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## **Stocktaking and Gap Analysis Report for the Health Adaptation Planning**

The report was developed within the framework of the technical consultancy to assess the knowledge base and propose recommendations for climate change adaptation planning for the health sector in Armenia

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## **ABBREVIATIONS**

AMD	Armenian Dram
AUA	American University of Armenia
BBP	Basic Benefit Package
BMI	Body Mass Index
CHSR	Avedisian Onanian Center for Health Services Research and Development
COPD	Chronic Obstructive Pulmonary Diseases
CSD	Circulatory System Diseases
CVD	Cardiovascular Disease
GHG	Greenhouse Gas
GII	Gender Inequality Index
GOA	Government of Armenia
HIV	Human Immunodeficiency Virus
IAC	Information Analytic Center
IDI	In-depth Interview
ILCS	Integrated Living Condition Survey
INDC	Intended Nationally Determined Contributions
IPCC	Intergovernmental Panel on Climate Change
MIDAS	Medical Institution Data Analysis System
MOH	Ministry of Health
NAP	National Adaptation Plan
NCD	Non-communicable Disease
NCDC	National Center for Disease Prevention and Control
NGO	Non-governmental Organizaztons
NIH	National Institute of Health
OOP	Out of Pocket Payment
PHC	Primary Healthcare
RA	Republic of Armenia
SDG	Sustainable Development Goal
SHA	State Health Agency

SNCO	State Non-Commercial Organization
SPH	Turpanjian School of Public Health
TB	Tuberculosis
UNDP	United Nations Development Programme
UNFCCC	United Nations Framework Convention on Climate Change
UNICEF	United Nations International Children's Emergency Fund
WHO	World Health Organization
YSMU	Yerevan State Medical University after Mkhitar Heratsi

## **EXECUTIVE SUMMARY**

Climate change is threatening sustainable human development globally. Because of its geographic and climatic characteristics, Armenia is considered one of the most climate change sensitive countries in Europe and Central Asia region. The health impacts of climate change became more apparent in recent years. The human health is considered as one of the vulnerable sectors in Armenia which should be prioritized in the climate change adaptation efforts.

Avedisian Onanian Center for Health Services Research and Development of the Turpanjian School of Public Health, American University of Armenia with financial support from the Green Climate Fund and United Nations Development Programme Armenia aimed to conduct a comprehensive stocktaking for the health sector in order to address existing barriers and support the prioritization of climate change adaptation investments in Armenia. Through desk review and qualitative interviews with the key informants from various health determining sectors the research team identified and synthesized available information on climate change health impacts and assessed the capacity and gaps in the health sector highlighting the areas that require strengthening. The elicitation of major gaps and implications of climate change for the health sector and its ability to adapt was conducted in accordance with the building blocks of the health systems as per WHO Climate-Resilient Health System Framework. As part of the desk review situational analysis was conducted to describe population health including major health indicators, burden of climate-sensitive diseases (both infectious and non-communicable diseases) and socio-economic determinants of health (including situation regarding poverty, nutrition, gender inequalities, population structure, access to water, sanitation and hygiene, access to and availability of energy sources, access to transportation and open spaces).

Similar to the rest of the world temperatures are increasing in Armenia: in the period 1929-2016, the average temperature increased by 1.23°C, changing more drastically in recent years. Climate change results in hotter and drier summers, reduction in river flow and more frequent and intensive natural disasters such as flooding, droughts, landslides and mudslides, hailstorms and frosts. The situation in Armenia is projected to worsen with the advancing climate change which will negatively affect different climate-sensitive sectors such as water resources, agriculture, energy, ecosystems, settlements and infrastructures, tourism, as well as human health.

Studies documenting health impacts of climate change on human health are scarce in Armenia. Climate change is expected to have direct (accidents due to extreme weather events) and indirect impacts on the health of the Armenian population (due to changes in temperature and precipitation, as well as increasing population of carriers and transmitters of different infectious-diseases). Climate change is expected to lead to increase the burden of number of non-communicable diseases such as cardiovascular diseases, obstructive chronic pulmonary diseases, accidents, injuries, and poisoning. Additionally, the warming climate may also increase the risk of a range of communicable diseases and vector-borne diseases such as cholera, malaria, acute intestinal infections and others.

In the management of health risks, including those related to climate change the Armenian health sector developed and approved numerous legal acts, policies, and strategies. However, no specific focus on climate change health adaptation measures was found in most of the documents guiding the management of health risks. Therefore, health risks determined by climate change are being addressed only indirectly with the potential of not fully covering all the health impacts of climate change. The assessment revealed a potential for improved political commitment to advance and mobilize human and financial resources for health adaptation activities in the country. Despite ongoing initiatives at different organization-based levels, there are no coordination mechanisms across individual programs within the sector and outside of it to maximize the protection of health. In routine management of health risks, the health sector has various multi-sectorial collaborations. However, the collaborations were numerously characterized as insufficient between the health and health-determining sectors. The Armenian health sector workforce needs further development to provide quality healthcare services in regions and improve overall knowledge on climate change and health linkage. In addition, climate change is not sufficiently incorporated into medical education and continuous professional development curricula. The country has health research capacity, however, almost none of the organizations focused their research efforts to study climate change and health. Despite the available and accessible health and climate-related disaggregated data, the health sector does not have a research agenda to follow. In addition, the methodology behind the health vulnerability assessment is not clearly defined and, in fact, may be even lacking evidence-based approaches for comprehensive identification of all climate-related risks and their projections. The health programs in Armenia are not climate-informed, especially those dealing with non-communicable diseases. Based on the identified



gaps corresponding recommendations were proposed to assist health adaptation planning in Armenia.

## 1. INTRODUCTION

### 1.1. Climate change and its health impacts globally

Continuous anthropogenic emissions and resulting record-level concentrations of greenhouse gases (GHGs) in the atmosphere due to industrialization, deforestation, and agriculture are major drivers of climate change. It is well-observed that since the Industrial Revolution the steady increase of GHGs concentration in the atmosphere has been associated with an increase in the mean global temperature.<sup>1</sup> In addition to increasing mean temperatures and precipitation, climate change is increasing the intensity and frequency of some extreme weather and climate events, including heat waves and extremes in precipitation (more droughts and more floods).<sup>2</sup> According to the United Nations Intergovernmental Panel on Climate Change (IPCC), the average global temperature increased by 0.85°C over the period of 1880-2012.<sup>3</sup> In contrast to the existing targets of buffering the 2°C increase in the temperature, another IPCC assessment concluded that increases in global mean temperature of 1.5°C above preindustrial levels will negatively impact human and natural systems.<sup>1</sup>

Climate change may have some benefits, such as warmer winters, but the negative impacts far outweigh any benefits.<sup>4</sup> The projected health risks of climate change are determined not just by changing weather patterns, but also by the social and environmental determinants of health, such as proper nutrition, clean air, safe drinking water, and secure shelter, and their interactions with climate impacts.<sup>4</sup> Extreme heat associated with climate change may directly contribute to deaths from cardiovascular and respiratory diseases.<sup>2,4</sup> Extreme heat may also lead to dehydration, as well as stroke and other cerebrovascular diseases.<sup>2</sup> High temperatures are increasing the duration of the pollen season, which may affect allergies and respiratory health. Therefore, according to the World Health Organization (WHO), people suffering from cardiovascular and respiratory diseases are more vulnerable to extreme high temperatures and also to higher levels of ground ozone, which are associated with higher temperature.<sup>2,4</sup> In this regard, elderly people are among the highest risk group.<sup>4</sup> For example, more than 70 000 excess deaths have occurred in 2003 in Europe from a summer heat wave.<sup>4</sup> Other vulnerable groups to higher temperatures include pregnant women and young children, poor households and homeless people, people who participate in frequent outdoor activities (hikers, outdoor workers, athletes), those living in urban areas and people with certain medical conditions.<sup>5</sup> In addition to the heat, other extreme weather conditions such as storms, extreme precipitation, droughts and flooding might increase with climate change, leading to emergencies that affect human health, more severely affecting vulnerable populations.<sup>2,5</sup>

The duration of the transmission seasons of vector- and water-borne diseases are projected to increase with climate change, which would contribute to an increased disease burden.<sup>2,4</sup>

Vector-diseases are those transmitted to humans by mosquitos, fleas or ticks (e.g. malaria, West-Nile fever or Lyme disease, etc.). Water-borne diseases occur after consumption of water contaminated by variety of pathogens and toxins; these can be associated with increased water temperatures and human activities.<sup>2</sup>

Climate change may affect food safety and security, due to variety of pathogens being more active with warmer temperature, and due to changes in the quantity and quality of our food.<sup>2</sup>

In addition to physical health, mental health might also be affected by climate change, in the form of increased stress and other mental health conditions. People already suffering from mental health conditions, elderly people, children, as well as, post-partum or pregnant women, are at higher risk of developing mental health conditions.<sup>2</sup>

Given an uneven distribution of roles, expectations and responsibilities between the genders in different cultures, vulnerability and adaptive capacity to climate change health impacts vary across regions.<sup>6</sup>

Countries with low economic activity are assumed to be more susceptible to climate change because the absence of strong health infrastructures will undermine the countries' adaptability to changes.<sup>4</sup> However, even the high income countries are thought to be jeopardized by climate change.<sup>2</sup>

Given the current trend of continuous economic growth and health progress, WHO estimated an additional 250,000 deaths annually during 2030-2050 because of extreme heat (particularly among elderly), diarrhea, malaria and childhood undernutrition.<sup>4</sup> However, some high income countries might be more successful in addressing increased temperatures through use of air conditioning.<sup>5</sup> Although air conditioning is used as a measure to protect people from heat-related health issues, it also has a potential negative effect on the environment and climate in general.<sup>7</sup> It increases electricity consumption and contributes to the "urban heat island" effect, meaning that temperatures in urban areas are higher than in the countryside due to human activities.<sup>8</sup> Additionally, excessive use of air conditioning may make people more dependent on it. As a result, people become less able to handle the heat mentally and physically, therefore their vulnerability to higher temperatures will increase.<sup>7</sup>

## **1.2.Global response to the climate change**

The first global targeted action to address the risks of climate change has initiated in 1992 by the United Nations Framework Convention on Climate Change (UNFCCC).<sup>1</sup> The Convention united 197 countries that aimed to prevent the anthropogenic influence on the global climate. With the adaptation of the Kyoto Protocol in 1995, the Convention strengthened measures against climate change. Under the protocol, the UNFCCC developed country parties committed to intensively control and reduce GHG emissions.<sup>1</sup> The recent Paris Agreement (2015) further escalated and accelerated commitments to avert the rise in global temperature above 2<sup>0</sup>C and even limit warming up to 1.5<sup>0</sup>C compared with the pre-industrial levels.<sup>1</sup> Sustainable Development Goal (SDG) 13 focuses on combating climate change and its outcomes, emphasizing two priority approaches as measures against climate change: mitigation and adaptation.<sup>9</sup> With mitigation, the global community sets to reduce emissions of GHGs. Nations aim to adapt to changes taking place with climate change.<sup>9</sup>

In the context of climate change, resilience, adaptive capacity and vulnerability are used to characterize the human systems' ability to absorb, cope with and adapt to climate change stimuli.<sup>6,10,11</sup> According to the IPCC, adaptive capacity is defined as the system's potential to adjust to variations and extremities of the changing climate, to address the risks and deal with the opportunities.<sup>12</sup> The most commonly cited determinants of adaptive capacity are: 1) available and accessible human, financial and information resources, 2) appropriate institutions, and 3) strong networks between different sectors.<sup>13-15</sup> From another perspective, the determinants of the adaptive capacity are factors that can be involved in mitigation and/or adaptation processes.<sup>14</sup> Strong links between institutions engaged in climate change management will enhance the adaptive capacity of the system in general.<sup>16</sup>

According to the WHO, some of the health consequences of global warming are preventable if necessary proactive actions are taken.<sup>17</sup> The effectiveness of prevention mechanisms and tools, however, depend on the health care systems' preparedness. Preparedness means having trained staff, providing an appropriate health care and physical environment, and collaboration with meteorological early warning systems to provide timely public and medical advice. In addition, based on the literature and existing heat-health action plans, WHO highlights several core elements for the national projects to address the health risks of heatwaves, including the existence of an accurate and timely alert system, a heat-related

health information plan, particular care for vulnerable population groups and having a real-time surveillance and evaluation system.<sup>17</sup>

### **1.3.National circumstances**

Despite having a small territory (around 30,000 km<sup>2</sup>), Armenia has a very diverse topography that represents almost all types of climate.<sup>18</sup> Overall, Armenia has a continental, dry climate, with hot summers at low and medium altitudes, long and cold winters at higher altitudes.<sup>19</sup> The vast majority (around two-thirds) of Armenia's territory is located higher than 1000 meters above the sea level, mainly varying between 1000 and 2500 meters.<sup>18</sup> Altitudes higher than 2500 meters above the sea level have an average annual temperature of -8°C; average annual temperature is 12-14°C in regions at lower altitudes.<sup>19</sup>

Because of its geographic and climatic characteristics, Armenia is considered one of the most climate change sensitive countries in Europe and Central Asia region.<sup>20</sup> The health impacts of climate change became more apparent in recent years. Considering the climatic changes taking place, the health of the Armenian population will primarily suffer due to increased frequency and intensity of extreme weather events, aridification, and shifts in climatic zones.<sup>20</sup>

Armenia ratified the UNFCCC in May 1993, the Kyoto Protocol in December 2002, and the Paris Agreement in March 2017.<sup>21,22</sup> Armenia's commitment to global climate change measures is reflected in the Intended Nationally Determined Contributions (INDC): Armenia intends to contribute to the reduction of GHG emissions in agreement with the global targets and to take actions towards mitigation and adaptation using ecosystem approaches. The INDC acknowledges human health as a vulnerable sector in Armenia and prioritizes it in the adaptation efforts.<sup>21</sup>

Considering the vulnerability of Armenia to climate change the Government began planning for national climate change adaptation. Within the scope of the "National Adaptation Plan (NAP) to advance medium and long-term adaptation planning in Armenia," national consultations and stocktaking exercises are being conducted to provide qualitative assessments of the necessary capacities and institutional frameworks in priority sectors. Through the NAP process, the country will identify medium and long-term risks, set adaptation priorities, and plan specific activities to meet the goals of the Paris Agreement and 2030 Agenda for Sustainable Development. Through technical consultancies in six priority sectors (water resources, agriculture, energy, health tourism, and human settlement), the

project aims to identify and address the existing barriers and challenges in those sectors and assist the climate change adaptation initiatives.<sup>23</sup>

## **2. STOCKTAKING OBJECTIVES**

Avedisian Onanian Center for Health Services Research and Development (CHSR) of the Turpanjian School of Public Health (SPH), American University of Armenia (AUA) with financial support from the Green Climate Fund and United Nations Development Programme (UNDP) Armenia aimed to conduct a comprehensive stocktaking for the health sector in order to address existing barriers and support the prioritization of climate change adaptation investments in Armenia. The specific objectives of the study are:

- Identification and synthesis of climate change impacts on human health, vulnerability, and adaptation;
- Assessment of the capacity, gaps, and barriers in the health sector to identify areas that require strengthening;
- Make recommendations for successfully undertaking health adaptation planning in the country.

### **2.1.Methods**

To meet the study objectives, the study team utilized a cross-sectional *qualitative research design* through desk review and in-depth interviews (IDI). The key informants including policymakers and experts in the health sector, representatives from the national and international non-governmental organizations, representatives from different health determining sectors, national experts/consultants and others. Given the multifaceted nature of the risks of climate change, we approached experts from different sectors engaged in climate change and health adaptation activities (see Annex 1). Overall, the research team completed 15 IDIs.

The research team used a purposive *sampling* technique to recruit potential key informants. In addition, expert sampling and snowballing approaches were used to recruit other key informants.<sup>15</sup> To achieve a comprehensive understanding of the situation in the health sector, the research team continued the recruitment of key informants for qualitative interviews until reaching saturation, meaning reaching a point in the data analysis process when the data does not provide any new information and further data collection would only result in repetitive findings.

