1 Substance Misuse and Toxicity

1.1 Definition

SUDs are treatable, chronic diseases characterized by a problematic pattern of substance use. Leads to impairments in health, social function, and self-control. A cluster of cognitive, behavioural, and physiological symptoms indicates that the individual continues using the substance despite harmful consequences (Think of an example).

A substance use disorder (SUD) is a mental disorder that affects a person's brain and behaviour, leading to a person's inability to control their use of substances such as legal or illegal drugs, alcohol, or medications. - NIH

inability to control use, strong cravings, neglecting responsibilities, loss of interest in activities, continued use despite problems, tolerance; withdrawal symptoms; and excessive time spent on obtaining or recovering from substance use === SUD

1.1.1 Different terminologies

Substance Misuse: Using any substance at high doses or in inappropriate situations resulting in a health or social problem, immediately (drinking a large amount of alcohol in a short period can lead to alcohol poisoning) or overtime (repeatedly using drugs or alcohol over months or years can lead to chronic health issues like liver disease, addiction, or mental health problems) is known as substance misuse.

Substance dependence vs addiction: Dependence means the body has adapted to the substance. This adaptation is the result of using a substance for a long time (weeks, months, or even years). When the substance is stopped, the body reacts negatively, causing withdrawal symptoms (Coffee). Addiction is when someone loses control over their desire to use a substance. Even if they know that using it will lead to negative consequences (like health issues or problems at work), they still feel a powerful urge to continue (Cigarettes).

Substance Tolerance: The body gets used to the medicine hence they need more or different kind to feel the same effect

1.2 Why is SUD a public health issue

Health Impact: SUD leads to various physical and mental health issues, contributing to preventable deaths and spreading infectious diseases. Economic Costs: It burdens healthcare systems, reduces workplace productivity, and increases costs related to treatment, law enforcement, and social services. Social Disruption: SUD affects families, leading to issues like domestic violence, neglect, and increased crime rates, which destabilize communities. Quality of Life: People with SUD often face stigma and isolation, impacting their well-being and ability to reintegrate into society.

1.3 Methamphetamine (ICE or Meth)

Meth → Heroin → Fentanyl (Increasing potency and danger)

Meth can be adulterated with fentanyl, a potent opioid. Mixing these substances can make meth cheaper to produce and potentially more addictive or lethal. Highest abused drug

Effects: 1. Euphoria, Increase energy and alertness 2. Chronic mood and cognitive changes: Irritability, aggression, panic, hallucination, memory impairment 3. Increased risk of early mortality and suicide attempts 4. Cardiovascular complications: Arrhythmia, myocardial infarction, heart failure 5. Stroke

Enforcement and treatment: Legal Enforcement: Illegal to possess or consume within or outside of Singapore (Misuse of Drugs Act, listed as Class A controlled drug). Screening and assessment: prompted by signs and symptoms from patient's presentation, history and/or physical examination. Drug testing: urine (7 days), saliva, blood, and hair (90 Days). Diagnosis: DSM-5 diagnostic criteria (Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition). Management: psychosocial interventions largely.

Challenges: 1. Surge in young people 2. New Psychoactive Substances

1.4 Alcohol

Effects: 100% of alcohol use disorders, 18% of suicides, 18% of interpersonal violence cases, 27% of traffic injuries, 13% of epilepsy cases, 48% of liver cirrhosis cases, 26% of mouth cancers, 26% of pancreatitis cases, 20% of tuberculosis cases, 11% of colorectal cancer cases, 5% of breast cancer cases, 7% of hypertensive heart disease cases

Reduce the overall level of alcohol consumption in the population by implementing policies

Reduce population-level consumption: Raise alcohol taxes, Raise the minimum prices of alcohol sold at retail, Raising legal minimum drinking age, Reduce permitted hours for sale of alcohol late at night, Advertising restrictions

Reduce alcohol-related road injuries: Publicity campaigns, Police enforcement of drink-driving laws (30/100mlB, 80/100mlBLD), Random breath testing, Ignition or alcohol interlock devices

Reduce alcohol-related interpersonal violence: Reduce trading hours for licensed venues, Improve venue security

Men have a lower percentage of body fat than women and they produce more alcohol dehydrogenase enzymes so we can have 2 drinks
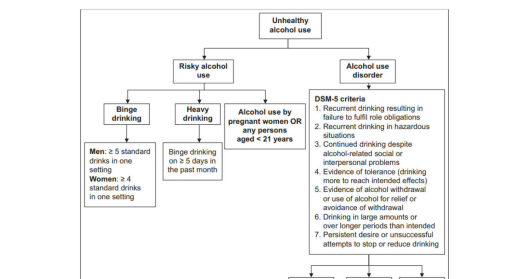
1.5 Opioids

A class of prescription drug used to reduce pain. Effects: Analgesia (pain relief), Cough suppression, Sedation, Respiratory depression, Euphoria

Symptoms: Constricted pupils, Breathing difficulty, Unconsciousness, May have seizures Management: Antidote: Naloxone (opioid antagonist), Supportive care: To improve breathing and ventilation

Withdrawal: Sweating, Bone or joint aches, Runny nose or tearing, Tremor, Restlessness, Anxiety or irritability. Management: Buprenorphine/Naloxone or Symptomatic management

Prevention of Opioid Misuse: Increase the availability of opioid dependence treatment, Reduce and prevent irrational or inappropriate opioid prescribing, Monitor opioid prescribing and dispensing, Limit inappropriate over-the-counter sales of opioids. In Singapore: Opioids are controlled drugs in Singapore, License requirement for import, store, wholesale, export, or manufacture, Regulations for bringing personal medication to Singapore approved by HSA, Restriction on the retail sale of codeine cough preparations, Opioids should not be prescribed as first-line treatment for acute and chronic pain, identify risk factors and patient factors before starting opioid therapy, Monitor patients under opioid therapy and Provide patient education on opioid use

1.6 Case Study

The opioid crisis in the United States has led to a sharp increase in opioid-related hospitalizations and overdose deaths, underscoring the urgent need for effective treatment alternatives to incarceration. Drug treatment courts (DTCs) offer a rehabilitative approach, providing structured programs that integrate community-based substance abuse treatment, frequent drug screening, and direct engagement with a Drug Court Judge. These programs use a mix of sanctions and rewards to encourage compliance and support recovery. Research comparing drug court participants to those on probation or parole without treatment indicates that drug courts may reduce relapse rates and improve recovery, delivering both social and economic benefits.

