countries with gatekeeping policies, which require the provisions of access to non-emergency hospital or specialist care via the PHC system,

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9 WHO. WHO Independent High-level Commission on NCDs.
15 Footnote 6, *Doctors and Nurses*, pp. 103–105.
enforcement is usually inefficient and such services remain underutilized. Health-care technologies can bridge this gap by (i) enabling community health workers to perform simple screening tests and sample collection through rapid point-of-care tests and innovative supply chain solutions that take health-care delivery to rural or hard-to-access settings, and (ii) connecting patients with the specialists through efficient mechanisms of consultation and referrals.

**Poor adherence to medication.** Globally, approximately 50% of patients do not adhere to their prescribed medications, thereby resulting in disease relapse; higher incidences of case complications; transfers from primary to a higher level of care facility, including rehospitalization; excessive drug wastage; and drug resistance. This is especially true for chronic diseases and mental health disorders, which require long-term course of medication. While there are multidimensional factors affecting medication adherence, the degree of their influence varies based on the regional and cultural context. Nonetheless, many health systems and pharmacists are accepting the role of innovative technologies in enhancing adherence to medication. With the ubiquity of smartphones and evolving digital ecosystem, there is a significant inclination for the use of digital technologies—including mobile medical apps, automated alerts, smart packaging, smart pill bottles, and the more recent bio-ingestible sensors—for enhanced adherence to the prescribed medications.

**Lack of integration of health services.** To strengthen the health systems in addressing NCDs, a patient-centric and UHC approach is required, which includes integrated delivery of health service at the primary care level. The implementation and impact of PHC integration, however, have been variable across the globe and challenged by several factors.

Technology-enabled integration of health services at the primary care level is acknowledged as a much-needed reform that can greatly contribute toward reducing the burden of NCDs (including mental health disorders) and tackle other long-term, often interconnected, communicable diseases (such as tuberculosis, HIV, or human papillomavirus [HPV] infection) in resource-constrained LMICs. Digital integration is further seen to promote better networks between primary care and specialist health-care providers. In several instances, and especially with NCDs, instant teleconsultations, and e-prescriptions. For patients seeking mental health care, online therapy, mental health assessment tools, and AI-powered chatbots are providing access to care, especially in regions with a stigma toward such conditions and/or those having a shortage of trained professionals.

**Technology-based interventions have proven or shown promise in the fight against NCDs and mental health disorders, especially in the context of primary care settings, can be broadly classified as follows:**

**Screening and early detection.** The inclusion of innovative health technologies, such as rapid point-of-care tests and digital health tools often enabled by artificial intelligence (AI), improves access to early detection and, therefore, allows timely interventions for better health management. In India, for example, the Digital LifeCare platform developed by Dell Technologies and the Government of India is employing a cloud-based mobile, web, and analytics solution in a public–private model for NCD management at scale. The platform digitizes health records and empowers health-care workers in population-based screening. AI-enabled NCD and mental health screening tools help identify hidden patterns in image, sound, or even transmitted electrocardiogram (ECG)-like data to support automation and improve speed and accuracy of diagnosis, particularly in settings lacking human resources who are skilled in interpreting device output.

**Telemadicine.** Telemedicine policies are evolving worldwide to facilitate remote consultations and specialist access to overcome geographical barriers and ensure timely access to care. During the coronavirus disease (COVID-19) pandemic, Malaysia integrated teleconsultation services into the government’s COVID-19 contact tracing app, MYSejahtera, which facilitated the uptake of teleconsultation services in the country. The National Telemedicine Service of India, eSanjeevani, is poised as a step toward digital health equity and achieving UHC. In several countries, social media platforms (e.g., Facebook Messenger, LINE, or WhatsApp) are also being used for appointment scheduling, teleconsultations, and e-prescriptions. For patients seeking mental health care, online therapy, mental health assessment tools, and AI-powered chatbots are providing access to care, especially in regions with a stigma toward such conditions and/or those having a shortage of trained professionals.