The research team developed a *semi-structured IDI guides based on the WHO Climate-Resilient Health System Framework*.<sup>24-26</sup> The capacities of health systems determine the effective monitoring, management, and adaptation to the health risks of climate change. In 2015, WHO adopted a framework to guide health systems to systematically and effectively promote adaptation to the health challenges of climate change.<sup>26</sup> The six core components of effective health systems are good leadership and governance, adequate health workforce, strong health information systems, availability of essential medical products and technologies, quality service delivery, and sufficient financing (Figure 1).<sup>26</sup>

As suggested by the framework, the guides consisted of sections based on the core components: service delivery, health workforce, information, medical products, vaccines and technologies, financing, leadership/governance. The guides were adapted for different groups of participants and were amended before/after each IDI, as needed. Overall, four guides were used in the assessment. The guides are presented in Annex 2.

*Data collection* consisted of a desk review and qualitative interviews, which were conducted simultaneously in spring/summer 2020.

Through the *desk review*, the study team reviewed available resources, important projects, and documentation to define where the Armenian health sector stands in terms of climate change adaptation activities. During the desk review, we reviewed and summarized available documents, including national communication reports, existing legal and policy documents, past and ongoing climate change adaptation measures undertaken by the Armenian Government. In addition, the CHSR team collaborated with the project partners, including UNDP/Armenia, the Ministry of Health (MOH) and other relevant agencies/institutions to identify documentation and materials.

Experienced CHSR researchers conducted *the IDIs*, which were audio-recorded with the agreement of the study participants. In case of refusal, a trained note-taker assisted the interviewer. The interviews were managed, transcribed, and analyzed using NVivo qualitative data management software.<sup>27</sup> The data was analyzed in Armenian and the findings were translated and presented in English. *Directed content analysis* guided the data analysis according to the WHO Climate-Resilient Health System Framework. The qualitative research findings were synthesized with the results from the document review.

The research team applied to the Institutional Review Board of the AUA for the approval of the study protocols prior to data collection (#AUA-2020-015).

### 3. POPULATION HEALTH

#### 3.1. Major health indicators

Armenia has achieved notable success in several focus areas of the third SDG goal, especially child health, prevention, and provision of universal healthcare for various infectious diseases, national immunization program, etc. In particular, Armenia has reached the SDG targets in terms of neonatal and under 5-year mortality. In 2018, neonatal mortality was 3.3 per 1 000 live births whereas the under 5-year mortality was 8.6 per 1 000 live births. Both values were significantly lower the highest recommended level of mortality by 4-5 times, respectively.<sup>28</sup> During several decades, the maternal mortality rate has experienced a gradual decrease reaching to the level of 25 deaths per 100 000 live births, which is lower than many countries in the region but higher than in the European Region.<sup>28</sup> Figure 1 demonstrates decreasing trends of neonatal, under 5-year, and maternal mortalities.

The coverage of the National Immunization Program is above 95% and is one of the highest in the European Region.<sup>29</sup> During recent decades, effective country-wide vaccination has enabled the control of various infectious diseases. In particular, no cases of polio, diphtheria, tetanus, and almost no cases of measles were observed during the recent years. The vaccination coverage in rural regions is slightly higher compared with the urban areas: 93% vs. 86%, respectively.<sup>29</sup>

In Armenia, Human Immunodeficiency Virus (HIV) is mainly concentrated in vulnerable communities such as drug users, migrant workers, men who have sex with men, and sex workers, however, the overall HIV prevalence is rather low.<sup>30</sup> According to the Joint United Nations Programme on HIV/AIDS estimates, the number of people living with HIV is approximately 3 500, with a prevalence rate among 15-49 aged adults 0.2 per 100 000.<sup>31</sup> Tuberculosis (TB) burden has been decreasing during recent years. According to the unpublished data of the National Pulmonology Center, the TB incidence and mortality have decreased by 2.2 and 3.2 times, respectively, between 2007 and 2018. However, the high prevalence of drug resistant TB remains an issue, as 20% of new TB cases and 44% of previously treated TB cases have drug resistance.<sup>32,33</sup>

The main causes of mortality in Armenia have generally remained the same between 1990-2018 with slight shifts in their placements in the list of top killer diseases (Table 1). The all-cause mortality rate in 2018 was 867 per 100 000 population with a higher share among males: 906 per 100 000 population vs. 814 per 100 000 population in females.



In concordance with the global tendency, the non-communicable disease (NCD) mortality in Armenia takes the biggest share with 93.0%. The circulatory system diseases (CSDs) and neoplasms continue to remain in the leading first two positions in the list of top causes of mortality in Armenia. The top causes of death for 2018 were CSDs accounting for 55.2% of total mortality, followed by neoplasms – 20.4%, diseases of the respiratory system – 7.7%, diseases of digestive organs – 4.7%, accidents, poisonings, injuries – 4.1%, endocrine system diseases – 2.3%, and other causes – 5.6%.<sup>34</sup> Trend of the main causes of deaths from 1990 to 2019 in absolute values are illustrated in Figure 2.<sup>35</sup>

Besides being among the top causes of mortality in the country, diabetes mellitus is also one of the main causes of living with disability. In 2016, the prevalence of diabetes among the population aged 15 and older was 2.6%. Fluctuating mortality rates from diabetes have been observed between 1990-2018; with the highest mortality of 48.8 per 100,000 in 2005. In 2018, the mortality rate reduced to 19.5 per 100,000 population.<sup>36</sup>

The profile of risk factors of most common causes of mortality remained the same between 1990-2017, with only minor changes in the rankings. As for 2017, the most vivid changes in the top risk factors of mortality concern child and maternal malnutrition which is currently ranked as 14<sup>th</sup> compared to 8<sup>th</sup> in 1990 and high body mass index (BMI) which has moved up by two spots to reach the fifth position. Currently, high systolic blood pressure, poor nutrition and dietary risks, high fasting plasma glucose, tobacco use, high BMI, high low-density lipoprotein cholesterol, and air pollution are leading risk factors for NCD mortality in Armenia. The level of overweight or obesity is the highest in the age group of 50-59 with a prevalence of 75.1%. Overweight or obesity is more prevalent among men in younger age groups, yet in the age groups above 40 years, it becomes more prevalent among women.<sup>28</sup> Physical inactivity (low-intensity exercise for less than 30 minutes weekly) is another behavioral determinant which in turn contributes to overweight and obesity. In all age groups of the Armenian population, physical inactivity is more prevalent among women. The prevalence of daily smoking men sharply increases in the age group of 20-29 (60.9%) and reaches the highest value of 68.0% in the age group 30-39. Among men 40 years and above, the smoking prevalence gradually decreases. The highest level of daily smoker women is documented in the age group of 40-49 with a prevalence of 3.6%. The proportion of people exposed to second-hand smoke during the last 30 days is rather high among women: ranging from 34.4% to 63.3% in different age groups.<sup>28</sup>

## **3.2. Burden of climate-sensitive diseases**

### **3.2.1. Infectious/communicable diseases**

The total share of deaths from infectious diseases among the most common causes of mortality in Armenia was 0.6% in 2019 and there is a slight decline in numbers over the recent years (Figure 3).<sup>35</sup>

After a century-long fight against malaria, in 2011 Armenia was certified as a malaria-free country.<sup>37</sup> Occasional malaria cases have been detected later, those were properly managed to prevent future outbreaks.<sup>38</sup> During 2012-2017, only 9 malaria cases were observed.<sup>38</sup> The latest cholera outbreak in Armenia was in 1998 when in one village 25 cases were reported.<sup>38</sup>

The total incidence of leptospirosis in Armenia was 4 cases during 2012-2017, with all being detected in 2014. The assessment of rodents showed that the positive cases of leptospirosis registered among rodents decreased by 1.5 times between 2015 and 2017.<sup>38</sup> Though during 2012-2017 only 14 episodic cases of tularemia were observed among humans, almost 95% of the area of Armenia is affected by a widespread and increasing trend of epizootic tularemia, imposing risk for transmission to humans as well.<sup>38</sup> During recent years, the highest incidence of anthrax was in 2012 and 2013 with 11 and 19 cases, respectively. During 2014-2017, the total number of cases was seven.<sup>38</sup>

Since 1999, new cases of visceral Leishmaniasis have been detected in Armenia. In the period of 2010 to 2014, 7 to 9 cases were observed, in 2016 and 2017 the new cases of the disease were 10 and 17, respectively. To understand the real scope of the disease, surveys were conducted in various regions in Armenia among children aged 1 to 5 years and dogs from the same territories. The study found that the morbidity of Leishmaniasis was higher in Syunik, Lori and Tavush marzes and in capital city Yerevan. Cases of the disease were also observed in Aragatsotn and Kotayk marzes between 2017 and 2018.<sup>38</sup>

The trends of incidence and prevalence of certain infectious and parasitic diseases are illustrated in Figure 4. During recent years the highest incidence and prevalence rates were observed in 2015 than a slight decline in numbers followed.<sup>35</sup>

The prevalence of acute intestinal diseases had been increasing during 2012-2015, with the highest number of 12,268 in 2015. However, the prevalence tends to decrease during recent years. The trends as rates per 100 000 population are shown in Figure 5.<sup>35</sup>

Statistics on some foodborne bacterial intoxications are also described in Figure 6 for the years from 2017 to 2019. Though there are cases of foodborne bacterial intoxications, none of the reported cases in 2018 and 2019 were fatal.<sup>35</sup>

The prevalence of acute upper respiratory tract infections is the leading one among climate-sensitive infectious diseases in Armenia. Figure 7, which illustrates the prevalence of acute respiratory infectious diseases, shows increasing trends in recent years.<sup>35</sup>

### **3.2.2. Non-communicable diseases**

The mortality rate of CSDs in 2018 was 478.6 per 100,000 populations with a 55.2% share in the overall NCD mortality. The proportions of mortality due to CSD nosologies are the following: ischemic heart disease, chronic and others - 24.6%, cerebrovascular diseases - 7.2%, hypertension – 4.0%, and acute cardiac infarction - 2.7%.<sup>28</sup> The mortality due to hypertension is significantly higher among women especially aged 70 and above: 84% vs. 67%. A similar pattern is true for ischemic heart disease mortality: 81% vs. 54%.<sup>28</sup> Figure 9 shows the mortality rates of CSDs per nosologies for the period of 1990-2019.

The recent data suggests that the incidence and prevalence of CSDs are increasing in Armenia. The increasing trends of incidence rates of CSDs per nosologies among the population aged 15 and above are presented in Figure 10.<sup>35</sup>

The share of chronic obstructive pulmonary diseases (COPD; including bronchitis, asthma, chronic pulmonary, and bronchiectasis) among the most common causes of death decreased during the recent years. In 2018 it comprised 1.5% of the main causes of mortality compared with 4.2% in 2016.<sup>28,39</sup>

The burden of mental health disorders in terms of their share in overall mortality is small (0.05% in 2018), however, the morbidity throughout several decades demonstrates a stable burden to the Armenian population. In addition, there is a slight tendency for increasing mortality from mental health disorders is also noticeable.<sup>28,39</sup> The trends in the incidence rate of mental and behavioral disorders per 100 000 population are presented in Figure 11 for the period of 1990 to 2019.<sup>35</sup>

### **3.3.Socio-economic determinants of health**

#### **3.3.1. Poverty**

According to 2018 data, 23.5% of the population in Armenia lives below the national poverty level. Among those living below the national poverty level, 1.4% were extremely poor, 9.2% were moderately poor (excluding the extremely poor) and the remaining 15.1% were just poor. In 2016, in urban areas, the poverty rate was about 28.8% while in rural areas was 30.4%. A larger difference was encountered between the capital Yerevan, which has the lowest poverty rate in the country (24.9%), and other urban communities of the country (33.2%). The income earned by rural population in Armenia is predominantly generated through agricultural production.<sup>40</sup> Hence, the poverty level in rural areas mainly depends on the agricultural growth.<sup>41</sup>

The poverty indicators in Shirak, Kotayk, Lori, Tavush, and Armavir regions were higher than the country average. The highest poverty rate in the country in 2017 was recorded in Shirak region, where 44% of the population was below the poverty line.<sup>41</sup>

In 2017, the poverty rate was higher in children aged 15-17 years compared to other age groups.<sup>41</sup> Households with three or more children aged 6 years or less had 1.9 times higher poverty risk (49.6%) than the national average, as well as higher than the households with fewer children. People with higher education were less likely to be poor. Unemployment increased the likelihood of being poor or extremely poor.<sup>41</sup>

The economic growth has had a huge impact on reducing the poverty rates of the country. Government policy programs have forecasted the poverty rate to decrease by 18% by 2022. Nonetheless, the current poverty status of the country is concerning.<sup>40</sup> Reaching this goal might be delayed by the economic loss due to the COVID-19 pandemic and the war.

One of the most common factors affecting equity in terms of accessibility and utilization of healthcare services is the patients' ability to pay, regardless of health needs.<sup>42</sup> Despite the slight variation of perceived health status between various socio-economic groups (10.0% of the non-poor, 8.8% of the poor and 12.6% of the extremely poor population reported about bad health status in 2017)<sup>41</sup>, there is a large discrepancy in the utilization of healthcare services between poor and non-poor population while experiencing certain health concerns. Early Social snapshot and poverty assessment has showed that of those who have reported being sick and approached a doctor, 41.6% were non-poor, 30% were poor and 24.1% were

extremely poor. Self-treatment and lack of finance were the main reasons for not approaching primary healthcare (PHC) facilities as of the recent Social snapshot and poverty assessment 2018.<sup>41</sup> The reasons reported for not visiting PHC facilities were mostly the same in Yerevan, other urban centers and rural areas. However, the lack of finance in rural areas was reported more frequently (25.5% vs 18.7% in other urban centers and 17.1% in Yerevan). In 2017, impaired accessibility and utilization of outpatient and inpatient healthcare services were largely explained by prevailing informal out of pocket payments (OOP) to compensate low public spending on health, formal high OOP to co-pay the services included in the basic benefit package (BBP), direct payments for services not included in the BBP, as well as poor quality of PHC services leading to self-referrals for inpatient and emergency care. In fact, in 2017 non-poor patients made on average 3.4 times higher expenditures in the PHC facilities compared with poor patients.<sup>41</sup> In addition, of those who sought for hospital care, 5.5% made direct payments to the medical personnel and 0.9% made expenses for gifts.<sup>41</sup> According to the Integrated Living Condition Survey (ILCS) of 2017, health expenses comprised 0.3% (AMD 67) and 0.1% (AMD 5) of poor and extremely poor households, respectively, in contrast to 6.2% (AMD 3,329) in case of non-poor households.<sup>41</sup>

### **3.3.2. Nutrition**

According to the Armenia Demographic and Health Survey 2015-2016, pre-school (under five) children in Armenia face many nutritional problems, including high rates of both stunting (9.4%) and overweight (13.6%). The same report shows that the stunting levels decreased twice over the last 5 years but the factors influencing the disease rates did not improve.<sup>30,43</sup> High rates of stunting (12.7%) were also addressed in a study conducted in 2013 among under five year old in Talin region, Aragatsotn marz, Armenia.<sup>44</sup> Stunting rates were almost double the national average in Aragatsotn and Shirak; the overweight rates were almost three times higher in Ararat and anemia rates among women and children in Gegharkunik were high.<sup>43</sup>

In 2016, the prevalence of obesity in Armenia was 22.3%.<sup>39</sup> The obesity was more prevalent among women compared to men: 25% vs. 14% in the 18-69 age group, 12% vs. 5% in the 18-44 age group and 45% vs. 24% in the 45-69 age group. The prevalence of overweight was 29% of the Armenian population and it was increasing along with an increase in the age groups: 13% vs. 74% in 15-19 and 50-64 age groups, respectively.<sup>39</sup> The prevalence of obesity and overweight were one of the highest in the WHO European Region.<sup>45</sup> In children

and adolescents excess body weight was also an issue (among adolescents aged 15 years - 15% of boys and 6% of girls). Both in Yerevan and the regions as well as in urban and rural areas the problem of excess body weight was comparable.<sup>46</sup>

### **3.3.3. Gender**

Despite the efforts of the Armenian government in recent years to reduce gender inequalities in the country, there are still remaining issues. Gender inequalities are still socially tolerated, which is more prominent in rural areas of the country.<sup>47</sup>