Drug courts are also more cost-effective than traditional incarceration. The annual cost per offender in a drug court program is substantially lower than that of imprisonment, and the reduced re-arrest rate among participants contributes to cost savings in the criminal justice system. Nevertheless, effective compliance enforcement remains a challenge. Sanctions must be carefully timed; while early punitive measures can lead to treatment failure, appropriately timed sanctions can encourage adherence, especially in participants initially resistant to treatment.

Individual Factors: Employment and lower educational attainment are linked to higher rates of treatment failure in drug courts. The statistics indicate that individuals who are unemployed face a significantly higher risk of failing in drug court programs. Educational levels also play a role, as those with less than a high school education are more likely to struggle with successful treatment outcomes. Furthermore, polysubstance misuse increases the likelihood of treatment failure. Sanctions received early in the program, particularly those within the first 30 days, have also been shown to affect treatment outcomes.

Institutional Factors: Working Industry The type of industry a person is employed in can influence substance use rates. The mining and construction industries have the highest rates of heavy alcohol use, while the accommodations and food services industry shows high levels of illicit drug use. Workers in these industries often face conditions that may contribute to substance use disorder (SUD), which in turn affects their potential for successful treatment in a drug court setting.

2 Workplace Safety and Health

2.1 Introduction to Occupational Health

Work can affect: Accidents and injuries, Obvious diseases, Hidden diseases, Incurable diseases. Health can affect work: Decrease productivity, Danger to self, Danger to others/community

1: Preventing and controlling occupational diseases and accidents 2: Eliminating occupational factors and conditions hazardous to health and safety at work; 3: The development and promotion of healthy and safe work, work environments, and work organizations; 4: The enhancement of the physical, mental, and social well-being of workers and support for the development and maintenance of their working capacity, as well as professional and social development at work; 5: Enabling workers to conduct socially and economically productive lives and to contribute positively to sustainable development.

2.2 Challenges / Changes

1. Rapid technological growth 2. 7 in 10 are in the workforce. 3. Shrinking workforce due to declining fertility rate (TFR > 2.1)4. Rapidly aging population and workforce (2015- 1 in 8, 2030 1-4) 5. The health of our working population is worse off than the general population 6. Cutting back on foreign manpower

2.3 Opportunities and Developments

Workplace Safety and Health Act (WSHA) - Focuses on creating a safe and healthy work environment by regulating workplace safety standards and enforcing preventive measures. Work Injury Compensation Act (WICA) 2019 - Provides compensation for employees who suffer injuries or illnesses due to work, covering medical expenses, lost wages, and permanent incapacity.

Total Workplace Safety and Health:

2.4 Case Study

In Singapore, the construction sector often exposes workers to prolonged periods of intense heat and humidity. This can lead to heat stress, dehydration, and other heat-related illnesses. Recognizing this health risk, Singapore's Ministry of Manpower (MOM) has implemented guidelines for managing heat stress, including mandating regular breaks, providing hydration facilities, and educating workers about heat risks. This case underscores the connection between environmental conditions at work and health, emphasizing the need for health safeguards in physically demanding sectors.

With an aging workforce and a rapidly evolving technological landscape, Singapore faces challenges in workplace safety, particularly for older employees who may struggle to adapt to new machinery and digital tools. This can lead to increased injury risks. In response, companies are introducing retraining programs to help older workers adapt to new technologies safely, and MOM has launched initiatives to encourage employers to create age-friendly work environments. This highlights a pressing issue where evolving job requirements and demographics necessitate focused safety measures.

The Total WSH initiative by the Workplace Safety and Health Council (WSHC) and MOM promotes a holistic approach to employee safety, health, and well-being. This programme encourages organizations to integrate safety practices, health screenings, mental health support, and ergonomic assessments into their overall management systems. The Total WSH framework is implemented across various industries, from construction to healthcare, illustrating Singapore's proactive efforts to create safer and healthier workplaces by addressing multiple aspects of worker welfare.

3 Robotics In Health Care

Benefits of robot: - Enhance patient care, Improve healthcare outcomes, Streamline healthcare process

3.1 Surgical Assistance robot

Surgical Instrument: Laparoscopic uses 2D camera and small tools; robotics-assisted uses 3D camera and dexterous robotic instruments. Surgeon Position: Laparoscopic - surgeon next to patient; robotics-assisted - surgeon at a console (Cannot use the sense of judgement). How Surgery is Performed: Laparoscopic - direct manipulation of instruments; robotics-assisted - robotic arms controlled via console. Access to Hard-to-Reach Areas: Laparoscopic offers moderate access; robotics-assisted allows greater access. Recovery: Both methods enable faster recovery, less pain, and reduced scarring than open surgery. Complications: Both have high severity but rare occurrences. Cost: Laparoscopic is affordable; robotics-assisted is very expensive (Social Equality), raising accessibility concerns.

Prostatectomy: Primarily robotic, Hysterectomy: Majority robotic, with some laparoscopic, Hernia Repair: Majority laparoscopic, with a smaller portion robotic, Colorectal Resection: Majority laparoscopic, with a smaller portion robotic, Cholecystectomy: Predominantly laparoscopic

3.2 Modular Robots

Purpose: These robots support patients in the rehabilitation process, aiding in recovery and helping regain mobility and functionality. Examples of Conditions: Useful for patients recovering from strokes, spinal cord injuries, multiple sclerosis, and paralysis. Purpose: Improves quality of life by enabling system-assisted walking, Monitors patient's form as they perform exercise, Measures degree of motion, Tracks progress of rehabilitation.

3.2.1 Exoskeleton robots
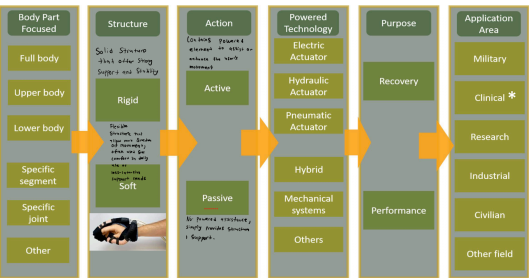
Benefits: Restores locomotion, Improves level of physical activity years after injury, Decreases seated time, increases standing and walking time, Promotes social engagement with friends and family.