**Wearable devices and remote monitoring.** Wearable devices and smartphone applications are enabling patients to track health indicators and share real-time data with their health-care providers. In several instances, and especially with NCDs, instant biofeedback through continuous monitoring has been shown to promote healthy behavior. Integrating data from wearable devices with the physician’s electronic health records (EHRs) and combining this with teleconsultation have improved patient outcomes by enabling continuity of care despite distance and transportation challenges. From Asia and the Pacific, Japan is one of the leading examples in the use of health apps that track physical activity and provide insights into lifestyle choices affecting NCDs. India, the Republic of Korea, and Singapore have also adopted technologies, ranging from consumer wearables for wellness management to those with vital sign–specific sensors.

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Electronic health records and health information exchange platforms. Implementing EHR and health information exchange systems streamlines patient data storage, improves data management, and ensures patient records are accessible and easily transferable across health-care providers. The insights derived from big data analytics help map out disease trends, prevalence, high-risk groups, and patient outcomes, thus facilitating better planning of targeted interventions. Health information tools, like clinical decision support systems, further assist health-care providers in making accurate diagnoses, proposing treatment plans, indicating drug interactions, reducing medical errors, and enhancing the overall quality of care.

However, the adoption of such systems by health-care providers, particularly at the PHC level of low-resource settings, is challenged by the quality of the system used, accuracy of data, internet bandwidth, lack of skill to efficiently use the tool, and high costs of operating and maintaining these systems. Implementation of digital systems at scale also necessitates the development and adoption of regulatory frameworks and standards to ensure patient data privacy and security. Several countries, including those in Asia and the Pacific, are making progress in this direction, such as the use of the national health information platform to enhance health data sharing and interoperability. India is also actively working on establishing a regulatory framework for digital health.

Innovative technologies for health workforce training. Underinvestment in education and training leads to scarcity of well-trained health workers who are fit-for-purpose and can serve as a cornerstone for comprehensive PHC access. The lack of skilled health workforce further impinges upon the adoption of state-of-the-art technologies, such as telemedicine, EHRs, mobile health (mHealth), AI, and information systems. Technology and science innovations are among the driving forces of change for the PHC system’s workforce. Digital tools are poised to reengineer the health systems for the next era of equitable and patient-centric care. They also present huge potential for enhancing the capacity of the health workforce by facilitating training, supervision, communication, and professional networking. Australia has incorporated clearly defined health workforce training into its national digital health strategies, while Viet Nam has seen success in the IBSA Fund-supported key eLearning platform during COVID-19 and beyond.

Cardiovascular Diseases
Cardiovascular diseases (CVDs) caused 9.85 million deaths in the Southeast Asian and Western Pacific regions in 2019, accounting for 45% of all NCD deaths in these regions. The economic impact of CVDs on developing economies is significant, primarily because of the prevalence of CVD cases among working-age adults. Studies indicate that almost all CVD events, such as stroke and heart attack, occur in individuals with one or more of the following modifiable risk factors: high blood pressure, high blood cholesterol, elevated blood glucose level, tobacco use, and obesity. Quality, effective, and affordable PHC is essential for the prevention, early detection, and control of CVDs, particularly in the LMICs. This enables targeted screening for the identification of high-risk individuals, delivers cost-effective and evidence-based treatment and care, and provides referral for specialist care, when needed.

Screening and Diagnosis
• Routine check-ups include assessing heart sounds, palpitations, etc. Examples of AI-enabled technologies are smart stethoscope and multimodal pulse oximeters with heart rate and pulse rate functionalities to detect symptoms of CVDs.
• Automated digital blood pressure monitoring is part of routine health screening at the PHC level.
• CVD risk factor identification uses laboratory tests, such as blood tests, to check for cholesterol levels, lipid profile, and type 2 diabetes.
• ECG tests for heart rhythm assessment are provided by several PHC systems in Australia, India, Japan, and Singapore, which are equipped with portable point-of-care ECG devices as part of government programs.