Evidence suggests that the potential for women to contribute to the Armenian economy is significantly unused.<sup>48</sup> In 2017, Armenia ranked 55<sup>th</sup> among 160 countries in the Gender Inequality Index (GII). Reproductive health, empowerment, and economic activity are the three dimensions of the GII developed by the UNDP. It represents the loss of human development due to gender-based inequalities in mentioned dimensions: the lower the score the higher the level of equality between men and women. The GII score of Armenia (0.262) is lower compared to Europe and Central Asia (0.270). The lower score is explained by the number of seats in the National Assembly (18.1%) and the higher proportion of women with at least secondary education (96.9%). Labor force participation of women is 49.6% compared to 69.9% for men.<sup>49</sup> There is also a significant gender pay gap as women's average monthly wages are about 65.9% of men's average earnings.<sup>47</sup> Due to male labor migration about one third (27.2%) of rural households are headed by women.<sup>47</sup> Women have greater responsibilities for various domestic activities and agriculture labor, therefore natural disasters makes them more vulnerable to climate change. An assessment conducted by the Asian Development Bank in 2019 in Armenia revealed that women have fewer resources to recover from the consequences of natural disasters, which is one of the reasons that women are more vulnerable to climate change and also need to be actively involved in disaster risk reduction activities and programs. Women represent more than half (56.0%) of the poor and the evidence shows that female-headed households are more likely to live in extreme poverty (29.2%) compared to the households headed by men (24.4%).<sup>50</sup> One of the reasons behind this is that women have limited income opportunities in rural areas and there is a gender pay gap.<sup>47</sup> Armenia enhanced social protection to address the described inequalities and reduce the poverty level especially for a household headed by single women, however, continuous efforts are needed to close the gap.<sup>50</sup>

The evidence suggests that compared to men, women in both urban and rural areas are more likely to describe their health as good or very good (49.8% vs. 42.3%, respectively). Additionally, women in urban areas are more likely to describe their health as good or very good compared to rural areas (50.9% vs. 48.1%, respectively).<sup>51</sup>

Domestic activities are mainly the responsibilities of women which makes them the major users of water in households. This makes them vulnerable to the restrictions of water access. A study indicated that women in rural areas spend more time on domestic activities (6 hours 6 minutes per day) compared to urban women (4 hours 53 minutes per day), and about three times more compared to rural men (2 hours 37 minutes).<sup>47</sup> In rural communities, where the household have less access to domestic appliances such as washing machines and dishwashers, unavailability of constant water supply adds an extra burden on women's workload, as they are also responsible for fetching water.<sup>47</sup>

There is also a gender imbalance in terms of accessibility to and utilization of transportation. Especially in rural areas, where women rarely drive cars, they mainly depend on their husbands to accessing transportation. The limited access to transportation also means that women are dependent on their husbands to access health services, especially in rural areas.<sup>47</sup> The number of women car owners is increasing in Armenia; however, it is happening mainly in urban areas and especially in Yerevan. The transportation issue might hinder women's opportunities for income generation. A research conducted by the Asian Development Bank concluded that women in rural areas have limited access to markets, learning opportunities, and businesses not only due to limited physical mobility but also due to social norms.<sup>47</sup>

Another gender inequality that exists in rural areas of Armenia is the limited participation of women in decision making both at household and community levels. In households, women are mainly involved in smaller decisions not involving significant issues. Similarly, at community level, the main decision-makers are men, which is more socially accepted. Women are rarely elected as community leaders. These perceptions and social norms affect women's access to political positions and participation in public life.<sup>47</sup> However, their participation is crucial at all level decision-making activities to avoid gender biases and inequalities. Additionally, the involvement of women in disaster risk reduction and climate change adaptation measures and activities has a potential to decrease their vulnerability to climate change and increase their empowerment.<sup>50</sup>

### 3.3.4. Population structure

As of January 1, 2019, the de jure population of the Republic of Armenia was 2 965 300 people.<sup>52</sup> In 2019, the share of the urban permanent population was 63.9%, and the rural population was 36.1% of the total. The largest cities of the country are Yerevan (1 081 800), Gyumri (113 500) and Vanadzor (78 400), comprising 43% of total Armenian population.<sup>52</sup> Over the recent years, in the Armenian population, the proportion of women increased from 49% in the 1920s to 53% in 2019.<sup>52</sup> In urban population, the share of women was also higher (53.6%) compared to rural population (50.8%).<sup>52</sup>

In line with the global target of ensuring health and well-being for all, during the last almost thirty years of independence, Armenia has passed a long way to moving forward to the third SDG goal and its targets of improved reproductive, maternal, newborn and child health; prevention and treatment of infectious diseases and NCDs and enhancement of the healthcare system.<sup>53</sup> Various health indicators such as demographic characteristics, disease morbidity and mortality, behavioral risks describe the population health structure and outline the potential for the prevention of major health challenges.<sup>28</sup> During several decades, Armenia faces alarming changes in its demographic structure.<sup>28</sup> The Armenian population is aging with a proportion of population 65 years and above is 12.8%. This value exceeds the threshold of the aging population by 5.8%.<sup>28</sup> According to projections, in case of the absence of effective interventions to address the issue of population aging in Armenia, in 2050 the proportion of 65 years and above population will reach 22-23%.<sup>28</sup> Evidence shows that the issue of population aging is comparatively higher in marzes Tavush, Lori, Vayots Dzor, and Yerevan.

Reduced proportion of the 0-14 age group by 1.5 times has also contributed to a distorted population structure.<sup>28</sup>

An increase in fertility and a gradual decrease in mortality are determinants of natural increase and population growth and therefore are contributing factors of a balanced population structure. Armenia, however, faces a distressing trend in the fertility (cumulative birth), as the fertility rate has dropped to 1.6 becoming the lowest estimate in the region, far crossing the simple reproduction threshold of 2.15.<sup>28</sup> Luckily, Armenia is a leading country in the region experiencing a steady increase in the life expectancy surpassing Georgia. In 2018, the overall life expectancy was 75.9 years with a slightly higher value among women compared to men (78.7 vs 71.9 years) (Figure 12).



However, growing life expectancy contributes to a more skewed ratio of old to the young population. This may eventually result in adverse effects in terms of impaired economic prosperity and increased burden on the healthcare system, as it is known that along with the individual level aging, the incidence and prevalence of NCDs tend to increase.<sup>28</sup>

### **3.3.5. Access to water, sanitation and hygiene**

The Armenian Constitution, laws, and regulations outset the right to safe drinking water and sanitation for all.<sup>54</sup> Armenia has rich water resources. From 10.2 billion cubic meters of water per year on average, 2.4 billion is used for drinking purposes.<sup>54</sup> In 2017, 97.3% of households in Armenia had access to drinking water. Similarly, in 2015, the majority (98.1%) of the Armenian population had access to drinking water: 99% and 97% in urban and rural areas, respectively.<sup>55</sup> The border villages suffer water shortage much more than the rest of the country.<sup>56</sup> About 96% of drinking water is groundwater drawn through boreholes, wells, and springs. All the residents of the capital, Yerevan, and about 95% of other urban residents are connected to centralized water services. In spite of Armenia's good quality water, as of 2011, water delivered to consumers often failed to meet the WHO microbiological standards for water due to the negligence of disinfection facilities, inadequate water pressure due to outworn pumping stations and poor management of utilities. Moreover, bigger urban centers experienced delivery and quality shortfalls that usually caused secondary contamination.<sup>54,57</sup> By 2017, the quality of drinking water in Yerevan was reported to be high due to high-quality groundwater resources.<sup>57</sup>

As of 2015, the majority of the Armenian population (76.6%) had access to safely managed sanitation services, including a hand-washing facility with soap and water. Access to sanitation is considerably better in urban areas (96.1%) compared to rural areas (48.6%).<sup>55</sup> However, in most schools and kindergartens of Armenia, the sanitary-hygienic conditions of toilets, hot water, as well as means of using drinking water are insufficient.<sup>58</sup> A study conducted in 2019 showed that in randomly selected 121 public schools and 80 kindergartens the WHO recommendations on sanitation were not met. The majority of schools (86%) and kindergartens lacked hot water for appropriate sanitation.<sup>58</sup> Currently, Armenia does not have appropriate bathroom sanitation regulations and standards. To fill the gap, the My Step foundation currently implements a project aiming to localize and consolidate hygiene and sanitation standards in public schools.<sup>59</sup>

### 3.3.6. Access to and availability of energy sources

The main sources of energy that are traditionally used in Armenia are oil, natural gas, nuclear energy, hydropower, and coal.<sup>60</sup> Armenia's primary energy resources cover only 8.3% of the country's total fuel and energy needs.<sup>61</sup> To meet its energy consumption needs, Armenia mainly relies on electricity and gas. The country primarily depends on imported natural gas, which is accounting for 59% of Armenia's total primary energy supply and 82% of the consumption of fossil fuel. The deliverability of the gas is quite high in the country (nearly 95%).<sup>38</sup>

The high proportion of energy in the country is being used for heating. Armenia's heating season is quite long and, in some regions, winter is quite severe. As a result, heating expenses take quite a big portion of households' budgets. Considering the socio-demographic peculiarities, housing conditions and other thermo-physical characteristics of buildings the heating options of households differ. However, the heating options mainly depend on the income level of households.<sup>62</sup> A survey conducted in Armenia to explore the overall picture of residential energy consumption showed, that natural gas was the main source of energy used for heating purposes in the country in 2014-2015 (51%).<sup>62</sup> It is twice less expensive as a heating source than using electricity.<sup>38</sup> According to the same survey, the latter was used by 13% of households. Mainly small households used electricity for heating purposes and in most of the cases (70%) heated the house partially and the temperatures were below 19 degrees.<sup>62</sup> The use of natural gas was more prevalent in urban areas: about 72% and 60% in Yerevan and other cities, respectively. Rural areas (67%) and individual houses (53%) were mainly heated using wood. In comparison, biofuel was one of the sources used for heating (up to 15%) in colder areas. Overall, about 10% of households used biofuel as the primary source of heating in villages.<sup>62</sup> The smoke emissions of biofuel are known to have negative health consequences and are an important source of indoor air pollution. Most frequently, women who are responsible for cooking in the households and children are more affected. Biofuel smoke exposure is associated with reduced birth weight, early childhood mortality and acute respiratory infections.<sup>63</sup> Additionally, it can affect nutritional status of children and physical development increasing the risk of anemia and stunting.<sup>63,64</sup>

Similarly, for heating water natural gas was the most frequently used option (72%), followed by electricity (16%) and wood (10%). Households mostly used gas stoves for cooking purposes (63%).<sup>62</sup> The survey indicated, that fewer households (5%) use air conditioners; it is

used more in Yerevan (10%) and on average households used for four hours per day during the summer season.<sup>62</sup>

### **3.3.7. Access to transportation**

Armenian transportation model consists of a few railway lines and an extensive road network.<sup>65</sup> Even though the rate of private car ownership has been increasing at a steady pace during the recent years, it was relatively low. The distribution of registered vehicles in Armenia in 2010 was as follows: light four-wheeled trucks 83%, buses 12%, heavy trucks 5%. Public transport plays a critical role, especially in cities. Armenia's severe climate with low temperatures and heavy snowfall is one of the biggest issues that interferes with transportation.<sup>65</sup> The capacity of the transportation network is considered adequate for meeting the estimated demand of the country up to 2020, however, lack of funds hindered its further development.<sup>65</sup> In recent years, the government is prioritizing rehabilitation and reconstruction of the transportation infrastructure.

In Armenia, the number of cars per 1,000 population was 145 in 2017, whereas the car property index was comparable with similar countries: 155, 124, and 155 in Georgia, Albania and Republic of Northern Macedonia, respectively.<sup>66</sup>

In the context of transportation, the term accessibility implies the easiness of utilization of various services through urban and rural transportation infrastructures including public transport.<sup>66</sup> Various factors determine accessibility and utilization of transportation. One of the important ones, also a determinant of sustainable development, is the quality of roads. Some reports suggest that 66% of the Armenian population lives in areas with close access to good quality roads (within 2km). Yet, in 2017, 610 000 people did not have access to good quality roads during severe weather conditions. In rural communities, the proportion of good quality roads over bad ones is the highest in Kotayk and Armavir marzes.<sup>66</sup> Since 2018, the government has made road reconstruction as one of its top priorities. According to the Ministry of Territorial Administration and Infrastructure, in 2019, 335 km of roads in Armenia were reconstructed. In 2020, further 500 km roads are planned to be repaired.<sup>67</sup> In terms of physical accessibility, most of the population in rural areas lives within 30 minutes from the towns of 15,000 people. However, regular public transportation system has various drawbacks that need systematic solutions. Not all the communities are covered by the transportation network. In 2019, there were about 153 interregional and 263 intraregional

routes serving 682 communities in Armenia. About 220 communities in 2019 still lacked access to regular transportation services.<sup>68</sup>

The condition of roads and transportation network does not seriously affect accessibility of healthcare facilities, as nearly in all regions of Armenia, the geographic distribution of healthcare facilities is even with at least one healthcare facility in every community. The time needed to reach the closest healthcare facility ranges from 10-17 minutes.<sup>66</sup> Health services availability and access are the least in Shirak marz, but even in this region the time needed to access the primary health post is about 17 minutes at most.<sup>69</sup>

The ILCS of 2017 showed that 75.1% of households residing in rural communities reported about having healthcare facility within 1 km from their place of residence and only 1.1% of households reported about having a healthcare facility more than 10km away.<sup>41</sup>

Monitoring of public transportation in two marzes (Vayots Dzor and Syunik) has identified a high rate of dissatisfaction with the quality of public transportation and respective recommendations were proposed for improving its accessibility.<sup>70</sup>

Though the Government of Armenia have numerously strategized the improvement of accessibility to transportation in urban and rural areas as a pledge for socio-economic development and particularly for improving the accessibility to healthcare services, no specific linkage was ever made with the climate change health adaptation.<sup>68,71,72</sup>

### **3.3.8. Access to private and public open space**

The availability of open green spaces is important for different vulnerable groups such as children, pregnant women, disabled or older age people. It has a critical role in sustainable development and health adaptation. It also has a big role in the mental health of the population.<sup>73</sup> Open green spaces are an extremely important architectural solution for any community, generally contributing to physical and social activities, healthy lifestyle and wellbeing of the general population.<sup>74</sup> The availability of green spaces is linked to better self-reported general health, mental health, and quality of life, as well as lower number of respiratory illnesses.<sup>73</sup>

Similar to many parts of the world, the urban areas of Armenia often lack proper access to open and green spaces, which itself has an impact on population health, more severely affecting children. Moreover, children from poor households are more disadvantaged.

Access to open and green spaces, first of all, corresponds with access to clean air, which is one of the fundamental human health rights. Nevertheless, green and agricultural areas in Armenian communities affected by mining and smelting have high levels of heavy metal contamination, resulting not only in air pollution, but also poorer food and water quality.<sup>75</sup> Rapid urbanization and dense building construction is not only affecting the availability and access to clean and green spaces, but also negatively interferes with the natural self-purification of air.<sup>74,75</sup>

In general, there is a lack of green areas in Armenia and there is also a risk of losing the existing green areas.<sup>76</sup> Scientific data on the availability of green spaces in Armenia are limited, and the available resources are mainly concentrating in the capital Yerevan. Historically, Yerevan was designed with a big proportion of open green spaces contributing to the unique ecosystem of the city, though recent decades have shown a drastic decrease in those spaces as they were used for urban constructions.<sup>74</sup> Nevertheless, the efforts towards recovering the green areas of the city have been successful in recent years and the proportion of green areas increases in the city. In 2015, green areas of Yerevan covered about 6,760 ha, which is about 30% of the total area of the city. This number covers all kinds of green vegetation and includes both public and private spaces.<sup>57</sup> However, the standard ratio per inhabitant stands at 7.6m<sup>2</sup>, which is an indicator of green space situation and currently, is below the WHO recommended minimum value of 9.0m<sup>2</sup>.<sup>57</sup>

According to key informants, the health sector in Armenia is not involved in the monitoring of public and private open and green spaces and does not have data on its availability and accessibility despite its high importance for climate change and health: *“I do not know how to do a monitoring, I do not know what to compare with what.”* [Expert 15].