Limitations: Long fitting time, More suited for users with good motor learning capability, Heavy material for exoskeletons (safety concerns – ankle swelling, pressure injuries), Not suited for community ambulation (modest ambulation speed 0.2 m/sec; indoor vs outdoor terrain), Not suited for patients with tetraplegia, Reasonable hand functions required to hold assistive device (walker or crutches) and maintain balance or stability while using the exoskeleton.

Jebsen-Taylor Hand Function Test: s a clinical tool used to evaluate fine and gross motor skills of the hand by having patients perform everyday tasks like writing, picking up small objects, and moving items. It includes seven timed tasks that assess hand speed, precision, and coordination for both hands. Shorter completion times indicate better hand function. The test is widely used in rehabilitation to track progress, measure treatment effectiveness, and plan interventions for those recovering from conditions affecting hand movement.

3.2.2 Prosthetic Limbs

1. Passive prostheses: Does not provide active hand and joint movement, 2. Body-powered prostheses: Motion of shoulder blade and upper arm to operate hook/elbow joint, 3. Externally powered myoelectric prostheses: Provide active movement without shoulder or upper arm motion, 4. Hybrid prostheses: a strap-cable system which holds the prosthesis on and uses the motion of the person's shoulder blade and upper arm combined with an externally powered hand to facilitate movements. 5. Activity-specific prostheses - These prostheses are created for specific tasks or activities (Like the running one)

The ideals of an upper extremity prosthesis are smooth manipulation with fidelity, sufficient grip strength, dexterity, and fine motor control in a coordinated manner.

3.3 Service Robots

Uses: 1. Logistics and delivery in Hospitals 2. Cleaning and disinfection in public places 3. Blood drawing

3.4 Social Robots

Purpose: 1. Creates friendly and effective interaction with a human user 2. Provides companionship 3. Giving assistance to the user 5. All of which with the aim to achieve measurable progress in quality of life, often related to motivation, rehabilitation, or learning

Signs of dementia: 1. Poor or decreased judgment 2. Frequent memory loss that affects daily activities 3. Problems with abstract thinking 4. Problems with language, e.g., forgetting simple words 5. Loss of initiative 6. Misplacing things or putting them in inappropriate places 7. Difficulty performing familiar tasks 8. Changes in personality 9. Disorientation with time and place 10. Changes in mood or behavior

Social Robot for dementia patients: 1. Provides comfort and companionship (Animal therapy) (PARO) - PARO is a therapeutic robot designed to resemble a baby seal. It is used for animal-assisted therapy, providing comfort and emotional support, especially beneficial for dementia patients by reducing stress and encouraging social interaction. 2. Autonomous, Programmable, humanoid robot (NAO - is a humanoid robot that can be programmed to interact with patients, helping with cognitive exercises, companionship, and providing reminders. It is often used in therapeutic settings to engage dementia patients in activities that promote mental stimulation and improve mood. 3. Used for communication and social interaction (ability to transmit voice and mimic face and head motion) - Telenoid is a teleoperated communication robot designed to mimic human facial expressions and gestures. It allows caregivers or family members to communicate with dementia patients remotely, providing a comforting presence and interaction that feels more personal and engaging for the patient.

Challenges in using robotics in Healthcare: 1. Trust & Social Acceptance 2. Ethical marketing 3. Privacy and Data Security 4. Algorithmic Bias 5. Inequality and digital divide 6. Job displacements 7. Defining collaboration between robots and professionals

3.5 Case Study

Stroke is a leading cause of disability in Singapore, with many survivors experiencing long-term physical impairments that impact their ability to walk, maintain balance, and perform daily activities. The healthcare system faces challenges in providing sufficient rehabilitation resources due to the increasing age population, which heightens the demand for stroke rehabilitation services.

Intervention: Robotic exoskeletons, such as the EksoGT and HAL (Hybrid Assistive Limb), have been introduced in some Singaporean rehabilitation centers to support stroke patients in their recovery. These robotic devices assist patients in walking by providing physical support and controlled movement, enhancing the rehabilitation experience. They are especially beneficial in improving gait and balance, offering patients a way to regain movement that would otherwise take months through traditional physical therapy.

In Singapore, these exoskeletons are being used in hospitals like Tan Tock Seng Hospital, which has adopted robotic-assisted therapy as part of its rehabilitation programs. The robotic exoskeletons enable patients to perform repeated, precise movements, helping to retrain their muscles and brain for walking, a process known as neuroplasticity.

Outcomes: Patients using robotic exoskeletons have shown improved walking speed, endurance, and confidence in their physical abilities. The exoskeletons provide more intensive, consistent training than standard therapy sessions, and the structured, repetitive movements have been proven to facilitate faster recovery. Furthermore, patients report a greater sense of independence and motivation, as they can physically see and feel their progress.

Public Health Impact in Singapore: By incorporating robotic exoskeletons into rehabilitation, Singapore's healthcare system can alleviate some of the pressure on healthcare providers by reducing the time and manpower required for traditional physical therapy. The technology also addresses the issue of limited space and personnel in hospitals, as one therapist can supervise multiple patients using robotic devices.

This case highlights the role of advanced robotics in tackling public health issues in Singapore, enabling the healthcare system to better meet the needs of an aging population while improving quality of care and patient outcomes.

4 Introduction Global Health

Global health today focuses on improving worldwide health, reducing disparities, and protecting societies from global threats that transcend national boundaries.