Monitoring and Management
• Integrated health information systems and EHRs for patient data access and referrals take into account the regulatory frameworks and standards of countries to ensure patient data privacy and security. Examples of health services digitalization are Indonesia’s SATUSEHAT, a platform of data connectivity, analysis, and services for integrating inter-applications and health facilities, and Tamanu, the electronic patient records systems adopted by the Pacific island countries.

EXAMPLES OF HEALTH-CARE TECHNOLOGY LANDSCAPE

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• **Teledmedicine and mHealth** are adopted for remote monitoring and teleconsultation. For example, India is implementing eSanjeevani, an initiative that enables teleconsultations for specialist services via video conferencing at the PHC systems (including health and wellness centers) and, in certain instances, allows patient details to be sent electronically to hospitals prior to appointment.

• **Use of wearable devices** is often integrated with smartphone apps for monitoring health parameters, with option of data sharing with health-care providers.

### Diabetes Mellitus

In Asia and the Pacific, the prevalence of diabetes varies considerably across the region. Among the population ages 20–79 years, the prevalence in 2021 ranged from 9.9% in East Asia and the Pacific region to 12.3% in South Asia and 17.4% in the Pacific island countries. In terms of numbers, 90 million people in Southeast Asia and 206 million people in the Western Pacific have diabetes in 2021. More than half of all the people living with diabetes are undiagnosed.

The economic burden of diabetes is pronounced, given the requisite daily medications and frequent glucose-level monitoring for effective management.

### Screening and Diagnosis

- **Population-level initiatives**, such as organizing screening campaigns for early detection, are promoted.

- **Routine or opportunistic blood tests** are performed on individuals visiting PHC to identify abnormal glucose levels.

- **Urine glucose** is tested to screen for glycosuria or to monitor the success of lifestyle modification and treatment in sugar control.

- **Oral glucose tolerance test** is sometimes recommended to screen for pre-diabetes, high-risk individuals (e.g., gestational diabetes), or individuals having inconclusive fasting glucose results.

- **Laboratory tests**, such as the Hemoglobin A1c testing, are integrated into the PHC systems for a comprehensive assessment of long-term glucose control. Hemoglobin A1c test provides thorough evaluation of average blood glucose levels over the past 3 months.

### Monitoring and Management

- **Medication adherence** refers to patient’s compliance with prescribed medications. To enhance adherence, medication management apps and web-based platforms are used, often in conjunction with smart pill boxes. In India, mobile applications, such as Netmeds and 1mg, provide medication reminders, dosage schedules, and information about prescribed drugs.

- **Continuous glucose monitoring** helps manage diabetes by recording real-time values of blood glucose levels. In Japan, the Guardian Connect system from Medtronic is popularly used for continuous glucose monitoring, coupled with a smartphone app to help users manage their diabetes more effectively.

- **Insulin therapy** is the administration of insulin for individuals with diabetes. The Government of India has made the provision of insulin as a free essential medicine through the Pradhan Mantri Bhartiya Janaushadhi Pariyojana initiative and the Free Drugs Service Initiative of National Health Mission.

### Management of Complications of Diabetes

- **Diabetic retinopathy** can be detected early using the fundus photography for retinal imaging. The images taken at the PHC are usually analyzed remotely by specialists through telemedicine. In some cases, AI-enabled imaging devices are used for automated diagnosis of retinal conditions.

- **Diabetic nephropathy** can be detected by evaluating touch sensitivity through screening tests, such as the superficial pain sensation test, Semmes-Weinstein monofilament examination, and thermal and vibratory perception tests.

- **Diabetic kidney disease** can be detected using the spot microalbuminuria test, which is recommended for PHC testing.

### Chronic Respiratory Diseases

The major forms of chronic respiratory diseases (CRDs) are asthma, affecting 262 million individuals globally in 2019; and COPD, with 212.3 million people affected. COPD primarily affects older adults, typically diagnosed after 40 years of age, but often stemming from exposures beginning in childhood. Among the predominant risk factors are tobacco smoke (responsible for 90% of COPD-related deaths) and indoor and outdoor air pollution (with a projected increase in deaths of over 30% in the next decade). This burden is expected to rise significantly because of escalating tobacco usage, urbanization, increase in air pollution, and extreme temperatures from climate change.