## **4. CLIMATE CHANGE AND HEALTH IMPACTS**

### **4.1. Climate change in Armenia**

#### **4.1.1. Observed climate change in Armenia**

Temperatures are increasing in Armenia, similarly to the rest of the world: in the period 1929-2016, the average temperature increased by 1.23°C, changing more drastically in recent years (in the period 1929-1996, the increase was 0.4°C, in the period 1997-2007, it was 0.85).<sup>19</sup> In addition, in the period 1935-2016, average precipitation decreased by 9%, of which 3% was estimated for the period 1996-2016.<sup>19</sup>

Armenia has experienced ecosystem damage in the form of desertification, drought and land degradation.<sup>77</sup> Similar to other countries, climate change results in hotter and drier summers, reduction in river flow and more frequent extreme events (e.g. hot dry winds, droughts, hail and spring frosts); these events affect vulnerable agriculture, natural ecosystems and biodiversity, infrastructures (e.g. transportation routes (roads, highways and railways) and homes, buildings, communication networks), and water resources.<sup>18,77</sup>

Particularly, in the period 1935-2016 the climate in some regions such as the north, south and central parts of Armenia became drier, while in some regions there was an increase in precipitations. Those regions are Shirak plain, the Lake Sevan basin and the Aparan-Hrazdan regions.<sup>38</sup>

Climate change also resulted in a significant change in the frequency and intensity of *natural disasters*. Compared to the period of 1961-1990, when 168 cases of natural disasters were observed, over the period of 1975-2016, the overall number of natural disasters increased by 40 cases.<sup>38</sup>

Flooding is one of the frequently observed disasters in Armenia. It affects nearly 40 000 people yearly.<sup>78</sup> The climate change also resulted in an increase in the number of days with strong and very strong droughts in recent years: in the period of 2000-2017, those days increased by 33 compared to the average for the period of 1961-1990. In recent years a drier climate was also observed in the mountainous regions of the country.<sup>38</sup>

Droughts are also one of the frequently observed disasters in Armenia. In 2000, droughts seriously affected nearly 297 000 people in the country by creating agricultural, food security, and drinking water availability issues.<sup>79</sup>

Other natural disasters representing a risk for the Armenian population are landslides and mudslides. About 35% of the population lives in regions that are under the risk of landslides and mudslides. Those occur in more than 100 communities in Armenia and affect hundreds of residential buildings, communications and road infrastructures, and other vital structures.<sup>79</sup>

It is estimated that about 15-17% of Armenia's agricultural areas are affected by hailstorms, and 368 villages are located in dangerous areas subject to hailstorms. The maximum number of hailstorms occurred in the Shirak plain, while the highest number of heavy rainfalls were observed in Tashir and Ijevan regions.<sup>79</sup>

A high number of frosts occurred in the Ararat valley and foothill areas.<sup>38</sup> Strong winds and storms also occur in Armenia, however their impact on the population and infrastructures is not well documented.<sup>79</sup>

#### **4.1.2. Projected climate change in Armenia**

Climate change projections in Armenia were estimated under two scenarios. The first scenario assumes average temperature is projected to increase by 1.3°C by 2040, 2.6°C by 2070 and 3.3°C by 2100, while the second scenario projected temperature to increase by 1.7°C, 3.2°C and 4.7°C, respectively.<sup>18</sup>

Precipitations are projected to decrease by up to 2.7% by 2040, 5.4% by 2070, 8.3% by 2100 compared to the annual average (592mm) of the period of 1961-1990. However, due to high variability and precipitations and various affecting factors, the precipitation assessment is challenging.<sup>38</sup> In the near future (2011-2040), summer rainfalls are expected to decrease by 10-23%. In 2050, summers will be significantly drier compared to nowadays and the number of consecutive dry days will increase by 7-11%. On the other hand, the frequency of extreme rainfall is also expected to increase by 22-32% by 2050.<sup>38</sup>

Along with the expected changes in temperature and precipitations, it is also expected that extreme events will occur more frequently resulting in higher temperatures, longer droughts, frequent flooding, landslides, and others. Thus, it is projected, that climate change will have negative effects on different climate-sensitive sectors such as water resources, agriculture, energy, ecosystems, settlements and infrastructures, tourism, as well as human health in Armenia.<sup>38</sup>

### **4.2. Climate related health impacts in Armenia**

#### **4.2.1. Known health impacts in Armenia from observed climate change**

According to the 4<sup>th</sup> National Communication Report, there is an increase in the incidence of cardiovascular and respiratory system diseases as a result of climate change and atmospheric air pollution in Armenia.<sup>38</sup> This negative impact of climate change and atmospheric air pollution is particularly concerning in urban communities. This is related to the impact of particulate matters (2.5 micron or smaller), which can lead to cardiovascular, respiratory system and oncological diseases. A preliminary study results indicated a very weak correlation between the mortality rates and the average annual air temperature.<sup>38</sup>

In 2012, a study was conducted in Armenia to explore the hygienic peculiarities of climate change and its impacts on the health of the population in Armenia.<sup>80</sup> In the scope of the study, the average daily air temperatures and extreme weather events and heatwaves in Yerevan between 2004 and 2007 were examined and compared with the mortality rates and causes of deaths with a focus on cardiovascular diseases (CVDs). Most frequently daily average temperature shifts were observed in winter and spring months, suggesting that this period is the most unfavorable for the population in terms of frequency and intensity of CVDs. The results indicated, that 31.4% and 25.9% of ischemic heart disease deaths and 30.4% and 27.6% of acute myocardial infarction deaths occurred in winter and spring months, respectively. The lowest number of deaths from these diseases was observed in summer and fall.<sup>80</sup> A similar picture was observed in the statistics of deaths from diseases of the respiratory system and genitourinary system. Mortality from endocrine system diseases was the highest in winter, and from diseases of the digestive system in winter and summer. While exploring the mortality rates and causes of deaths in the hottest month (August 2006) of that period, the study found that there was a significant increase in the following cases: ischemic heart disease - by 25%, gastrointestinal diseases - by 88%, respiratory diseases - by 70%, accidents, injuries, and poisoning - by 54%. The study concluded that the extreme heat of August 2006 caused 143 additional deaths.<sup>80</sup> However, we cannot comment on the methodology this ecological study used to make this estimation of additional deaths.

A study was conducted in Armenia to assess the risk of malaria in the country as an impact of climate change. The presented data showed that a rise of air temperature was expected in Armenia, which could result in significant growth of vulnerability of some of the regions in terms of malaria. It was concluded that compared to other regions the rise of the temperature would be significant in the western and central regions, especially in the Ararat valley.<sup>81</sup> Currently, only unique and imported cases of the disease are registered in Armenia; these cases did not become rooted and indigenous.<sup>38</sup>

#### **4.2.2. Projected health impacts in Armenia**

The main health impacts of climate change were studied and projections discussed in four National Communication reports to the UNFCCC (in 1998, 2010, 2015 and 2020). Each report summarizes the priority health outcomes sensitive to climate change and the , corresponding adaptation measures to manage possible adverse risks.<sup>18,82,83</sup> A national climate change vulnerability assessment was also discussed in a report prepared by the



Armenian Red Cross Society in the scope of the “Climate Forum East” project.<sup>20</sup> In 2016, another report on climate change and health policy analysis was prepared in the framework of the mentioned project aiming to find out the main issues the Armenian healthcare system would face in the context of climate change and assist climate change policy development for the protection of public health. The project made some recommendations for the national policy in the context of climate change, which should ensure the medical-biological safety and safe environment for all and should be prioritized in all areas of economic and legal developments.<sup>84</sup>

Climate change is expected to have direct (accidents due to extreme weather events) and indirect impacts on the health of the Armenian population (due to changes in temperature and precipitation, as well as increasing population of carriers and transmitters of different infectious-diseases).<sup>18</sup>

Human health vulnerability assessments in the referenced reports showed that climate change will lead to increase in the burden of diseases that are already significantly affecting general health of the Armenian population as discussed earlier. Trends of *CVDs* are going to be affected due to more extreme weather conditions (low and high temperatures) and volatility of atmospheric pressure.<sup>18</sup> Although morbidity and mortality rates from *CVDs* are higher in winter and spring seasons,<sup>18</sup> increases in the frequency and length of projected heat waves are likely to contribute to even higher rates.<sup>20</sup> The risks are considerably high among the vulnerable groups of populations, such as older age citizens. Patients with *CVDs* and central nervous system diseases are the most vulnerable groups to climate change, followed by the patients with asthma and allergic diseases.<sup>18</sup>

The warming climate may also increase the risk of a range of communicable diseases because of the establishment of more favorable conditions for various infectious diseases’ transmitters and therefore enlarging the transmitters’ habitats.<sup>18</sup> Higher rates of *vector-borne diseases* are expected, such as cholera, malaria, acute intestinal infections and others. Using empirical-statistical methods, it was projected that the probability of *cholera* outbreak would increase because of an increase above the threshold of consecutive days with high air temperatures. Even though the last cholera outbreak occurred in late 1998, the causative agent of the disease is still present in rivers and lakes.<sup>20</sup>

Starting 2011, Armenia has been considered a malaria-free area. Increasing temperatures are projected to increase the likelihood of the re-emergence of *malaria*.<sup>81</sup>

High temperatures with climate change are projected to increase the risk of several dangerous infectious diseases carried by ticks and mosquitoes (*i.e. Tyagin fever, West Nile fever, Sydney fever, and Crimean-Congo fever Western tick-borne encephalitis*) in neighboring countries, along with the risk of spread into Armenia.<sup>18</sup>

Climate change is also projected to increase the morbidity rates of *acute gastrointestinal diseases and upper respiratory infections*. The incidence of gastrointestinal diseases doubled between 2000-2004.<sup>18</sup>

Climate change also can create unfavorable living conditions for some animals (carriers of diseases such as mice that transmit *plague and tularemia*) that could result in decreased risk of disease transmission.<sup>18</sup>

As few cases of *anthrax* are detected in Armenia and spores of the vectors survive up to 150 years in the environment; it is expected that more cases of anthrax are possible in the future.

Agriculture is one of the highest climate change sensitive segments. Livestock production can be directly (the influence of temperature increase on animals) and indirectly (the impact on disease spread) affected by changes in temperature. Climate change related transitions could result in severe changeability in the quality and quantity of livestock production such as meat, milk, wool as well as water resources.<sup>18</sup>

It is important to mention that the most vulnerable groups to infectious disease are people residing in rural areas and those who are directly involved in natural landscapes and products.<sup>18</sup>

*Children* are one of the vulnerable groups for climate change. The United Nations International Children's Emergency Fund (UNICEF) Armenia office in collaboration with the UNICEF headquarters, published a report in 2018 summarizing the impact of climate change and its consequences on children in Armenia and provided recommendations for risk minimization.<sup>85</sup> A variety of climate conditions in the country, such as extreme weather events, desertification, decreased precipitations and increased average temperature already negatively affect children's health. Extreme weather events are more severely affecting agriculture-dependent rural communities and therefore, children living in rural communities. Indoor pollution in houses and schools is another issue of concern affecting children's health. Further climate change-related transitions might worsen the impact on children health if no proper interventions are taken. UNICEF made recommendations for different affected

sectors, including health, nutrition, disaster risk reduction, water and sanitation and education. Health-related recommendations included supporting further investigation of indoor pollution and toxic metal contamination impact on children's health, therefore enforcing evidence-based decision making at a governmental level in collaboration with relevant organizations.<sup>85</sup>

With higher temperatures in the summer season, the population in Armenia is becoming vulnerable to *heat waves*, causing excess morbidity and mortality.<sup>20</sup> In recent years, the number of hot days and heat waves increased across the entire territory, especially in Yerevan city and Meghri town.<sup>20</sup> In Yerevan, this was also linked to the "urban heat island".<sup>8</sup> In lower elevations, heat waves are more variable. Increased frequency of heat waves is expected to lead to higher mortality rates from a range of heat-related health conditions, including CVDs, obstructive chronic pulmonary diseases, accidents, injuries, and poisoning.<sup>20</sup> Air pollution may increase the impacts of higher temperatures, therefore urban areas in Armenia are more vulnerable.<sup>18</sup>

According to the Third National Communication, Vayots Dzor is one of the most vulnerable regions in Armenia because of the continuous increase in temperature. Children and older people are highly vulnerable to the spread of infectious diseases, exacerbation of NCDs, and injuries and death caused by extreme weather changes. Coping mechanisms developed in this region include free outpatient medical assistance for all since 2006, and the extension of the community and neighborhood drinking-water supply network by 15% in 2010. Specific activities under the direct responsibility of the MOH in Vayots Dzor, as part of the Adaptation Action Plan, include research and monitoring for sanitary and infectious-diseases, provision of proper conditions for medical assistance and trained medical staff in all communities, as well as the strengthening of the preventive veterinary systems. All these activities aim to prevent the spread of infectious and animal diseases.<sup>18</sup>

Certain communities in the Lori region faced increased frequency of water related disease outbreaks in the period of recent years as a result of inadequate water quality and lack of chlorination.<sup>86</sup> Lori region vulnerability assessment towards climate change planned construction and operation of a water chlorination station. Through water chlorination the activity aimed to decrease the health and various pathogenic bacteria infection risks of people living in the communities. Another challenge imposed by climate change on the specific communities of Lori region is spring and fall floods harshly imperiling water lines being

constructed with asbestos pipes. The vulnerability assessment planned reconstructing the riskiest part of the community's water line to improve its stability and security level.<sup>86</sup>

#### **4.2.3. Gaps in climate change health vulnerability assessments in Armenia**

Key informant opinions on the climate change vulnerability assessment included in the National Communication Report diverged. Some experts considered them quite comprehensive and in line with the international standards: *“If you look at the reports [national communication reports] of different years, you will see how much it has improved. It has expanded its scope to include all [health] issues... In my opinion, it is in line with the latest WHO guidelines, there is nothing that is not included in the report. There are even issues which are not studied well, however, even those are partially included.”* [Expert 15]. However, other experts identified some gaps. Some experts expressed a concern that the existing assessments were not based on evidence-based methodology, which only allowed to identify and describe some potential health issues, without conducting a risk assessment: *“We identified issues, but no solutions were offered there [in the national communication reports]. There was not even a risk assessment methodology as such. We just described, it was a descriptive analysis, not a risk analysis.”* [Expert 9]. According to an expert, the potential reason for not having a comprehensive health vulnerability assessment could be the absence of evidence base and comprehensive research studies in Armenia: *“To make more evidence-based suggestions, we need to be able to do more rigorous research, which is not always the case now.”* [Expert 9].

## **5. ASSESSMENT OF HEALTH SYSTEM AND ACCESS TO HEALTH SERVICES**

### **5.1. Leadership and governance**

After the collapse of the Soviet Union the healthcare system of Armenia has undergone major organizational and legal reforms. The cumbersome centralized Semashko system inherited by Armenia was soon abandoned and became decentralized. During the Soviet era, the healthcare system was fully funded by the state and provided universal access to a wide range of state funded services, emphasizing secondary and tertiary care.<sup>87</sup> After independence, the Government of Armenia (GOA) started a large scale reform, which targeted the PHC system and the financing system as well as optimizing the hospital network which saw a reduction of about 62% in the number of hospital beds from 1990 to 2019.<sup>35</sup>

The law “On Medical Assistance and Services to the Population” (adopted in 1996) is the main legal document which regulates healthcare delivery in the country.<sup>88</sup> The healthcare sector is also regulated by several other laws, governmental decrees, and ministerial orders. Area-specific health strategies and programmatic documents related to fields such as TB or HIV/AIDS are also approved by the GOA which are approved for five-year term and are periodically updated by the MOH.<sup>89</sup>

The health sectors’ policy priorities are described by the government in the annual State Targeted Health Programs, prepared by the MOH, and approved by the GOA, after which it is presented to the National Assembly of Armenia.

The MOH of Armenia is the key regulator of the health system in the country. It is responsible for the development and implementation of healthcare policy, through drafting health legislation, developing health programs and strategies, approving regulations for service delivery standards, treatment protocols, and guidelines.<sup>89</sup> Licensing of healthcare facilities is conducted by the Licensing Agency of the MOH, which enables the MOH to exercise its regulatory functions. The MOH is also the sole purchaser of services provided by the GOA under the BBP, the process of purchasing is facilitated by the State Health Agency (SHA) by contracting and purchasing services from around 500 providers both private and public. The MOH also owns and manages around 16 healthcare institutions, which are mainly disease-specific, such as the National Center of Pulmonology, and the National Centre for Mental Health Care.