Black Death: 1. 100 Million dead (25%), 2. Started when habitats of wild rodents in Central Asia disrupted by human/farming expansion/new trading patterns 1348 (Venice): 1. Believed that plague came by ships 2. Adopted 30-day detention period 3. Expanded to 40 days (i.e., "quarantine") 4. Used island as quarantine station (lazaretto) 5. Didn't work (spread by fleas on rats) 6. Barred exit of people/goods from cities/regions Public health measures are local and unilateral

Imperialism/Colonialism (late 1400s) (Boat): 1. Transmission of disease in multiple directions 1.1 Europeans carried influenza, typhus, smallpox, cholera 1.2 Falciparum malaria from Africa to Americas via European slave ships 1.3 Syphilis from Americas (early Spanish/Portuguese explorers) back to Europe 2. High occupational mortality among displaced indigenous groups, bonded laborers, African slaves

Imperialism/Colonialism (late 1400s): 1. Decision to counter infectious diseases ("tropical diseases") based on external interests: 2. Protect health of European and American colonial personnel and workers 3. Enhance productivity, safeguarding commerce 4. Top-down, local compliance was achieved through compulsion 5. Narrow focus (on single disease)

International Health (1850s): Fear of epidemic: 1. Large-scale immigration from Europe and Asia to the Americas 2. Explosion of mineral extraction, manufacture, trade, marketing of goods + revolution of transportation (steamships, railroads, Suez Canal) 3. 6 cholera pandemics between 1816-1899 4. On-the-ground cooperation deemed as beneficial for:

Control of outbreaks (of tropical diseases): 1. Stabilise colonies and emerging nation states 2. Improve diplomatic relations 3. Expand consumer markets 4. Encourage transfer and internationalising scientific, bureaucratic and cultural values

Public Health: Geographical reach: Focuses on issues that affect the health of the population of a particular community or country, Level of cooperation: Does not usually require global cooperation, Individuals or populations: Mainly focused on prevention programmes for populations, Access to health: Health equity within a national or community is a major objective, Range of disciplines: Encourages multidisciplinary approaches, particularly within health sciences and social sciences

International Health: Geographical reach: Focuses on health issues of countries other than one's own, esp those of low-income and middle-income, Level of cooperation: Usually requires binational cooperation, Individuals or populations: Embraces both prevention in populations and clinical care of individuals, Access to health: Seeks to help people of other nations, Range of disciplines: Embraces a few disciplines but has not emphasised multidisciplinarity

Global Health: Geographical reach: Focuses on issues that directly or indirectly affect health but that can transcend national boundaries, Level of cooperation: Often requires global cooperation, Individuals or populations: Embraces both prevention in populations and clinical care of individuals, Access to health: Health equity among nations and for all people is a major objective, Range of disciplines: Highly multidisciplinary within and beyond health sciences

Key Elements of Global Health: 1. Transcends national boundaries 2. Requires global cooperation 3. Prevention and clinical care 4. Health equity for all 5. Interdisciplinary, multidisciplinary within and beyond health sciences

Why relevant to us ?

Health is interconnected globally: In today's world, diseases can easily cross borders, as seen with COVID-19. Strengthening health systems worldwide is crucial because protecting one region can help protect others, creating a safer global environment.

Shared: Many health issues, especially non-communicable diseases like diabetes or heart disease, have common risk factors across nations. Addressing these requires international collaboration to develop shared solutions and prevent widespread health impacts.

Health Inequities Persist: Disparities in health outcomes are still present, even in advanced countries. Global health efforts work to address these inequities, aiming for fair access to health resources and opportunities for all individuals.

Climate Change: Climate change is a global problem affecting health through extreme weather, pollution, and changing ecosystems. These impacts are felt worldwide, so addressing climate change is essential for protecting global health.

Economic Impacts: Health crises can disrupt economies through trade issues, higher healthcare expenses, and lowered productivity. Global health issues, therefore, have a direct economic impact, underscoring the need for coordinated global responses.

1. Equity is the absence of avoidable or remediable differences among groups of people, whether those groups are defined socially, economically, demographically, or geographically. (WHO) 2. Health inequities are systematic differences in the health status or in the distribution of health resources between different population groups, arising from the social conditions in which people are born, grow, live, work and age. (WHO)

High GDP Does not Mean High Life Expectancy

Determinants of Health

Social & Economic Environment: This includes external influences such as income, education, social support networks, employment, and culture. These factors can affect access to healthcare, quality of life, and stress levels, all of which impact health. For instance, higher income often enables better access to healthcare and healthier lifestyle choices.

Physical Environment: The physical surroundings in which people live and work, including safe and healthy workplaces, safe housing, roads, and general working conditions. A clean and safe physical environment reduces the risk of accidents, exposure to pollutants, and other health hazards.

Individual Characteristics & Behaviors: This refers to intrinsic factors like genetics, gender, and personal behaviors. These characteristics can influence how susceptible a person is to certain health conditions or how they respond to illness. For example, genetics can predispose individuals to certain diseases, while behavior choices (such as smoking or exercise) significantly impact health.

Myth and Assumption

Expertise: There is a misconception that outside experts possess a superior understanding of health problems in other regions, believing they know best how to solve local health issues. Another assumption is that health problems in other places are simpler than domestic issues, underestimating the complexity of local contexts.

Accountability: It is often assumed that good intentions alone justify actions in global health. This belief suggests that interventions don't need approval or input from the local people they aim to serve, potentially overlooking the importance of community involvement and transparency.

Equity vs Efficiency: Another myth is that programs motivated by equity and solidarity should not be concerned with efficiency. This implies that as long as an intervention aims to address inequalities, it doesn't need to consider resource allocation or effectiveness, which can lead to ineffective use of resources.

Case Study Global Health: HIV prevention serves as a prime example of global health in action due to its significant impact across nations, particularly in low- and middle-income countries. HIV spreads beyond national borders, making it essential for countries to collaborate on prevention, treatment, and awareness efforts. Organizations like the World Health Organization (WHO), UNAIDS, and the Global Fund lead coordinated efforts to fund research, distribute antiretroviral therapies, and promote policies supporting vulnerable populations. Preventive strategies, such as safe sexual practices, condom distribution, and pre-exposure prophylaxis (PrEP), are integrated with clinical care, including access to antiretroviral therapy (ART), to reduce new infections while supporting those already affected by HIV. This approach emphasizes health equity, addressing the disproportionate impact on vulnerable groups, such as those in poverty or marginalized communities, and ensuring that services are affordable and accessible. HIV prevention is inherently interdisciplinary, combining public health, medicine, psychology, sociology, and policy-making to create a comprehensive response. Scientists work to develop effective treatments, social scientists address stigma reduction, and policymakers build frameworks to support affected communities. This global health approach to HIV prevention not only targets disease reduction but also promotes equitable access to healthcare, striving to meet the unique needs of each affected population.

5 Humanitarian Emergency

5.1 Definitions and Characteristics of Disasters

An event or series of events that represents a critical threat to the health, safety, security or wellbeing of a community or other large group of people, usually over a wide area.