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While prevention of CRDs is challenging, proper management can effectively control their impacts. In Asia and the Pacific, people with CRDs tend to visit more general practitioners as compared to specialists, indicating a potential for advancing primary care interventions for the diagnosis and management of CRDs.30

Screening and Diagnosis

- **Clinical assessment** includes physical examination; auscultation; and clinical respiratory assessment for oxygen saturation, respiratory rate, abnormal cough, or lung sound. Pulse oximeter is listed as a priority medical device by WHO31 and comes as a standalone or multimodal device for early detection and intervention of hypoxemia. Despite this, health facilities in LMICs report shortages of pulse oximeters. There are challenges in scaling up the adoption of pulse oximeters because of the investment needed in upskilling the health workforce, especially at the PHC level.
- **Diagnostics** use spirometry for an objective assessment of lung function to detect asthma and COPD. For imaging, digital portable chest X-rays, often coupled with AI-enabled analysis tools, help in identifying structural abnormalities or reduced lung capacity in patients with suspected CRDs.
- **Blood tests** are conducted to identify biomarkers related to respiratory health, inflammation, and immune response.

Monitoring and Management

- **Medication adherence** can be improved using medication management apps and web-based platforms.
- **Smart inhalers and remote patient monitoring** use built-in sensors and mobile connectivity to enable the administration of correct metered dose, enhance medication adherence and, in many instances, monitor the lung function remotely in real time. Innovative AI-enabled smartphone technologies are being piloted for cough sound-based analysis of CRDs to differentiate them from infectious cough due to tuberculosis or COVID-19 (e.g., India’s Swaasa, Salcit Technologies, and eHealth of Wadhwani AI).

Cancers

Cancer is the second leading cause of mortality worldwide, accounting for an estimated 9.6 million deaths.32 Survival rates of many types of cancers prevalent in Asia and the Pacific—oral, breast, and cervical cancers—can be high with early detection and strong health systems that are capable of providing services for diagnosis and treatment on time.

In Asia, the rate of oral cancer ranges from 0.9 to 9.8 per 100,000 population, the highest prevalence being in India (9.8), Sri Lanka (9.7), and Bangladesh (9.5).33 This is related to the high use of tobacco, including smokeless tobacco. Early detection of oral cancer is associated with a high survival rate of 80%. However, as there are fewer symptoms in the early stages, there are significant delays in the diagnosis of oral cancer. In Sri Lanka, oral visual inspection is commonly performed at the primary care level for the early detection of oral cancer. In Bangladesh, visual-based oral cancer screening camps are organized by the PHC to reach a broader population.

Cervical and breast cancers are common cancers among women in Asia and the Pacific. The COVID-19 pandemic caused a disruption in the availability of breast cancer screening in many countries. Poorer prognosis leads to higher mortality rates. Cervical cancer is preventable with screening test and vaccination. This highlights the need to develop and sustain programs for the screening of breast and cervical cancers close to communities at scale.

Screening and Diagnosis

- **Clinical screening** can be promoted through population-level initiatives, such as organizing screening campaigns. Routine physical examination for clinical evaluations include visual inspection and palpation of specific areas for signs of cancer.
- **Cancer screening programs** of governments have deployed mobile units equipped with screening facilities to reach remote areas. In Thailand, mobile screening units are used to provide cancer screenings in rural areas.

Monitoring and Management

- **Risk category identification** involves clinical screening, such as HPV testing to identify individuals infected with high-risk strains associated with cervical cancer. In India, Malaysia, and the Philippines, HPV testing is integrated into the PHC’s cervical cancer screening programs.
- **Confirmatory diagnosis** uses imaging technologies, such as X-rays and ultrasonography, for detecting various cancer types.
- **Patient education and support programs** focus on cancer awareness, early detection, treatment options, and support services.