The regional (marzes) health facilities in Armenia are mostly managed by the health departments of the regional administrations and/or the local authorities. Those facilities include regional medical centers, polyclinics, and rural primary healthcare centers. The regional authorities are responsible for approval of the facility budgets and monitoring its execution, appointing facility managers, personnel management, revisions in the provided services list. The local authorities are not involved in procurement of services from those facilities, as those functions are carried out by the SHA.

#### **5.1.1. Legal framework for health system adaptation**

In the context of climate change, good *leadership* and strong *governance* include addressing the health risks of climate change through prioritization, incorporating the risks into policy planning and enforcement, and establishing multi-sectoral collaborations and partnerships

across programs within the ministry of health and across ministries whose policies affect population health.<sup>26</sup>

Since the ratification of UNFCCC, Armenia's Government has taken several measures for the protection of public health from the risks of climate change. However, Armenia still does not have a united and systematized document as a national policy on climate change and healthcare.<sup>84</sup> Armenian government developed and approved numerous legal acts on management of health risks, disaster risk reduction, emergency response, and other climate sensitive issues.

In 2013, the Armenian government approved the establishment of the *National Center for Disease Prevention and Control* SNCO (NCDC) under the MOH, which aims to coordinate and implement effective measures to guarantee the sanitary-epidemiological security of the general population of Armenia and provide corresponding services in line with the international standards (Decree N 1134-N).<sup>90</sup> They are responsible for prevention and control measures for all communicable and non-communicable diseases, including those sensitive to climate change. The NCDC implements several programs that directly or indirectly address climate sensitive health risks in Armenia.<sup>91</sup>

A set of government decisions approved in Armenia aimed to assess the spread and manage the risks of infectious diseases (Annex 3).<sup>18</sup> Due to the implemented preventive measures incidence of numerous infectious diseases decreased and control systems were improved. In particular, during 2010-2020 the government approved two national immunization programs (2010-2015 and 2016-2020) to prevent, eliminate and eradicate a list of infectious diseases through the preventive immunization program (Decree N 46-N and N 10).<sup>92,93</sup> The government approved a national program for the 2011-2015 period targeted at preventing the import and settlement of malaria in Armenia by improving and ensuring appropriate monitoring systems (Decree N 23). The program mentions the importance of prevention of malaria as climate change in Armenia can result in new cases of malaria.<sup>94</sup> For preventing and fighting against infectious diseases the government approved 2012-2016 strategy program that included the list of respective measures aiming to decrease the burden of infectious diseases in the country through development and implementation of targeted interventions, improving the monitoring and information systems, capacity development of timely response and diagnosis, continuous education of healthcare workers, etc. (Decree N 1913-N). It is mentioned in the document that climate change affects the spread of infectious

diseases globally and that the climatic conditions of Armenia are favorable for some disease transmitters.<sup>95</sup> In 2012, the government also approved another decision (Decree N 50) to control and decrease the burden of human and animal common infectious diseases and improve and reinforce multi-sectoral collaboration of main stakeholders through targeted interventions towards prevention and control of infectious diseases, capacity building for timely response and diagnosis, continuous education of healthcare providers, and encouragement of relevant research. The document does not have a wording related to climate change and its impacts on infectious diseases common for people and animals.<sup>96</sup> A program along with 2014-2018 time-table for implementation of corresponding measures (Decree N 22) was approved by the government to fight against infectious disease transmitters in Armenia. The program specifically aimed at preventing the transmission of various infectious diseases and fighting against their transmitters including especially dangerous infections through implementation of control, monitoring and assessment of transmitters of different infectious diseases, implementation of scientific and applied research of transmitters, capacity building among healthcare workers, and awareness raising among the general public. The document specifies that due to climate change various transmitters can spread and expand their areas leading to an increase in the burden of infectious diseases globally and historically, several such diseases were observed in Armenia including malaria, leishmaniasis, tularemia and others.<sup>97</sup> Furthermore, in 2010 regulations and sanitary norms for the control of disease transmitters (rodents and insects) were developed and approved to prevent the spread of infectious diseases by decreasing the number of transmitters (Decree N 13-N). The document does not have a wording related to climate change.<sup>98</sup> As a result of various measures, many infectious diseases such as malaria, polio and diphtheria were not observed in Armenia in recent years. Many other infectious diseases such as measles, rubella, anthrax, tularemia, and others have been rarely observed.<sup>95,99</sup>

Numerous government decisions and state programs were approved to decrease the burden of non-communicable diseases in the country, including those sensitive to climate change. However, none of the reviewed health policies on non-communicable diseases considered climate change and its influence on NCDs. Various national strategic programs focused at an early screening, prevention and treatment of NCDs have led to a positive tendency of decreasing CSD mortality in all nosological groups. The targeted programs include 1) state assured screening for hypertension and diabetes mellitus among 35-68 years old population by PHC providers; 2) state assured primary percutaneous coronary interventions to reduce

mortality and morbidity from acute coronary syndromes; 3) state-assured acute ischemic stroke treatment program.<sup>28</sup> Particularly, back in 2011, the government approved three national strategies for controlling non-communicable diseases responsible for the highest share of mortality in Armenia, e.g. CVD, diabetes, and malignancies (Decree N 11).<sup>100</sup> In 2014, the government approved a strategic program focusing on facilitating healthy lifestyle to prevent premature mortality and morbidity due to non-communicable diseases and improvement of mental health and reduction of trauma through targeted interventions to increase the number of people leading a healthy lifestyle and prevent risky behaviors, awareness raising among the general public about the benefits of a healthy lifestyle and health impacts of risky behaviors, continuous collaborations between the main stakeholders and communities (Decree N 50).<sup>101</sup> Later in 2016, the government approved a 2016-2020 strategy plan for controlling most prevalent non-communicable diseases (Decree N 4).<sup>102</sup> The strategy focused on developing and improving a system for managing and preventing non-communicable diseases by addressing main risk factors and increasing the public's awareness of those factors, preventing obesity, overweight and decreasing the morbidity of chronic obstructive pulmonary disease and asthma, exploring environmental determinants and risks, and preventing their impact on human health as well as strengthening surveillance and monitoring mechanisms. For specifically preventing trauma and trauma-related complications, in 2015 the government approved a 2015-2020 action plan (Decree N 55) that enforced collaborative approach for trauma prevention, an analysis of the main trauma causes and the current burden of trauma in Armenia, continuous improvement of trauma care quality and improvement of the public's awareness of the main reasons of trauma, as well as prevention of professional trauma-related morbidity and mortality.<sup>103</sup>

Quality control of drinking water is carried out by the NCDC according to a program approved in 2018 (Decree N 363-A) aiming to monitor the quality of drinking water throughout Armenia. The program entails sampling of drinking water from different supply systems and analysis of the quality in order to explore possible health risks and assess the epidemiological situation.<sup>104</sup> Another program was launched the same year aiming to monitor the quality of drinking water of the lake water taps and soil in the coastal recreation and swimming zones of Lake Sevan (Decree N 642-A). The program particularly aims to assess the lake water quality, drinking water quality near the lake, the quality of soil and sanitary epidemiological safety around the coastal recreation zones of the lake as well as prevent



diseases due to polluted water and soil among the population living/traveling to the mentioned zones.<sup>105</sup>

The N 842-Ն order of the MOH defines the microclimate indicators and their optimal and acceptable levels for the workplace. The main microclimate indicators are air temperature, surface temperature, the relative humidity of the air, speed of airflow, the intensity of heat radiation. The optimal and acceptable levels of the listed indicators are categorized based on the work grade by energy consumption. The requirements for optimal and acceptable levels of microclimate indicators vary by type of a work: the required levels of air temperature decrease with the increase in energy consumption. For each work category, the range of optimal microclimate indicators and the ranges of acceptable levels of microclimate indicators are presented (below and above the optimal level). In addition, the document also defines the acceptable duration of work for the situations when the actual air temperature inside the working area is above or below the highest and lowest acceptable levels.

According to the 153 Chapter of the Labor Code of the RA, additional breaks should be provided to the employees whenever the air temperature exceeds 40°C or is below 10°C.<sup>106</sup>

The MOH is one of the governmental bodies contributing to disaster risk reduction in Armenia.<sup>107</sup> In the context of disaster risk reduction strategy of Armenia accepted in 2012 (Decree N 281-N), the MOH is responsible for various risk reduction activities: to carry out investigations, give corresponding recommendations and raise awareness of the population on possible health risks; to assess the sanitary-epidemiological situation after the disasters; to implement epidemiological and quarantine measures, organize operative medical groups for the timely response to the disasters and ensure first aid; to provide medical care for the affected people, contribute to the evacuation activities by providing medical care during and after the evacuation; and control the quality of drinking water.<sup>107,108</sup>

### **5.1.2. Leadership and governance for health adaptation**

Qualitative interviews with stakeholders/key informants from different sectors showed that in the past, the Armenian government did not prioritize climate change health adaptation measures. This is reflected in the lack of targeted policies and strategies to address climate-sensitive health risks. Though the aforementioned policies address climate-sensitive health risks, those are not directly linked to climate change. Furthermore, interviews revealed that currently in Armenia there is no specific focus on health adaptation measures: *“No, unfortunately, nothing purposeful is being done in that direction yet. . . no targeted actions*

*are being taken. We just do our routine work, for example, mapping, monitoring the prevalence of infectious diseases, pathogens, vectors, reservoirs, however, no specific actions are being taken for health adaptation.*” [Expert 9]. In fact, during the interviews, experts were more inclined to discuss the wider environmental impacts of climate change rather than health. A possible explanation is the absence of health adaptation measures per se.

International organizations’ efforts were put together to explore climate change health impacts among certain groups, however, the governmental sector did not prioritize such activities in the country. The key informants suggested that, as a result of 2018 changes in the government, health impacts of climate change may have a potential to become a priority for the health sector.

One of the experts representing the Ministry of Environment talked about raising interest in exploring climate change and its general impacts by the Armenian government. According to him/her, a department within the Ministry of Environment with responsibilities and commitments to develop a National Adaptation Plan and Nationally Determined Contributions are being formed, which is indicative of increasing political will. The experts also mentioned that the health sector will be one of six priority areas. *“In my opinion, this problem [national adaptation to climate change] is really very important... It always was an important problem, but the government did not seem to be giving adequate attention. A separate agency has now been set up to deal with the issue more seriously.”* [Expert 4].

## **5.2. Health workforce**

Medical education in Armenia is provided through 6 institutions, one state university, and 5 private universities. The only state-accredited medical university which provides undergraduate and postgraduate medical education is the Yerevan State Medical University after Mkhitar Heratsi (YSMU). Training for mid-level health specializations such as nursing and midwifery is provided through 20 institutions, 12 public and 8 private.<sup>109</sup>

Since independence, the Armenian health workforce has contracted.<sup>42</sup> In 2017 the total number of physicians from all specialties including dentists was 12,964 (43.6/ 10,000 population) while for mid-level health professionals, the total number was 16,796 (56.5/10000).

One of the major issues within the healthcare system of Armenia is the uneven distribution of professionals between the capital city of Yerevan and the marzes. In 2019, the number of

physicians per 10,000 population in Armenia was 47.2. In the capital city Yerevan the number of physicians per 10,000 population was considerably higher (93.8 per 10,000 population) compared to other marzes ranging from 15.7 per 10,000 population in Armavir marz to 25.0 per 10,000 population in Shirak marz. Similar trends in distribution was reported regarding mid-level health workforce in 2019.<sup>35</sup> The poor social living conditions in marzes and low compensation creates barriers in attracting medical professionals to the regions, this, in turn, leads to limiting access to quality health care services, forcing people who live in marzes to seek care in the capital city enduring extra financial burden.

High levels of health professionals' migration out of the country have also been recorded in recent years. The migration is partly attributed to higher salaries in some European countries for health professionals.<sup>42</sup>

The WHO framework suggests that an adequately trained and competent *health workforce* will ensure strengthened technical, professional, organizational and institutional capacities of health systems. They should be able to raise awareness of the links between climate change and health among professional audiences and the general public.<sup>26</sup>

The indepth interview with key informants revealed that there was no focus on enhancing the capacity of healthcare workers on climate change and health related issues. According to them, the health workforce was adequately prepared to deal with the health-issues overall, however, their competencies are inadequate on the link between those health issues and climate change: *“Of course, many people are dissatisfied with our primary care, but it seems to me that physicians recognize the diseases and refer patients for further check-ups, however, they do not connect diseases with climate change... It is not written anywhere that those [diseases] are connected [to climate change]. In other words, they are not even aware of which diseases are climate-sensitive. First of all, there is a lack of knowledge, there is a lack of awareness among both medical specialists and the population.”* [Expert 9]. Another expert revealed that in the curriculum of the YSMU, they dedicate two or three days to raise awareness of climate change and health among medical students, however, no comprehensive coverage of the topic was provided: *“During studying we spend two or three days on the climate, the climatic peculiarities of Armenia and we partially touch upon the global climate change, the immune system of the population.”* [Expert 13]. Experts talked about continuous medical education system, however, none of the experts mentioned targeted educational programs or trainings regarding climate change and health. An idea was raised to work

towards enhancing the capacity of health professionals in terms of evidence-based up-to-date techniques and methodologies in the field of prevention and disease control that could be done through collaborations with different organizations: *“People [specialists] need to know what equipment they need, what methodology to use, how to do it all... those capabilities are still lacking in our country at the moment.”* [Expert 6], *“In regards to new methodology, I think there is a need... for further application of new methodologies [for research on climate change], maybe introduction of other new mechanisms, collaboration in this regard would be very desirable... The world is developing very fast, there is always something to add.”* [Expert 15].

However, some experts were uncertain about the health workforce competencies in the context of climate change and health. According to an expert, assessments would be necessary to objectively evaluate the necessary knowledge and skills of different groups of health workforce through the prism of climate change: *“You know, we have all that. But they [workforce competencies] must be assessed in the context of climate change. It must be assessed separately, if we want to start something global in the direction of climate change, then it must be done separately [the assessment]. We have capabilities, but in order to integrate them we have to sit down and work. This could be something like scientific research that many might be interested in.”* [Expert 10].

### **5.3. Service delivery**

#### **5.3.1. General information on services utilization**

Utilization of healthcare services has declined after the collapse of the Soviet Union, especially for PHC facility visits. In 1990 the average frequency of PHC visits per one person was 7.8, while in 2001 the average was 1.8. Due to efforts of the MOH over the years to improve access to care and improve PHC services this number increase reaching 4.1 in 2017. This indicator still remains low in comparison to the European average of 7.5 per person per year.<sup>109</sup>

A similar trend is observed in the average number of hospitalizations - in 1990 the average number of hospitalizations per 100 population was 13.1, dropped to 4.9/ 100 population and bounced back to 13.3/ 100 population in 2017. The European average is 17.8/100 population.<sup>109</sup>

The proportion of the population satisfied with health care services increased during 2008-2017 at the expense of a decrease in the proportion of the dissatisfied population.<sup>41</sup> However, high proportions of population satisfied with healthcare services has been widely discussed and explained by low expectation of population towards the health sector.<sup>42,110</sup> In 2017, the proportion of population dissatisfied with healthcare services was 23.7% compared to 29.0% in 2008.<sup>41</sup>

### 5.3.2. Climate-informed service delivery

Safe and quality healthcare *service delivery* should build on existing programs while considering country-specific health risks of climate change and assure appropriate responses to extreme weather events.<sup>26</sup>

When trying to explore specific programs targeting health risks of climate change, vector-borne diseases were mainly highlighted compared to another well-acknowledged climate sensitive health issues. In fact, experts did not consider programs targeting CVDs, cerebrovascular and respiratory diseases, and other climate-sensitive non-communicable diseases as a measure of health adaptation.

The NCDC is the only center involved in the control and management of vector-borne diseases. It performs regular monitoring of vectors and vector-borne infectious diseases and continuously works on enhancing the number of monitored vectors involving new species in the monitoring. For that purpose, they enhanced the laboratory capacity and trained personnel, which according to an expert improved the early detection and diagnosis capacity capabilities: *“Only NCDC conducts constant, periodic monitoring of vectors, and the monitoring is constantly expanding . The types of vectors and nosologies to be monitored have been added. At the same time, the NCDC constantly monitors/analyzes the data in comparison with the disease cases... The NCDC expanded the laboratory capacity, which allowed to detect more diseases and types of pathogens, both vector-borne and others... A huge amount of work has been done, the NCDC laboratory has been completely equipped, specialists have been trained...”* [Expert 15]. Another expert explained that even though much bigger attention was given to the vector monitoring, not much was done in terms of providing targeted solutions to prevent and control the spread: *“As for the vector-borne diseases, I said that we identify the issues, for the time being, that is, we observe vectors: their geographic locations, the composition of species, which is constantly changing. However, no targeted solutions are being provided.”* [Expert 9].