Types: 1. Natural (earthquakes, floods, hurricanes, volcanoes, landslides, wildfires etc) 2. Man-made (conflict, environmental degradation, pollution, industrial accidents) 3. Complex

Characteristics

1. Large displaced population 2. Population usually settled in temporary locations: High population densities, Inadequate food/shelter, Unsafe water, Poor sanitation, Infrastructure compromised or destroyed, 3. Increased risk of transmission of "epidemic-prone diseases" (mainly infectious diseases) → increased health risks

5.2 Determinants of Disaster Risk

Exposure refers to the number and share of the population at risk of various disaster events. Intensity Levels are categorized as Strong, Severe, and Extreme. Types of Disasters under exposure include: 1. Earthquakes 2. Tsunamis 3. Cyclones 4. Coastal Floodings 5. Riverine Floodings 6. Droughts 7. Sea-level rise

The WorldRiskIndex is determined by the formula: WorldRiskIndex = √(Exposure × Vulnerability)
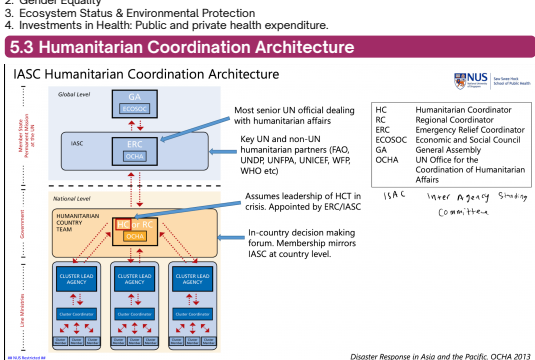
Vulnerability: Vulnerability is divided into three key areas:

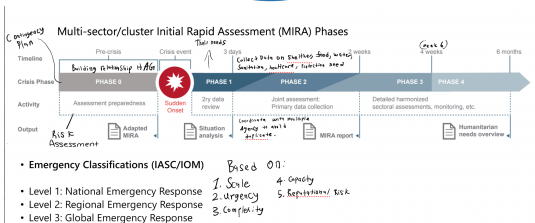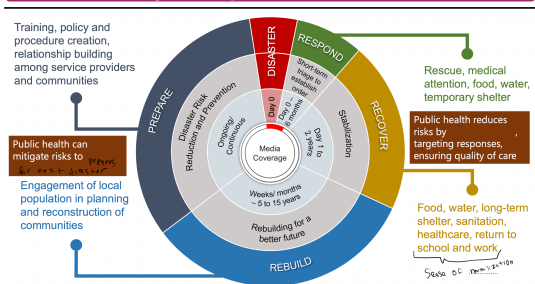**a) Structural Characteristics and General Conditions of Societies Factors affecting vulnerability include:**
1. Public Infrastructure: Access to basic sanitation and drinking water services.
2. Housing Conditions: The prevalence of slums and fragile dwellings.
3. Nutrition: Rates of undernourishment.
4. Poverty & Dependency: Levels of economic hardship.
5. Economic Productivity & Income Distribution: Measured by GDP and Gini Index for inequality.
b) Formally/Informally Organized Activities and Measures Organized responses to risk and disaster management include:
1. Government and Authorities: Levels of corruption and system fragility.
2. Medical Services: Availability of physicians and hospital beds.
3. Material Coverage: Extent of insurance coverage.
c) Lack of Adaptive Capacities: Refers to the societal structures and systems in place to adapt to and mitigate risks, such as:
1. Education & Research: Literacy levels and research investments.
2. Gender Equality
3. Ecosystem Status & Environmental Protection
4. Investments in Health: Public and private health expenditure.

5.3 Humanitarian Coordination Architecture

IASC Humanitarian Coordination Architecture

HC	Humanitarian Coordinator
RC	Regional Coordinator
ERC	Emergency Relief Coordinator
ECOSOC	Economic and Social Council
GA	General Assembly
OCHA	UN Office for the Coordination of Humanitarian Affairs

Most senior UN official dealing with humanitarian affairs

Key UN and non-UN humanitarian partners (FAO, UNDP, UNFPA, UNICEF, WFP, WHO etc)

Assumes leadership of HCT in crisis. Appointed by ERC/IASC

In-country decision making forum. Membership mirrors IASC at country level

Disaster Response in Asia and the Pacific, OCHA 2013

5.4 Disaster Management Cycle

Training, policy and procedure creation, relationship building among service providers and communities

Public health can mitigate risks to ___ for next disaster

Engagement of local population in planning and reconstruction of communities

Rescue, medical attention, food, water, temporary shelter

Public health reduces risks by targeting responses, ensuring quality of care

Food, water, long-term shelter, sanitation, healthcare, return to school and work

Rebuilding for a better future

Multi-sector/cluster Initial Rapid Assessment (MIRA) Phases

- **Emergency Classifications (IASC/IOM)**
- Level 1: National Emergency Response
- Level 2: Regional Emergency Response
- Level 3: Global Emergency Response

Based on:
1. Scale
2. Urgency
3. Complexity
4. Capacity
5. Reputational Risk

When international support is reduced is expected to be the begin of the recovery phase once the country takes over recovery begins

R/RPhase - Surveillance 1. Monitoring a population's health and identifying priority immediate and long-term health needs 2. Following disease trends for early detection and control of outbreaks (Early Warning Alert and Response Network — EWARN) 3. Assisting in planning and implementing health programmes 4. Ensuring resources are targeted to the most vulnerable groups 5. Monitoring the quality of health care 6. Evaluating the coverage and effectiveness of programme interventions

Preparation Phase:

Learning from Recovery to Build Resilience: After a disaster, recovery experiences help identify what worked and what didn't, which can improve future preparedness. This knowledge strengthens communities' ability to handle similar events in the future.

Recurring Natural Hazards: Some natural hazards, like floods, happen repeatedly in certain areas due to location and climate. By recognizing these patterns, communities can prepare better, such as by building defenses, to reduce the impact of future disasters.