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30 D. Y. Wang et al. 2018. Practice Patterns for Chronic Respiratory Diseases in the Asia-Pacific Region: A Cross-Sectional Observational Study. *International Archives of Allergy and Immunology*. 177 (1). pp. 69–79.
32 WHO. Health Topics: Cancer.
Mental Health
WHO indicates that mental health disorders are slightly more common in high-income countries (15.6%) than in LMICs (12.9%). As per the Global Burden of Disease Study 2019, the prevalence of anxiety is 3.2% in Southeast Asia and 3.4% in Western Pacific; whereas, the prevalence of depression is 3.5% in Southeast Asia and 3.3% in Western Pacific, with some variations across the countries.

Screening and Diagnosis

- **Population-level initiatives** are used to assess mental health conditions. These initiatives include organizing screening campaigns and various routine and standardized patient questionnaires (e.g., Patient Health Questionnaire–9 in India, Nepal, Sri Lanka, Thailand, and Viet Nam; and Generalized Anxiety Disorder 7 surveys in Bangladesh and India).
- **Mental health support apps** are online platforms or mobile applications that offer self-assessment tools, mood tracking, and mental health-care services. Mental health platforms, telehealth, and telepsychiatry enable individuals to consult with mental health professionals remotely and overcome the barrier of stigma in care-seeking behavior. For example, Myanmar’s online TherapyMantra provides a platform for virtual sessions with qualified therapists for patients dealing with stress, depression, anxiety, and other mental health issues; Bangladesh’s Moner Bondhu and Relaxy provide psychosocial awareness as well as affordable and personalized mental health-care and well-being support; and the Government of India hosts Tele MANAS, a toll-free phone-based comprehensive mental health-care service.

Monitoring and Management

- **Wearable devices and apps** can be used for monitoring of mental health conditions and well-being.
  - **Wearable devices.** Smartwatches and fitness trackers equipped with sensors can monitor physical and behavioral indicators, potentially offering insights into mental health conditions. In India, Neuophony uses wearable headsets to capture electroencephalography and brain waves neurofeedback data for noninvasive and drug-free treatment of common mental health disorders.
  - **Voice analysis.** Some technologies analyze speech patterns and voice characteristics to detect signs of mental health disorders. Affective computing tools are being explored for emotional analysis.
  - **Other digital technology and artificial intelligence solutions.** Natural language processing and machine learning algorithms analyze various data sources to identify patterns associated with mental health disorders and often help with treatment and care.

WAYS FORWARD

The top lessons and recommendations from the technology landscape analysis are summarized below:

Lessons Learned

- **Diverse health-care landscapes.** The health-care landscape differs across Asia and the Pacific, considering the varying levels of infrastructure and other health systems resources, manufacturing capacity, and adoption of innovative medical and digital health technologies. There are also influencing factors to consider, such as socioeconomic structure, demographics, cultural sensibilities, and budget allocation for health.

- **Interconnectedness of noncommunicable diseases and mental health.** This interconnection needs to be identified and addressed for attaining better health outcomes, preventing additional indirect expenses due to multiple visits to the health-care facilities, avoiding welfare loss to the households, and saving overall cost to the health systems.

- **Barriers to technology adoption.** Understanding and documenting the barriers to technology adoption are important for the successful integration of PHC technologies.

- **Regulatory hurdles.** Early recognition of regulatory challenges and complexities that may impede the swift adoption of new technologies in health-care settings and the design of a clear road map for navigating the necessary compliance can accelerate the timeline of product introduction to the market, thereby facilitating its adoption by the health systems.

- **Challenges of digital technologies.** Lack of a streamlined system of patient data storage, interoperability, and standards for data privacy and security can severely impede the adoption of digital health technologies. Such adoption by health-care providers at the PHC level is also challenged by the quality and associated cost of the system used, data accuracy, internet bandwidth, and lack of skill to efficiently use the tool.

- **Inequalities in access.** There are also disparities in the access to technology, particularly in rural and economically disadvantaged areas, emphasizing the need for inclusive solutions that are locally appropriate and adaptable. These solutions should allow for affordable mass screening, support efficient sample transport to a hub laboratory, enable energy-efficient storage and transportation of cold-chain-sensitive medical products, and connect patients with specialists through digital or online platforms for consultations and referrals.