In accordance with the national emergency-response plans, the NCDC ensures preparedness and guarantees an early response to emergency situations by closely collaborating with other sectors. The NCDC has rapid response teams (who also provide trainings) and guidelines to undertake preventive measures for emergencies: *“Having the responsibility of ensuring emergency preparedness in emergency situations in its charter, the NCDC collaborates [with other responsible bodies] and ensures quick response. The NCDC particularly works with biological factors, because the detection of chemical factors is mainly the responsibility of the Ministry of Emergency Situations, but its health impacts and preventive measures are usually carried out in close collaboration with the NCDC team. So, in such situations [emergency], NCDC reacts and works, takes preventive measures, has a prepared and trained team for this, has specialists, they also do trainings in this regard, there are certain guidelines, exercises... The work in that direction is already being done. Emergencies do not always happen, but the NCDC always keeps its preparedness at a high level.”* [Expert 15].

The experts also highlighted that especially after the COVID-19 outbreak the healthcare system gained relevant experience and will be more prepared for future emergency situations including those caused by climate change: *“After this COVID-19 we gained an experience to repurpose healthcare facilities and the experience showed that it is possible to organize the healthcare system in a way to ensure a rapid response. It seems to me that there will be no problem in this regard, if there is a need, we will be able to organize a quick response in every region and community.”* [Expert 9]. In case of expected extreme weather events such as extreme heat or extreme cold, the NCDC undertakes preventive activities for the general public through health communications: *“Nothing has been done in the direction of extreme weather conditions for years, but in recent years we have been actively working. The prognosis has improved. We did not have a long-term forecast before, we did not know in advance that we would have a heatwave, but now that we have it, we always prepare the population in advance, carry out awareness raising, we did it also in case of expected extreme cold.”* [Expert 15].

One of the experts specified the role of the NCDC in prevention and control of water and food-borne infectious diseases. The enhanced laboratory capacity allowed to detect and monitor a wider range of pathogens. In the case of outbreaks of water- or food-borne diseases, the NCDC ensures early detection and response: *“It carries out epidemiological monitoring of diseases, for this, it expanded the laboratory capacity, added the number of pathogens that can be detected. Detection of outbreaks and early response, including water-*

*and food-borne intestinal infections, are completely the responsibility of the NCDC.”* [Expert 15]. The experts mentioned preventive programs related to climate-sensitive conditions including various immunizations, disinfection activities when needed, fight against rodents and others and highlighted the high level of preparedness in this regard.

The experts emphasized raising attention towards the prevention of non-communicable diseases. Though, in practice, the NCDC has a little role in this regard, they have prepared healthy lifestyle guideline to contribute to the prevention of cardiovascular diseases: *“As an important preventive measure for CVDs, we have developed and implemented a healthy lifestyle guideline for primary healthcare.”* [Expert 15].

#### **5.4. Health infrastructure**

Health care services in Armenia are delivered through public and private providers. In total 494 PHC providers are present in Armenia out of which 355 are publicly owned, 120 are privately owned, and 19 other entities.<sup>35</sup> A total of 125 inpatient facilities are available out of which 79 are public, 39 private, and 7 other entities. Table 2 presents the distribution of PHC facilities and hospitals by marzes.<sup>35</sup>

According to one of the experts, the health infrastructure is continuously being strengthened and improved. All healthcare facilities all over Armenia including hospitals and primary healthcare facilities have been improved and modernized with the help of state and donor fundings. Due to the COVID-19 pandemic, healthcare infrastructure in all regions was strengthened by opening new hospitals and improving ambulance and resuscitation services: *“As you might know, the healthcare system in recent years has constantly improved its infrastructure, hospitals, dispensaries, which were completed with international funding and resources from the state budget. In other words, it is a system, the infrastructure of which is constantly improved, modernized, opportunities are created so that they can do it [provide appropriate services]. The latest example is related to the coronavirus: the healthcare system was strengthened in all regions. Clinics were opened in the context of COVID-19, resuscitation was strengthened, infrastructure and ambulances were improved . . . Water supply issues are solved in the [healthcare] facilities.”* [Expert 15].

#### **5.5. Integrated risk monitoring and early warning**

Early warning systems are in place aiming to notify the main stakeholders including the MOH about dangerous weather phenomena; this responsibility is carried out by the

Hydrometeorological and Monitoring Center of the Ministry of Environment. The warnings about those events are not only given simultaneously with the weather forecast but also with short text warnings. In case the event has already happened, which was not predicted, the service generates information on the intensity, directions, and further developments. At the same time, in case of the prediction of several dangerous meteorological phenomena, the text of the warning indicates the name of each of them, the period of occurrence, and the peculiarities of development. Sometimes analysis of data shows that the predicted dangerous meteorological phenomenon might occur later or sooner than expected. In these situations, a warning pause or cancelation could be made.<sup>111</sup>

The text of the warnings of dangerous meteorological phenomena includes 1) the serial number of the warning from the beginning of the year, 2) the date of the expected event, the time and the duration of the event, 3) the place of occurrence and the directions of the spread of the event, and 4) the name of the event and the maximum intensity.<sup>111</sup>

Warnings are communicated by telephone and /or Internet, mainly in text form, in accordance with the regulations approved by the government. In order to improve the provision of information on dangerous events, a red "Attention" window has been created on the main page of the hydrometeorological service website, where a warning about the pending dangerous event is placed. The Hydrometeorological and Monitoring Center, using new technologies, plans to create a map version of the warning of dangerous events, where the information about each dangerous event could be given with a specific indication of the place of occurrence and with a color corresponding to the intensity of the event. Advice on the implementation of appropriate measures to reduce the impact of the event will also be given.<sup>111</sup>

To reduce the impact of extreme events, there is a Climate Watch System, a mechanism with which the necessary information on the expected climatic anomalies are prepared and communicated to main stakeholders. The purpose of this mechanism is to provide information on significant climate abnormalities currently occurring on a daily, monthly, and seasonal basis. The information is addressed to specific stakeholders so that they and decision-makers are able to take early actions to reduce the expected damage from those abnormalities.<sup>111</sup>

The MOH carries responsibility for early warnings of the population about possible unfavorable weather conditions such as extreme heat and heatwaves. It is being done by all



possible channels in mass media and social networks. The warnings include information on possible health risks of weather events and behavioral measures to protect population health from being impacted. The number of such warnings almost doubled during the recent years.<sup>38</sup>

The interviews with the key informants from the healthcare sector confirmed the described practices of early warnings: *“Usually in the beginning of each summer, we make press releases or warnings to the population on what to do so that the extreme heat does not affect them so that they avoid direct sunlight. We provide information on how to protect themselves from infectious diseases. Of course, there are such announcements, press releases, speeches, we warn in general.”* [Expert 9]. The risk monitoring and early warnings are also in place in case of the increased risk of infectious diseases. An expert described a case of malaria as an example of appropriate risk monitoring and early warning in Armenia: *“For example, one year we had a case of malaria, which was in the Ararat Valley, where we have a high number of mosquitoes, especially mosquitoes transmitting malaria. We did additional entomological research in that area, then insecticide work, and we also worked with the community's medical staff to increase the sensitivity of the system. In other words, if there are people with fever, they should definitely think also about malaria, send them for appropriate examinations. So, we work with healthcare workers... In addition, work was done with the population so that they know how to prevent mosquitoes from spreading too much in their area and visit a doctor when having a fever.”* [Expert 9].

## **5.6. Essential medical products and technologies**

Defining and approval of the essential drugs list in Armenia is conducted through an order of the MOH. The essential drugs list in Armenia is based on the WHO model lists of essential medicines and was first introduced in 2000.<sup>112,113</sup> The MOH has always been engaged in the central procurement of certain types of drugs from the essential drugs list, specifically for citizens registered in outpatient facilities and have conditions for which the drugs are provided by the government. The list of social groups and conditions for which the MOH purchases fully or partially those drugs are mentioned in the GOA Decree N 642-Ն.<sup>114</sup>

Health promotion and immunization programs are the responsibility of the MOH and the MOH is the single purchaser of vaccines for the country. Armenia has a multi-year immunization plan for 2016-2020. A unified immunization schedule has been approved and is conducted by PHC providers in outpatient facilities nationwide.<sup>87</sup> The immunization program has been highly successful with a reported coverage rates reaching 95%. Armenia

has been declared polio-free since 1996, with only a few numbers of reported cases of tetanus, pertussis, and diphtheria since 2001.<sup>87,115</sup> According to an expert, the healthcare system in Armenia is adequately prepared in terms of medical products and technologies to tackle the consequences of climate change. A good example of this is the current international programs on vector-borne diseases: *“Of course there are [essential medical products and technologies]. We have international level vector-borne disease programs. We have been working with the United States and European Union for many years. We have been participating in international programs for several years... Depending on what we want or need, there might be a need for assessment [in the context of climate change], we need to think systematically.”* [Expert 10].

### **5.7. Management of environmental determinants of health and communication with health authorities**

The Hydrometeorology and Monitoring Center SNCO of Ministry of Environment of RA is responsible for a set of environmental health determinant monitoring such as air quality, water quality, and waste monitoring. The air monitoring center consists of 16 main stationary active sampling and automated observation stations which conducts monitoring on a daily basis and 211 mobile passive sampling observation points, which perform monitoring on a weekly basis. The organization conducts monitoring of the main pollutants of the air including sulfur dioxide, nitrogen oxides, carbon monoxide, dust and ground-level ozone, sulfur dioxide, and nitrogen dioxide. Air quality assessment is conducted according to the RA Government N160-N decree (2006).<sup>116</sup> Air quality management includes control of various air pollution sources such as emissions from industries, transport, open agricultural and municipal waste, and open burning of biomass and regulated by the respective policies.<sup>117</sup>

According to the NCDC representative, the air quality management is the responsibility of sectors other than health whereas their organization’s main role is the analysis of available air quality data against climate-sensitive health outcomes. However, this type of analysis is not always conducted properly due to a lack of complete monitoring data being collected by the Hydrometeorology and Monitoring Center SNCO: *“We have an air pollution issue; however, the problem of research remains because of the quality of monitoring data, which is very important in this regard. Our health data covers the entire territory of Armenia, we have the opportunity to work with them in all settlements. Unfortunately, the [environmental] monitoring data are not always like that, they are limited, we do not have a global pollution monitoring system, which can detect small particles (PM10 or PM2.5 particulate matter) in*

*the air.*” [Expert 15]. Therefore, the NCDC does not have the full range of air quality data to analyze against the climate-sensitive health outcomes.

Similarly, the Hydrometeorology and Monitoring Center provides surface and groundwater quality monitoring data. Surface water quality is described by up to 45 physicochemical indicators with a frequency of 5-12 times per year. Water quality assessment is supervised in accordance to the RA Government N75-N decree (2011). Underground freshwater monitoring network consists of 100 groundwater springs of 6 water basin management areas (Northern, Akhuryan, Hrazdan, Sevan, Araratyan, Southern), which include 25 self-flowing wells, 32 borehole wells, and 43 natural springs. The center carries out monitoring of water volume, level (pressure), and temperature 6 times per month. Additionally, groundwater quality monitoring is performed in 40 springs twice a year and around 40 indicators are determined for each spring (major anions and cations, metals and salt regime elements).<sup>118,119</sup>

In addition, through its enhanced laboratory network, the NCDC conducts epidemiological observations to monitor pathogens. Then preventive and control measures follow: *“We carry out epidemiological monitoring of diseases, we expanded the laboratory capacity, we have added the number of pathogens that we can detect. Detection of outbreaks and early response, including water- and food-borne intestinal infections, are completely our responsibility.”* [Expert 15].

Waste management is one of the key priorities of the government of Armenia and it is strategized as a mega goal in strategic development framework “Armenia Transformation Strategy 2050”.<sup>120</sup> The current waste management in Armenia comprises of several directions including prevention of generation and reduction of plastic bags, medical and industrial waste; reuse of disposed products through repairing or direct use; recycling of plastics, paper, and cardboard, glass, lead batteries, and car carcasses; energy recovery (waste-to-energy); separated and sorted collection of municipal solid waste for future recycling; collection, transportation, and disposal. To date, the existing national strategy was not implemented completely due to lack of financial and administrative resources.<sup>120</sup>

The key informants explained that in case of a risk for any type of outbreaks linked to waste accumulation, collaboratively with municipal services and local self-regulatory bodies they retrospectively undertake measures to resolve the issue and prevent the spread of vectors: *“Regarding waste, since organic waste contributes to the spread of leishmaniasis, (leishmaniasis-carrying mites lay their eggs on accumulated waste) if we have a case [of*

leishmaniasis] *in any community or area, we work with the municipal services and local self-regulatory bodies and remove those accumulations, so that we do not have favorable conditions for their spread. But it is not done in advance [for prevention], we do this after the case is registered, as an anti-epidemiological measure.*” [Expert 9].

Food insecurity and malnutrition affect 15% of the Armenian population who cannot access or afford food to meet their daily needs. People living in rural areas in Armenia and those at the poverty threshold take the highest burden of food insecurity. The highest proportion of certain types of food such as pork, poultry, vegetable oil, legumes, wheat are being imported thus increasing dependency in case of emergencies. Dietary habits where salt, baked foods, and potatoes prevail, consumption of fruits and vegetables is not enough, can negatively affect the situation regarding food security. The food security index did not improve between 2010 and 2017.<sup>121</sup>

The Food Safety Inspectorate supervises quality of food, veterinary and sanitary services against bacteriological, physico-chemical indicators regulated by the sanitary and hygienic standards and guidelines approved by the MOH: *“The food safety inspectorate does not have any role in the climate change efforts, we have a clear legislation where the normatives for food safety are defined, such as bacteriological as well as physico-chemical indicators, and they are not related to climate change. We do not have any legal mechanisms regarding climate change to conduct any research.”* [Expert 8] Within the scope of formal collaboration with the Food Safety Inspectorate, there is a mechanism in place for health-related information exchange (e.g. iodine levels in salt, poisonings).

### **5.8. Health communications**

The MOH strategizes health communication in various areas to raise the general populations’ awareness on major public health issues. Various channels such as mass media, multimedia, social media, and mobile communications are used to convey health messages to the public. The content of those messages is developed by the professional health community of the MOH, particularly from the NCDC and National Institute of Health (NIH).<sup>122</sup>

The health communication is considered as an essential tool by the MOH. There are public relation unit, minister’s press secretary, and media assistant within the ministry. With the purpose of delivering health messages these staff address various aspects of health communication such as risk communication, health journalism, media advocacy, and social marketing.<sup>122</sup>

Almost all experts pointed out general public's poor awareness and skepticism towards the issue of climate change and its potential impact on health. The health sector experts confirmed that the MOH utilizes various health communication means and assured that those can be effectively employed in the context of climate change: *"The MOH has all the levers to ensure health communication. It has developed both tools and mechanisms, and if there is a need for any communication related to climate change, the MOH will do it. It was done in the past when needed, it is still being done today."* [Expert 10]. Additionally, some of the experts suggested educating children about climate change starting from schools, which could also help to raise their social responsibility with regards to the protection of the environment.

The MOH undertakes risk communication activities dedicated to the general and specific (in case of outbreaks) groups of the population to raise awareness and prevent possible unfavorable outcomes. The representatives of the NCDC described their activities targeted at improving local communities' awareness of various health risks. For example, in case of a spread of a certain type of vector in a specific region, the NCDC educates the local population on how to protect themselves and prevent the spread of the disease: *"For example, if there is a risk of malaria, the medical staff and the public are being informed, so that everyone knows that if they get a fever they immediately should go to the doctor and try to prevent the spread of mosquitoes in their area."* [Expert 9]. Similar health communication messages are delivered before seasonal changes and climate events to prepare the public for potential water or food born outbreaks and heatwaves: *"Usually before the summer, we give press releases, speeches, warnings to the population about measures to protect themselves from heat and infectious diseases."* [Expert 9]. The interviews did not reveal targeted health communication interventions to the public specifically conveying health messages on climate change, health risks for the general public and vulnerable groups. However, already implemented general health communication and communication about health effects of extreme climate events (e.g. heat waves) by the NCDC could indirectly improve health resilience to climate change of the general public.