Do's and Don'ts: 1. Don't work solo – work with other relief teams, especially the local teams 2. Don't be too gung-ho (don't put yourself or others at risk) 3. Do be sensitive on: Photo-taking, Eating 4. Do take care of yourself and your team-mates (physically and mentally) 5. Do hand-over/exit well (external support → "local" capacity)

5.5 Case Study

Case Study: Humanitarian Response to Typhoon Haiyan (Yolanda) in the Philippines

Background In November 2013, Typhoon Haiyan, one of the strongest tropical cyclones ever recorded, struck the Philippines, causing widespread destruction. It affected millions, destroyed infrastructure, displaced populations, and led to thousands of casualties.

Phase 1: Preparedness The Philippines, situated in a typhoon-prone region, had some preparedness measures in place, such as early warning systems and community drills. However, the unprecedented strength of Typhoon Haiyan tested these systems. The Philippine government and international partners had worked on disaster risk reduction and management plans, but the scale of the typhoon required additional international support.

Preparedness Lessons: The country recognized the need for stronger infrastructures, better evacuation centers, and more efficient resource mobilization to handle future super typhoons. Phase 2: Response After Haiyan made landfall, the response phase kicked in. The Inter-Agency Standing Committee (IASC) activated a Level 3 emergency response, which is the highest level, indicating the need for a coordinated global humanitarian effort.

International and National Coordination: The United Nations (UN) and humanitarian organizations rapidly mobilized. The UN's Office for the Coordination of Humanitarian Affairs (OCHA) set up a coordination hub, while the Philippine National Disaster Risk Reduction and Management Council (NDRRMC) led efforts on the ground. Clusters were established to cover different sectors: health, shelter, water and sanitation, food security, and logistics.

Immediate Actions: Medical teams, food, water, and temporary shelters were deployed. The response included lifesaving medical assistance, distribution of food supplies, and provision of safe drinking water and sanitation facilities.

Phase 3: Recovery and Transition After several months, the response phase transitioned to recovery as immediate humanitarian needs lessened. This involved rebuilding efforts, resettling displaced people, and restoring basic services. By early 2014, international agencies gradually started handing over responsibilities to the Philippine government.

Transition Planning: During this period, the Philippines took over more responsibility, moving from immediate response to long-term recovery plans. International agencies provided guidance and funding but scaled back direct involvement. Phase 4: Reconstruction In the following years, efforts focused on rebuilding infrastructure, such as homes, schools, and hospitals, with a goal of "building back better" to increase resilience to future typhoons. The government, along with international donors and NGOs, invested in strengthening building codes, reinforcing coastal defenses, and improving community-level preparedness.

Learning from Recovery Through this experience, the Philippines and its partners identified critical lessons, such as the importance of resilient infrastructure and the need for better early-warning dissemination, especially in remote areas. The recovery phase also highlighted the importance of mental health support and community engagement in rebuilding efforts.

Recurring Natural Hazards Since the Philippines experiences frequent typhoons, the disaster prompted the country to integrate new policies and strategies to manage recurring risks. These include investing in flood defenses, upgrading evacuation centers, and ensuring communities are better informed and prepared.

6 Climate Change

6.1 Definitions and Scale of Climate Change

What is Climate Change?

1. Weather: Refers to the short-term conditions in the atmosphere. It includes events like rain, temperature, and wind that occur over hours or days. Examples given are: 1. Rain squall: a brief, intense rain. 2. Cyclone: a more severe storm system, lasting longer than individual rain events.

2. Climate: Refers to the long-term average of weather patterns over a significant period (30 years or more). Climate is measured over months, years, decades, or even centuries.

3. Climate Variability: This is the natural fluctuation in climate patterns over months to years. It includes patterns like: 1 - Wet Season/Dry Season: Seasonal changes in rainfall. 2 - El Niño/Southern Oscillation (ENSO): A climate pattern affecting weather worldwide, causing variations in temperature and precipitation every few years. 3 - Pacific Decadal Oscillation (PDO): Another climate pattern that affects ocean temperatures over decades, impacting weather on a broader scale than ENSO.

5. Climate Change: Refers to shifts in climate patterns over decades to centuries , often due to factors like greenhouse gas emissions and industrial activity. This long-term change includes global effects such as: 1 - Global Warming: The gradual increase in Earth's average temperature. 2 - Sea Level Rise: As polar ice melts, sea levels rise, threatening coastal areas. 3 - Ocean Acidification: As oceans absorb more CO_2, they become more acidic, affecting marine life.
Climate Change impacts vary regionally: As global temperatures rise, the hottest days become hotter, soil moisture declines in dry areas, and extreme rainfall events intensify. These changes increase the risk of heat stress, droughts, and floods, particularly affecting vulnerable regions. Climate change thus drives more extreme and uneven weather impacts worldwide.

Impacts of climate Change: 1. Physical Water Availability: Reduced rainfall and increased droughts lead to water scarcity, impacting agriculture and daily needs. 2. Agriculture/Crop Production: Changes in climate disrupt crop yields and force adaptation in farming practices. 3. Animal and Livestock Health: Heat stress and disease spread harm livestock health and productivity. 4. Fisheries and Aquaculture: Ocean warming and acidification reduce fish populations and disrupt fishing communities. 5. Infectious Diseases: Warmer climates expand disease-carrying vectors, spreading illnesses like malaria. 6. Heat, Malnutrition, Wildfire Harm: Increased heatwaves cause illness, crop failures lead to malnutrition, and wildfires harm respiratory health. 7. Mental Health: Climate-induced disasters create stress, trauma, and long-term mental health issues. 8. Displacement: Rising seas and extreme weather force migrations, creating economic and social challenges. 9. Inland Flooding: More intense rainfall causes frequent urban flooding, damaging infrastructure. 10. Coastal Damages: Storm surges, worsened by rising seas, threaten coastal cities and infrastructure. 11. Infrastructure Stress: Extreme weather requires costly adaptations and maintenance of infrastructure. 12. Key Economic Sectors: Tourism, agriculture, and fisheries suffer due to climate impacts. 13. Terrestrial Ecosystems: Shifting climate zones disrupt species, causing biodiversity changes. 14. Freshwater Ecosystems: Warmer waters alter habitats and reduce water quality. 15. Ocean Ecosystems: Rising temperatures and acidification lead to coral bleaching and marine biodiversity loss.