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Other barriers. These include insufficient funding; limited domestic manufacturing capacity that meets the quality standards and procurement lead times; lack of appropriate distribution network; inadequately managed supply chain; weak post-market surveillance; maintenance and software updates, when needed; and other factors such as cultural resistance, lack of awareness, challenges in integrating new tools into existing health-care systems, and digital divide.

Enablers of technology adoption. The key enablers for the successful adoption and implementation of PHC technologies are the enhanced capacity of health workers and the strengthened engagement of patients.

Enhanced capacity of the health workforce. Training the health workforce to effectively use and integrate new technologies into their PHC practice for NCDs and mental health will help them see technologies as enablers rather than as extra workload. Changes in the training course curriculum are needed for the next generation of health workers and allied professionals to embrace digital health technologies, such as telemedicine, EHRs, mHealth, AI, and information systems.

Strengthened engagement and empowerment of patients. Acknowledging the importance of patient engagement and empowerment emphasizes the need for user-friendly interfaces and educational resources. This includes enabling patients to take ownership of their health management through self-testing technologies, including the use of portable devices and applications for tracking and sharing health indicators with their health-care providers.

Other enablers. These include (i) understanding unmet needs and designing solutions for a good market fit, (ii) robust clinical testing and performance evaluation, (iii) adherence to regulatory and standards requirements, (iv) strong data privacy and security measures to build trust among patients and health-care providers, (v) operational feasibility, (vi) human-centered and culturally sensitive design approach, and (vii) affordability.

Successful pilot interventions. Some examples of successful implementation of technologies for managing NCDs and mental health in PHC settings are national-level initiatives—e.g., eSanjeevani (India) and SATUSEHAT (Indonesia).

Recommendations

Promoting human-centered design approach for technology adoption and implementation. Involving local communities in co-designing and rolling out technologies through a human-centered design approach results in innovations that not only address the health-care needs of communities but are also culturally appropriate for the local context, therefore ensuring sustainable user acceptability.

Building a sustainable and fit-for-purpose health workforce. Capacity-building is needed to ensure that the health workforce is well-equipped in utilizing health technologies effectively. Together with conventional methods, digital tools present huge potential to improve the health workforce by facilitating training, supervision, communication, and professional networking.

Providing incentives for adoption. Incentivizing health-care providers (e.g., through financial rewards or recognition programs) can facilitate the effective adoption and integration of technologies. It is highly recommended to undertake evidence-based operational feasibility and usability assessment of technology innovations prior to their introduction in the systems.

Integrating the health information systems. The implementation of digital systems that can seamlessly manage and exchange both NCDs and mental health data at scale necessitates the development and adoption of regulatory frameworks and standards to ensure patient data privacy and security.

Strengthening the care continuum through telehealth and telemedicine. Telehealth and telemedicine enhance access and the continuum of care for NCDs and mental health by overcoming geographical barriers and enabling timely access to specialists. Online therapy, mental health assessment tools, and AI-powered chatbots have shown promise for patients seeking mental health care by providing access in regions with a stigma toward such conditions.

Supporting public–private partnerships. Advocacy for increased public–private partnerships is needed, with the decision-makers leveraging the expertise of both sectors in developing, implementing, and scaling up technology-driven health-care solutions.

Developing policy frameworks for mental health integration. There is a need for the development and strengthening of policy frameworks that specifically address the integration of mental health technologies into PHC settings.

Understanding the prerequisites for introducing innovative technologies. These prerequisites include harmonizing regulatory and safety standards, incentivizing local manufacturing, and defining a clear pathway for in-country and cross-country marketing approvals. At the manufacturer’s end, the design framework and development of new technologies should factor in the road map for market entry.

Investing in research and development. Increasing funding (including novel financing mechanisms) for research and development in health-care technologies will help foster innovation and create effective solutions for NCDs and mental health. It is also important to establish effective mechanisms for information, biorepository, and biological data sharing.