During the interviews with key informants, health communication activities within the healthcare system were not revealed. In general, there is a lack of specific climate change health communication within the Ministry of Health and with the general public. Hence, there is a substantial need to raise awareness of the link between climate change and health among various target audiences including policymakers, healthcare workers, researchers, media, NGOs and other health determining sectors.

## 5.9. Financial resources of the health sector

Very low public spending on healthcare continues to be one of the main challenges of the Armenian healthcare system: it was 13.1% of the total health expenditure in 2018.<sup>123</sup> On the other hand private OOP spending represented 86.2% of the total health expenditure in the same year. Financial risk protection remains weak in the Armenian healthcare system and it is poorly equipped to deal with the growing burden of communicable and non-communicable diseases.

Public resources generated through general taxation are used by the GOA to finance a range of services under the BBP for the entire population such as primary healthcare, emergency care, treatment of TB and HIV/AIDS, and maternal and childcare. The BBP also provides a defined list of medical services to specific groups of the population for whom most inpatient services are provided by the GOA, with some exceptions. Examples of those groups include people with disabilities, children from age 0-18, military personnel, and their families, and others. Between 2018 and 2020, the BBP eligible population and included services have been significantly expanded: the package of services covered by the BBP now includes use of expensive technology for diagnostics, all oncologic surgeries, most of radiologic services for oncologic patients, emergency care in intensive care units, all COVID-19 related services; eligibility criteria were changed to include a bigger number of socially vulnerable groups of population in the coverage. Overall, there are 19 groups of people who qualify for BBP coverage.<sup>124</sup> The MOH has also increased the budget allocations for the mentioned services and introduced mechanisms to eliminate informal payments—for example, reporting of state budget use at each facility level via the ARMED eHealth system.<sup>124</sup> To ensure the effective functioning of the health system, adequate *financing* is needed. Moreover, in order to be able to control potential climate-sensitive health risks, additional financial resources and targeted allocation should be considered for the health system. According to the WHO, countries should conduct assessments in order to identify available financial sources, finance gaps, and opportunities.<sup>26</sup>

With regards to financing climate change health adaptation measures, almost all experts were consistent that the government of Armenia has not yet prioritized actions in terms of allocation of financial resources. Experts explained that currently, actions implemented in Armenia are possible only through resources allotted by international donor organizations. Some experts further elaborated that the past government was not interested in investing

resources in adaptation measures to climate change. According to them, in case of a valid justification of the problem, the current government will be more likely to allocate financial resources: *“The former government did not want to invest resources [in climate change adaptation measures], they said there was no money. If we can persuade, show, prove [that climate change adaptation is crucial], it is very likely that resources will be allocated by the current government.”* [Expert 6].

#### **5.10. Cross-sectoral intersections between health and health-determining sectors**

Cross-sectoral collaboration between ministries, international organizations, and other stakeholders is imperative to deliver coordinated and effective efforts in protecting and maintaining public health, since many sectors such as environment, education, agriculture, law enforcement, economy deal with public health issues. Only effective cooperation between all these sectors could achieve tangible results, not possible only by the efforts of the Ministry of Health alone. Analysis of Public health services in Armenia conducted in 2010 concluded that although collaboration between the Armenian government and international organizations in relation to public health programs was strong, the collaboration between the ministries and government agencies, as well as the civil sector, was weak.<sup>125</sup>

A more recent self-assessment of essential public health operations conducted in 2018 by the MOH of Armenia, indicates that intersectoral-decision making for public health is recognized by the GOA as an integral part of improving the health of the population, however, implementing intersectoral decision making and collaboration have proven to be challenging. Structure and mechanisms within the GOA are mandated to support cross-sectoral planning and development of policy, an example includes the Ministerial committee on Social Affairs. In a number of public health policy documents, a commitment to cross-sectoral comprehensive decision-making approach is evident, however in reality collaboration mechanisms even though are formally in place, they are most often not implemented. Strict demarcations between the sectors and viewing the health sector as the sole responsibility of the MOH hinder the collaboration and viewing health as a collective goal of utmost importance.<sup>122</sup>

Various governmental (i.e. Ministry of Environment, Health and Labor Inspectorate, Food Safety Inspectorate) and international (i.e. UNICEF, Armenian Red Cross Society) organizations as well as entities of the MOH (NCDC and NIH) are involved in various

aspects of management, control, and prevention of health risks, including those linked to climate change. However, the nature and the level of cross-sectoral collaboration was reported to be varying and at times limited.

Experts representing governmental organizations described their routine activities and the way those addressing climate-sensitive health risks. For instance, experts from the Ministry of Environment identified various aspects of collaborations with the health sector linked to the health impacts of climate change. According to the expert from the Hydrometeorology and Monitoring Center, generation and publicization of climate and environment-related data for early warning purposes is one of the main means of collaboration with the health sector. Climate policy department specialist mentioned about joint efforts with the MOH for climate-related policy development. According to a key informant, the NCDC does not implement health adaptation measures, rather they merely conduct routine activities involving risk mapping, epidemiological surveillance, outbreak management, and vulnerable population awareness-raising without specifically relating/labeling it to climate change: *“No, unfortunately, nothing so purposeful is being done in that direction yet... no targeted actions are being taken. NCDC just keeps doing routine activities...”* [Expert 9]. In the scopes of these activities, NCDC and its branches collaborate with various sectors including local self-regulatory bodies, utility service, veterinary services and etc: *“We collaborate with various ministries, with local self-regulatory bodies, with the Ministry of Environment, with the Urban Development Committee, with the former Ministry of Agriculture, with the Ministry of Economy, with veterinarians, they are our direct partners, so we are in constant contact with them. Indeed, we closely collaborate with the Ministry of Emergency Situations in different directions, we have joint orders... We even worked with them during this COVID-19. We always have constructive interdepartmental collaboration.”* [Expert 15]. Though, the NIH implements research activities to study and analyze population morbidity and mortality, key informants suggested about absence of climate change-related functions and responsibilities in the NIH: *“NIH does not have any direct function related to climate change, it is beyond the NIH functions [mandate]. Of course, NIH have prepared various reports, tried to study the health indicators of the population - morbidity, mortality from various diseases, also in the regional level...”* [Expert 14].

The Health and Labor Inspectorate is responsible for the supervision of activities of various businesses from the perspective of occupational safety and occupational health. According to the expert, climatic patterns as a result of climate change and the impact on occupational



safety and occupational health are also included in the sanitary norms: *“Our tools are sanitary norms, with which we control the activities of different economic entities... We prevent anything that can affect a person's health during the work process. For example, during heat waves, working hours are set for workers working outdoors.”* [Expert 5].

The expert stressed the absence of any mechanisms or practices related to climate change in the Food Safety Inspectorate, however, he/she described some collaboration with the MOH: *“The inspectorate collaborates with them [MOH] in food safety for humans and animals, use of pesticides and poisonings, but as for climate change, I do not have any information.”* [Expert 8]. Two organizations collaborate in regard to food safety for humans and animals, poisoning, and pesticide use. The level of collaboration with the MOH could be improved, proposing to further enhance it through information exchange, joint events, and higher involvement of the MOH into technical documents and sanitary standards: *“There are collaboration mechanisms between Food Safety Inspectorate and the MoH but they are not very effective, the same is between all the governmental bodies, and in this regard we need reforms to improve the situation. We need to work more objectively together, have an exchange of information, organizing events, need to involve MOH in the development of the technical rules, such as the permissible levels of chemicals on the health of humans.”* [Expert 8].

Experts representing educational institutions with teaching and research capacity highlighted absence of collaboration with the health sector to promote the topic of climate change in the country's teaching and research agenda: *“I know that there are programs there, work is being done, but the collaboration has not happened. There is only a collaboration with the hydrometeorological service.”* [Expert 13].

The role of international organizations is far more tangible and targeted to climate change as compared with the governmental sector. According to the experts, programmatic activities that are implemented by the international organizations focus on specific aspects of climate change health impacts consistent with the organizations' missions. For instance, UNICEF approaches climate change and health issues from the trajectory of children's right to live in a healthy environment: *“As an organization, UNICEF's mission is to see if the various rights of children are protected and to assist the government in protecting those rights. UNICEF considers the child's right to live in a healthy environment.”* [Expert 6]. On the other hand, the Armenian Red Cross Society implements activities for strengthening emergency

preparedness capacities, but these efforts do not specifically focus on climate change. Additionally, the expert told that in the past they carried out a few projects targeting climate change health vulnerability assessments; however, they do not have ongoing projects on climate change and health: *“We have been doing big projects [climate change related] since 2013. The first project was called “Climate Forum East”. Seven countries were included in the project in total, and local networks were being set up. We conducted several studies with these joint efforts. In those years, there were measures mainly aimed at assessing climate change health vulnerability. We also took into account the legislative framework of the health sector. In the end, recommendations were given based on the results of that evaluation. This was followed by the second phase of the “Climate Forum East”, which was a larger project and aimed at carrying out these recommendations... Now we do not have any specific activities in that direction, if I am not mistaken, we do not have such a project.”* [Expert 11].

Almost all experts highlighted the importance of collaborations within and beyond the health sector both for climate change adaptation measures and in general, claiming that currently, the level of collaboration is weak. In addition, one of the experts explained that governmental institutions “prefer” to work independently strictly following their regulations and responsibilities, but the climate change is a multidisciplinary area and strong collaboration is essential between governmental, non-governmental, and academic institutions: *“Our government bodies like to work alone, that is, they do what is included in their charters. Climate change is a multidisciplinary field, which requires systematic collaboration between various state structures, not to mention non-governmental organizations (NGOs), academia and other sectors.”* [Expert 6].

## **6. HEALTH INFORMATION SYSTEMS AND ASSESSMENT OF HEALTH INFORMATION CAPABILITIES**

### **6.1. Health information and research capabilities**

As suggested by the WHO framework, strong *health information systems* assume identification of health risks and vulnerable populations specific to each country. These assessments should guide the management of climate change health risks and diseases, as well as assist in informed health decision making. In the meantime, national-level research should be conducted to continuously generate evidence on the relationship between health and climate change.<sup>26</sup>

Health research is fundamental in the process of informed decision making, policy development, and service delivery. During the Soviet era Armenia was one of the prominent republics in the Soviet Union with its research centers and human resources. Four research centers existed which employed nearly 850 researchers and staff. Those Scientific Research Institutes were; 1) The Institute of Epidemiology, Virology, and Medical Parasitology established in 1923, primarily involved in research in the areas of infectious disease epidemiology of viral, bacterial, and parasitic etiology, in 2017 it merged with the NCDC; 2) Institute of General Hygiene and Occupational Diseases, established in 1959, was involved in research related to environmental and occupational health with a focus on the mining industry, it merged with the National Institute of Health in 2017; 3) Institute of Environmental Health and Preventive Toxicology, established in 1972, it was involved in research related to environmental health standards and regulation of pesticides, plastics, and polymers, it is currently transformed into a lab functioning within YSMU; 4) Acoustics Research Center, established in 1980, involved in research of the biological impact of acoustic energy, and in the development of new metrological methods for acoustics, since 2014 the research center is affiliated with the NCDC of the MOH. After the independence due to scarce funding and deprivation of main functions and resources these research institutes employ currently nearly 93 researchers and staff, nearly 90% decrease in staff numbers.<sup>122</sup>

The main public entities which perform research functions are the NCDC and the NIH. The NCDC is responsible for surveillance, monitoring of disease dynamics, carry out public health programs, and participate in the development of public health policy, strategies, and legislation.<sup>122</sup> However, the NCDC is not in a leading position in public health research, because it does not have a research agenda to follow and a plan for research development.<sup>122</sup>

During the interviews with the experts, it was confirmed that even though the NCDC periodically conducts research studies, the research is not a priority area for this organization: *“Of course, we are considered a scientific-practical organization, not a purely scientific one, yes, we carry out certain scientific studies and analyze data a little deeper than necessary for practical work.”* [Expert 15]. The experts highlighted that the organization has the required resources to routinely carry out necessary research studies. However, some experts suggested impossibility of rigorous research due to different reasons, including lack of appropriate financing, personnel at the regional level, and high workload due to various situations such as the COVID-19 pandemic.

The research focus of the NCDC is the investigation and monitoring of various vectors, infectious disease, and risk mapping for the purpose of prevention and control of different infectious diseases. The research specifically focusing on climate change and health was not mentioned and highlighted during any interviews. Moreover, an expert stated that the research activities do not include and target the climate change component: *“No, we do not target climate in our analysis. In general, we give an analysis of the situation annually, it is posted on our website. We do not even have the tools to do that [climate change and health research].”* [Expert 9].

Additionally, some research studies focusing on environmental issues and health require additional capacities that are currently limited: *“As for other environmental factors, yes, to some extent, it should be understood that there are things that are a little more difficult to do; our research opportunities are limited in this regard, but we still try to address the most important issues in some way.”* [Expert 15]. It was revealed that there are no professionals within the NCDC with appropriate research training on environmental determinants and health, who could carry out specific research activities targeting environmental and climate change issues. In general, the research is carried out by epidemiologists, hygienists, and laboratory experts: *“You know, we do not have a separate specialist for climate change research. We have specialists who also deal with the climate change. The epidemiologists, hygienists, laboratory specialists of the NCDC are engaged in research activities, they also carry out scientific research.”* [Expert 10]. Thus, the capabilities to implement research on climate change and health is very limited.

The next major unit responsible for health information generation is the NIH. Established in 1963, the NIH apart from being the implementer of the core functions of the National Public Health Institute, it houses also the health sector’s information analytics center, which is responsible for gathering health data from all the units of the healthcare system. The NIH also provides postgraduate professional academic training. It also offers a one-year academic research training program for young medical graduates who want to pursue a career in research.<sup>125</sup> According to KI interviews, the NIH does not have any function related to climate change, it is beyond the organization’s mandate, and therefore, there is no research agenda in this regard.

Other health-related research organization includes the YSMU's department of Hygiene and Ecology, which conducts research on climate change and health, heavy metals in workplaces, as well as student nutrition.<sup>126</sup>

The CHSR of the AUA is a well-established and a recognized center for health services research activities. Since its inception in 1995 the CHSR has been involved in numerous research activities, advancing research and evidence in Armenia.<sup>127</sup> However, they have never conducted research on health effects of climate change.

The Acopian Center for the Environment at the AUA is a research center that focuses on environmental issues of Armenia, through research, education and community outreach promotes protection and restoration of the environment. Their research areas under the consideration in this center include biodiversity and conservation, sustainable natural resource management, clean energy, and energy efficiency, and as information technology and the environment. They also conduct a few projects on waste management in Armenia that has some climate change relevance.<sup>128</sup>

The self-assessment of essential public health operations in Armenia indicated that the MOH lacks a clear health-related research agenda, meaning that it does not identify priorities for the research centers and institutes.<sup>122</sup> Due to scarce resources the research in the majority of public health areas such as the burden of NCDs, social determinants of health, are not sufficient to address all the health risks. The MOH mainly cooperates with the United Nations organizations and international NGOs to satisfy the research needs. Other challenges that hinder the research implementation in the country include lack of skills in the workforce and inadequate capacity within research institutions.<sup>122</sup> It was also concluded, that there is a lack of coordination of and cooperation between research entities that hampers the development of the research and generating evidence to support policy-making of important public health issues in the country, including health effects of climate change.<sup>122</sup>

## **6.2.Data-gathering systems and communication of information**

During the healthcare system reforms of the 1990s, an electronic information system was introduced in Armenia which was used primarily by the SHA to process payment claims by hospitals. This information system facilitated the gathering of financial information, payment of providers, accounting, as well as automated data analysis. The system also provided the SHA with an opportunity to monitor volumes of provided services, undertake analysis of financial and activity data, and oversee allocations to different levels of providers.<sup>129</sup>

At a later stage, the Medical Institution Data Analysis System (MIDAS) or e-polyclinic for primary care facilities was introduced which enabled the monitoring of patient registrations and encounters. The e-hospital system was also designed to monitor inpatient care as part of MIDAS.