Triple planetary crises: 1: Climate change, 2: nature and biodiversity loss: Human actions are rapidly reducing species diversity and degrading ecosystems, disrupting the planet's ecological balance. and 3. Pollution: The contamination of air, water, and soil from industrial activities poses risks to both environmental and human health.

6.2 Impacts of Climate on human health

1. Climate and environmental changes have a range of both direct and indirect impacts on health. 2. Populations have different levels of vulnerability to these environmentally driven health stressors and may experience multiple impacts. 3. Southeast Asia is highly vulnerable to many of these impacts, and this is a priority for public health in the region.

Extreme Heat:

---

1. Heat stress is the leading cause of weather-related deaths. 2. Heatstroke has a high fatality rate. 3. Increases risk of other diseases.

Vulnerability to heat stress:

PHYSIOLOGICAL FACTORS: 1. Older and less-able people 2. People with certain medical conditions or taking certain medications or drugs 3. Pregnant people 4. Infants and children **EXPOSURE FACTORS:** 1. Outdoor and manual workers 2. People living in sub-par housing conditions or who lack access to cooling 3. People who are poor, displaced or experiencing homelessness 4. Athletes and attendees of outdoor events

Diseases influenced by climatic hazards: 223 diseases exclusively aggravated, 54 diseases both aggravated and diminished and 9 diseases exclusively diminished

Vulnerability factors	Exposure pathways	Health system capacity & resilience
• Demographic factors • Geographic factors • Biological factors & health status • Sociopolitical conditions • Socioeconomic factors	• Extreme weather events • Heat stress • Air quality • Water quality and quantity • Food security and safety • Vector distribution & ecology	• Leadership & governance • Health workforce • Health information systems • Essential medical products & technologies • Service delivery • Financing
Health systems & facilities outcomes: • Impacts on healthcare facilities • Effects on health systems		

Climate-Sensitive Health Risks: 1. Injury and mortality from extreme weather events 2. Heat-related illness 3. Respiratory illness 4. Water-borne diseases and other water-related health impacts 5. Zoonoses 6. Vector-borne diseases 7. Malnutrition and food-borne diseases 8. Noncommunicable diseases (NCDs) 9. Mental and psychosocial health

| Direct Effects	Indirect Effects
Changes in temperature, rainfall, and humidity impacting vector distribution and diseases	Climate-driven conflict and migration patterns
Impacts on biodiversity and host ecology, behavior, and distribution	Malnutrition due to food scarcity
Extreme weather events (e.g., flooding) and water-borne diseases	Logistical challenges in delivering control (e.g., during extreme events)
Changes in agriculture and food-borne diseases	Comorbidities (e.g., heat stress, chronic disease)
Many others...	Health system pressures and others
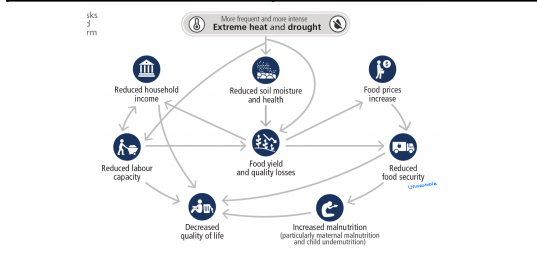
Figure 7: food insecurity and malnutrition
1. Agriculture (particularly livestock) remains one of the largest contributors to climate change and drivers of deforestation and biodiversity loss (Livestock produces methane) 2. Increased focus on developing alternatives to livestock industry while ensuring adequate nutrition for the population (Lab grown meat or plant-based meat) 3. Need to balance and optimize climate and health goals

Pollution 1. Climate change is a major driver of changes in air quality, particularly through wildfires and haze (heatwaves -> wildfires -> smoke) 2. Strong relationships between increased air pollution exposure and premature death: 2.1 Associated with cancer, lung disease, and other noncommunicable diseases, 2.2 Can increase susceptibility to infectious diseases (weakens the immune system) 3. Climate variability can also influence allergens (e.g., pollen) (Longer growing season pollen and allergic reaction)

Mental Health

1. Increased stress due to climate change, e.g., natural disasters (Hurricanes, floods, wildfires and droughts), economic factors (Lost of jobs from natural disaster) 2. Decreased access to nature and green spaces (green spaces reduce stress and improve well-being) 3. Solastalgia: distress caused by loss of home environment

6.3 Adaptation and mitigation measures to support public health

Adaptation: actions to address the risks of climate change 1. Can be individual, institutions or government actions 2. Overall goal is to prepare and respond to health risks from climate change

Mitigation: intervention to reduce greenhouse gas emissions to address root causes of climate change 1. Health sectors may advocate for changes in other sectors (e.g. energy) to reduce future health burdens 2. Increasing focus on reducing emissions of health sector
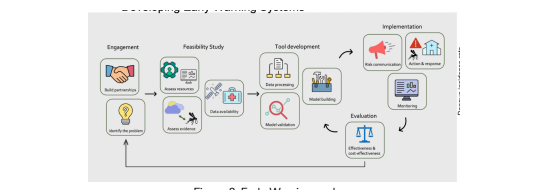

Figure 8: Early Warning system

dengue is a climate-sensitive disease influenced by temperature, rainfall, and humidity, which affect mosquito breeding and survival rates

D-Moss: **Community actions (1 week to 2 months prior)** like using nets and reducing standing water. **Local health staff measures (2 weeks to 2 months prior)** such as public alerts and mosquito spraying. **National planning (5 to 6 months prior)** for resource allocation at high-risk areas.

Mitigation Mitigation measures aim to reduce greenhouse gas emissions to prevent future climate change 1. Reductions of fossil fuel use 2. Tree planting and other measures to capture carbon

---

Mitigation and health co-benefits 1. Less severe global warming results in reduced health consequences of climate changes (e.g. fewer extreme heat days, etc) 2. Clean transport (electric vehicles) can reduce use of fossil fuels but also improve air quality 3. Reducing meat overconsumption can reduce climate impacts of livestock industry and support nutrition 4. Expanding green spaces and planting trees to capture carbon can have physical and mental benefits

Climate Resilient Health System Building Blocks of Health Systems (center): These fundamental components include leadership & governance, health workforce, health information systems, essential medical products & technologies, financing, and service delivery. These blocks are necessary for a functioning health system. **Climate & Health Financing:** Resources dedicated to supporting climate-related health initiatives, including emergency preparedness and management of health programs sensitive to climate. **Leadership & Governance:** Ensuring that decision-makers are prepared to lead on climate-related health issues. **Health Workforce:** Training health professionals to understand and respond to the health impacts of climate change. **Vulnerability, Capacity & Adaptation Assessment:** Assessing the vulnerability of populations and the capacity of health systems to adapt to climate-related challenges. **Integrated Risk Monitoring & Early Warning:** Systems in place to monitor climate risks and provide early warnings to prevent health crises. **Health & Climate Research:** Conducting research to understand the intersections between climate and health and inform policy and practices. **Climate Resilient & Sustainable Technologies and Infrastructure:** Building and utilizing technologies and infrastructure that can withstand climate impacts while being environmentally sustainable. **Management of Environmental Determinants of Health:** Addressing environmental factors, like water quality and air pollution, that impact health. **Climate-Informed Health Programs:** Adapting health programs to consider climate factors, ensuring they are responsive to environmental changes. **Emergency Preparedness & Management:** Preparing for and managing health-related emergencies that may arise due to climate change.

6.4 Case Study

In Singapore, climate change poses both direct and indirect health risks. Direct impacts include increased temperatures, which can lead to heat stress and heat-related illnesses. Additionally, more intense and frequent extreme weather events, such as storms and floods, may result in injuries, drownings, and infrastructure damage, potentially limiting access to healthcare. Indirectly, climate change can worsen air quality, leading to respiratory issues due to pollutants and haze, often exacerbated by wildfires. Shifts in rainfall and temperature patterns may also affect the spread of vector-borne diseases, like dengue, while disruptions to food security, stemming from climate impacts on agriculture, could lead to malnutrition and related health problems.

To address these health impacts, Singapore can adopt various adaptation measures. Investing in heat mitigation strategies, such as shaded or air-conditioned public spaces, can help reduce heat stress. Early warning systems for air quality and dengue outbreaks, combined with public awareness campaigns on heat-related risks, would enable residents to better adapt to these challenges. Additionally, enhancing infrastructure resilience against flooding and ensuring healthcare facilities are prepared to cope with extreme weather events are crucial adaptations. Expanding green spaces would not only offer cooling effects but also support mental health by providing greater access to nature.

The health sector can also contribute to climate change mitigation efforts in Singapore through several strategies. Reducing the carbon footprint of hospitals and healthcare facilities by utilizing renewable energy sources and improving energy efficiency would help lower emissions. Sustainable practices, such as waste reduction, recycling, and sourcing medical supplies responsibly, can further minimize the environmental impact of healthcare services. The health sector can advocate for cleaner air by supporting policies that aim to reduce vehicle emissions, thereby enhancing public health through improved air quality. Moreover, healthcare providers can educate the community on lifestyle changes that support climate mitigation, such as reducing meat consumption and opting for sustainable transportation. These combined efforts can help create a more resilient and sustainable health system in the face of climate change.

7 Public Health

1. Individual Level
Focuses on personal characteristics like knowledge, attitudes, skills, and self-efficacy. These individual traits and motivations influence how a person responds to interventions or programs. Key factors include education, socioeconomic status, and mental health, all of which impact personal behavior and decision-making.
2. Interpersonal Level
Examines relationships with family, friends, and social networks. These close social connections can provide support or, conversely, create barriers to positive behavior. Social support, peer influence, and family dynamics play a significant role in shaping an individual's choices and resilience in programs like rehabilitation.
3. Organizational/Institutional Level
Involves the structures within organizations or institutions that influence individuals, such as schools, workplaces, and healthcare facilities. This level considers how access to resources (e.g., healthcare, mental health services) and organizational policies (e.g., flexible work policies) impact an individual's ability to engage in positive behavior changes.
4. Community Level
Looks at broader social settings, including neighborhoods and local environments. Community norms, values, and resources can either support or hinder positive behavior. Factors include the availability of community resources (e.g., rehab centers), public perception, and the physical environment, all of which can affect the success of interventions in a community.
5. Policy Level
Encompasses local, national, and global policies and laws that influence health and behavior. Policies can create supportive environments for behavioral change by setting regulations and providing funding or resources. Examples include public health policies, laws regulating substance use, and funding for support programs, which can drive large-scale societal changes.

Public Health:

Focus on Prevention: Public health prioritizes prevention over treatment. This involves interventions that prevent diseases, injuries, and other health conditions from occurring or worsening (e.g., vaccinations, health education, screenings).

Population-Level Approach: Unlike clinical care, which is patient-focused, public health looks at the health of populations as a whole — whether at the community, regional, national, or global level.

Social Determinants of Health: Public health recognizes that factors like income, education, environment, employment, and social support networks significantly affect health outcomes. Addressing these factors is essential for effective public health interventions.

Health Equity: Public health aims to achieve equitable health outcomes, reducing disparities between different population groups. This means focusing on vulnerable and underserved populations to ensure everyone has access to healthcare and health-promoting resources.

Interdisciplinary Approach: Public health combines expertise from various fields, including epidemiology, environmental science, sociology, biostatistics, policy-making, and behavioral science. This interdisciplinary approach helps tackle complex health issues.

Global and Local Impact: Public health issues often cross borders (e.g., infectious diseases, climate change, migration), so the field requires both local action and international cooperation.

Community Involvement and Advocacy: Engaging communities and stakeholders is essential for effective public health initiatives. Public health professionals often work with community leaders, local organizations, and policymakers to drive health improvements.

Health Policies and Regulations: Public health shapes and enforces policies to protect and promote health. Examples include smoking bans, food safety standards, clean air laws, and vaccination requirements.

Data and Surveillance: Public health relies on data collection, analysis, and monitoring to track disease outbreaks, health trends, and risk factors. This helps to inform and guide policy and program decisions.

Preparedness and Response: Public health agencies play a critical role in preparing for and responding to emergencies, such as pandemics, natural disasters, and bioterrorism. This involves developing emergency plans, coordinating responses, and educating the public.

Health Promotion and Education: Public health encourages individuals and communities to adopt healthier lifestyles through education on topics like nutrition, physical activity, substance abuse, and mental health.

Environmental and Occupational Health: Ensuring safe environments — from clean water and air to safe workplaces — is a core component of public health, addressing risks that arise from environmental and occupational factors.