In 2017, the ArMed system replaced MIDAS. A privately operated health information system, ArMed allows real-time updates to patient registries through a unified system for primary, emergency, and hospital care. The system is integrated with the national population registry, preventing duplication of patient records. The system is not integrated with other health system databases such as the NIH database, or the NCDC database, which would enable policy-makers to make considerations for the burden of disease and population health needs in service delivery planning.<sup>130</sup>

There are governmental decisions that regulate data exchange between governmental bodies. Those decisions regulate the frequency and type of data to be exchanged. There is an information communication system in place called Mulberry, a computer program, which is used for efficient management of information communication between governmental organizations in Armenia including health and health determining sectors. The system is being used by the health sector to request and receive necessary information from different health determining governmental organizations including the Hydrometeorology and Monitoring Center SNCO of the Ministry of Environment. This way of data exchange was confirmed by many of the interviewed KIs and also by the experts from Hydrometeorology and Monitoring Center. Upon requests, the Hydrometeorological and Monitoring Center provides additional information and data, which is necessary for routine activities of the NCDC, such as average daily temperature, data on precipitations, speed of wind etc: *“We take the data that can affect the prevalence of mosquitoes, the expansion of their zones... That is, we take what we need. For example, we take information on average daily temperatures, meteorological precipitation, the wind speed and others, also at the regional level... what do entomologists need to make those specific calculations.”* [Expert 9].

Besides, the Hydrometeorological and Monitoring Center has a list of governmental and non-governmental organizations that periodically receive climate-related data from this center. The information is being disseminated among the government of Armenia, presidential staff, and other related bodies, territorial administration bodies, private organizations, and the general public. All the governmental bodies currently have comprehensive webpages with

available relevant data, which makes the information exchange easier: *“We have a number of government decisions that regulate the provision of data, who should provide what to whom. We have the websites of all the departments, which are very open, they contain a lot of information, which we all use, we do not bother each other unnecessarily, if there is any information on the website, we take it and work, it makes our work much easier. In addition, if necessary, we can request additional information, for example, the average daily temperature and they should calculate the annual average and provide us. We can even check such information by phone.”* [Expert 15].

The communication of information between the MOH and non-governmental organizations is being conducted via meetings, presentations, and round-table discussions, and a public council or expert’s panel next to the Minister of Health (e.g., on COVID 19).

### **6.3. Health data and information availability and access**

The Information Analytic Center (IAC) of the NIH serves the whole country as a source of expertise to assist the development of different health programs, policies, strategies, and legislation. The center gathers data on health statistics and assesses the health status of the population and is responsible for the monitoring of diseases and risk factors, health promotion and education. It generates regular reports for the MOH and WHO health for all databases. The annual budget of the center provided by the MOH is limited, which hinders the development of expanded research in various directions.<sup>122</sup>

The prepared reports and publications by the IAC are available through websites, newspapers, national and international journals, conferences and easily accessible for all stakeholders, including policy-makers, health professionals, the media, and the general population of Armenia.<sup>122</sup> The center annually prepares reports such as the “Armenia Health System Performance Assessment” or the “Health and Healthcare Statistical Yearbook”.<sup>131</sup> Those reports also include mortality and morbidity data on climate-sensitive diseases including CSDs, respiratory diseases, intestinal infections, food born poisonings, infectious diseases, and others. The reports also include similar annual data at the regional and hospital levels. The information is also presented by age, gender, marzes, and nosology. Upon requests, other disaggregated information can be accessed.

The NCDC through its webpage publishes various reports for specific health conditions including epidemiological situation regarding infectious diseases, food, and chemical poisonings. The reports are presented monthly and include disaggregated data by nosology

and regions.<sup>132</sup> Monthly reports on observed cases of infectious diseases, food and chemical poisonings, radiation are also available in the NCDC webpage which include disaggregated data by age groups, rural and urban population, months and year.<sup>133</sup> The webpage also presents maps of different outbreaks observed in recent years in Armenia.<sup>134</sup>

#### **6.4.Socio-economic and environmental data availability and access**

The National Statistical Service of the Republic of Armenia (Armstat) produces official statistics. It is financed by the state budget. The system provides official statistics in Armenia including socio-economic and environmental indicators. The system also ensures transparency and access to aggregated statistical information and metadata.<sup>135</sup>

The National Statistical Service and Ministry of Health of Armenia collaboratively produce the Demographic and Health Survey reports with 5-year intervals and besides health indicators also include data on various climate-sensitive aspects including indicators on drinking water, sanitation, and housing characteristics, and various socio-economic disaggregated data about the Armenian population.<sup>136</sup>

The Hydrometeorology and Monitoring Center SNCO of Ministry of Environment of RA is responsible for a set of environmental data such as air quality, water quality, forest, and waste monitoring. The monitoring center consists of 16 main stationary active sampling and automated observation stations which conducts monitoring on a daily basis and 211 mobile passive sampling observation points, which perform monitoring on a weekly basis. The organization conducts monitoring of the main pollutants of the air including sulfur dioxide, nitrogen oxides, carbon monoxide, dust and ground-level ozone, sulfur dioxide, and nitrogen dioxide. Air quality assessment is conducted according to the RA Government N160-N decree (2006). The data is publicly available on the Hydrometeorology and Monitoring Center webpage. Disaggregated daily, monthly and yearly data by location and indicators is available and presented in charts and graphs.<sup>116</sup>

Similarly, the center provides surface and ground water quality monitoring data. Surface water quality is described by up to 45 physicochemical indicators with a frequency of 5-12 times per year. Water quality assessment is supervised in accordance to the RA Government N75-N decree (2011). Underground freshwater monitoring network consists of 100 groundwater springs of 6 water basin management areas (Northern, Akhuryan, Hrazdan, Sevan, Araratyan, Southern), which include 25 self-flowing wells, 32 borehole wells and 43 natural springs. The center carries out monitoring of water volume, level (pressure) and



temperature 6 times per month. Additionally, groundwater quality monitoring is performed in 40 springs twice a year and around 40 indicators are determined for each spring (major anions and cations, metals, and salt regime elements). The surface and groundwater quality disaggregated data is also available through charts and graphs.<sup>118,119</sup>

The Ministry of Environment webpage provides comprehensive information on the meteorological situation in Armenia. There are series of published reports, which include monthly climate profile and forecasts. Data is presented by location, month, average daily and monthly temperatures, maximum and minimum observed temperatures.<sup>137</sup>

Table 3 summarizes the names of agencies and type of data they collect that could be used as main sources of climate change related health and environmental data.

### **6.5.Sufficiency and availability of in-country climate and health related research**

During the literature review the AUA team identified only two research reports on health effects of climate change in Armenia; however, we cannot judge about the quality of those studies.

The experts mentioned that there are no coordinated efforts for research on climate change. Currently, the research targeting specifically climate information and health data is almost absent in the country: *“As I mentioned earlier, if we can have an effective data collection and analysis system [on climate change related indicators], it will be very helpful to have appropriate advocacy and to develop effective plans and strategies. Again, the problem is that we do not have an effective information system or it is absent.”* [Expert 6]. There is no unified approach to climate change research; the country does not have climate change and health research agenda. IDIs with various key informants from health determining sectors confirmed this finding and raised the issue of lack of documented evidence on climate-related health impacts in Armenia.

A few research activities were described by the representative of YSMU on climate and health in collaboration with the Hydrometeorology and Monitoring Center, however, according to the expert even those few studies remained on papers and were never used in any way for the health sector adaptation. According to the expert, the research is essential for climate-informed decisions especially for developing strategies for vulnerable groups of populations: *“It is a pity that I could not collaborate with any other organization and my research remained on paper. I have suggested that these studies could be used by the MOH*

*and the Ministry of Emergency Situations. In the future, these forecasts could be used for raising awareness of the population in advance. But it remained, the work remained theoretical. Unfortunately, it had no practical implications. In this case, what is the value of those studies?” [Expert 13].*

Experts from the health sector revealed additional insight on possible reasons of research scarcity, particularly highlighting the lack of specific environmental indicators being routinely monitored: *“Some data, such as air monitoring and water and water reservoir monitoring data, are insufficient to fully assess health impacts... It is a difficult thing. Creating an air monitoring network is a huge thing for the country - it is connected with a laboratory, automatic stations, it is a big thing. Nevertheless, we always voice our demand and I am sure that the responsible sectors do what is possible.” [Expert 15].*

The KI interviews demonstrated that experts from the health sector were not clear on what data are needed for health impact assessment, and hence, never communicated with other sectors proactively requesting additional data collection that could help conducting research on health impact of climate change (e.g., develop in-country capacity to collect data on PM2.5 or PM10).

## **7. IMPLICATIONS OF CLIMATE CHANGE ON HEALTH-RELATED DEVELOPMENT GOALS, LEGISLATION, STRATEGIES, POLICIES, AND PLANS**

The elicitation of major gaps and implications of climate change health adaptation was conducted in accordance with the building blocks of the health systems as per WHO Climate-Resilient Health System Framework.

In the management of health risks, including those related to climate change the Armenian health sector developed and approved numerous legal acts, policies, and strategies. However, no specific focus on climate change health adaptation measures was found in most of the documents guiding the management of health risks. Even though health policy documents on infectious diseases touched upon climate change as a risk factor for the spread of infectious diseases, no specific considerations of climate change and its variability were reflected.

Those policy documents included the state program for prevention of malaria invasion and ecesis, 2012-2016 strategy program for preventing and fighting against infectious diseases, infectious diseases control program for infections common for people and animals, the program for fighting against infectious disease transmitters in Armenia, and regulations and

sanitary norms for the control of disease transmitters. None of the reviewed health policies on non-communicable diseases reflected on climate change and its variability including national strategies for controlling non-communicable diseases responsible for the highest share of mortality, healthy lifestyle strategy, 2016-2020 program of most common non-communicable diseases, and 2015-2020 program on trauma and list of measures for preventing trauma and trauma-related complications (Annex 3). Therefore, health risks determined by climate change are being addressed only indirectly with the potential of not fully covering all the health impacts of climate change. The listed main health policy documents should be revised to reflect climate change considerations. As suggested by the WHO framework, political commitment is essential for implementing a broad spectrum of targeted programs and strategies for climate change health risks. The assessment revealed a potential for improved commitment to advance and mobilize human and financial resources for health adaptation activities in the country. The international organizations' capacity and long-time expertise might further assist the government in effective and timely planning and coordination of health adaptation measures. Despite ongoing initiatives at different organization-based levels, there are no coordination mechanisms across individual programs to maximize the protection of health. Taking the case of emerging health adaptation measures in other health determining sectors, the health sector has the opportunity to prioritize and develop climate change health adaptation measures and further implement them. In routine management of health risks, the health sector has various multi-sectorial collaborations. However, the collaborations were characterized as insufficient between the health and health-determining sectors. More effective collaboration is essential for addressing such multi-dimensional issues as climate change is. Given the growing political will and existing structure, there is a room for improving and advancing the nature of interdepartmental collaborations.

According to the assessment of the Armenian health sector workforce, it needs further development to provide quality healthcare services in regions and improve overall knowledge on climate change and health linkage. In addition, climate change is not sufficiently incorporated into medical and nursing education and continuous professional development curricula.

The assessment showed that the country has health research capacity, however, almost none of the organizations focus their research efforts to study climate change and health. It can be implied, that the country lacks capacity specifically on this issue. Moreover, the NCDC as the leading organization in the prevention and control of most of the climate-sensitive health

risks does not prioritize research in general including those to assess climate change related health burden among the Armenian population. Despite the available and accessible health and climate-related disaggregated data, the health sector does not have a research agenda to follow. Having an appropriate research agenda is crucial and would be necessary for creating an evidence base to develop targeted policies and strategies and employ effective advocacy mechanisms. The research agenda should mainly aim to generate evidence on climate change and specific health outcomes in Armenia, identify priority areas and groups of population to support evidence-based decision making. In addition, the methodology behind the health vulnerability assessment is not clearly defined and, in fact, may be even lacking evidence-based approaches for comprehensive identification of all climate-related risks and their projections.

The health programs in Armenia are not climate-informed, especially those dealing with non-communicable diseases. From the perspective of service delivery of emergent climate-sensitive infectious diseases, the responsible bodies were prone to act retrospectively, reacting to already existing issues, rather than proactively to take preventive and early response measures. However, the experts from the health sector did not acknowledge it as a potential gap.

## **8. RECOMMENDATIONS**

Based on the assessment, the research team makes the following recommendations to assist health adaptation planning in Armenia:

- Take advocacy efforts with the Ministry of Health and the Government of Armenia to cultivate commitment to advance and mobilize human and financial resources for health adaptation activities in Armenia.
- Establish a unit or a working group within the health sector (the MOH) with defined roles and responsibilities to lead, govern and coordinate health adaptation activities.
- Revise relevant health policies and strategies indirectly linked to health risks of climate change to reflect climate change and health considerations from the perspective of adaptation and mitigation.
- Building upon the existing practices strengthen multi-sectoral collaborative capacity.
  - Define roles and responsibilities of health-determining sectors in protection from climate change-related health risks.

- Extensively use existing mechanisms of collaboration to engage and involve in joint decision-making activities for climate change adaptation.
- Organize frequent cross-sectoral meetings between the health and health-determining sectors to strengthen the communication and engagement.
- Ensure presence of health considerations in all the climate change related documents and climate change considerations in all health-related policies and strategies.
- Ensure the representativeness of women in all climate change health adaptation decision making activities.
- Conduct healthcare workforce needs assessment to evaluate knowledge, attitude and practices on climate change health impacts.
- Develop a health communication strategy to improve climate change health literacy and ensure involvement of various stakeholders including policymakers, healthcare workers, researchers, media and NGO representatives and other health determining sectors.
  - Launch an awareness raising campaign for the general public to increase the knowledge and improve attitude towards the climate change and its health impacts.
- Build the capacity of health workforce on climate change and health.
  - Revise medical and nursing education curriculum and ensure rigorous coverage of climate change and health.
  - Prepare and implement an accredited post-service training program for the healthcare workforce ensuring national participation (could be mandatory).
- Prioritize research and develop a research agenda in the field of climate change and health.
  - Establish an inter-disciplinary task force to develop a research agenda on the impact of climate change on health in Armenia and ensure the participation of relevant professionals, experts and researchers.
  - Organize stakeholder meetings including research and educational institutions, relevant NGOs to discuss the research agenda and its implementation.
  - Develop a specific list of climate change indicators (e.g., particulate matter) that could be used in health impact research to ensure routine monitoring and data collection of information necessary for such research by relevant agencies.
  - Coordinate country-wide research efforts to ensure generation of relevant and necessary evidence for climate-informed policy development.

- Adapt the evidence-based methodology of health vulnerability assessment recommended by the WHO for the local context.
- Conducts periodical and evidence-based health vulnerability and adaptation assessments.
- Ensure proper consideration of health vulnerability assessments in climate-informed policy development.
- Adapt and develop hygiene and sanitation standards and regulations for schools in Armenia based on the WHO standards.
- Ensure monitoring of availability and access to public and private open and green spaces.
- Identify regions/areas with poor or unequal access to open and green spaces and advocate on the importance of creating such places.
- Conduct a needs assessment and foresee potential increased demand of essential medical products and technologies in the sense of enhancing climate determined health burden and ensure sufficient procurement.

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## TABLES

**Table 1. Common causes of mortality, 2018**

Mortality cause		Mortality rate, 1990 <i>per 100 000 population</i>	Mortality rate, 2018 <i>per 100 000 population</i>
<b>1.</b>	Circulatory system diseases	305.9	487.6
<b>2.</b>	Neoplasms	99.9	175.1
<b>3.</b>	Diseases of the respiratory system	83.6	66.6
<b>4.</b>	Cerebrovascular diseases	55.6	62.2
<b>5.</b>	Diseases of the digestive organs	50.3	41.0
<b>6.</b>	Accidents, poisonings, injuries	21.1	35.6
<b>7.</b>	Diabetes mellitus	14.0	19.5
<b>8.</b>	Nervous system diseases	13.6	5.9
<b>9.</b>	Vector-borne and parasitic diseases	13.0	5.5

**Table 2. Number of public and private PHC and inpatient facilities by marzes, 2019**

Region	PHC	Inpatient
<b>Yerevan</b>	138	53
<b>Aragadzotn</b>	24	6
<b>Ararat</b>	60	6
<b>Armavir</b>	60	4
<b>Gegharkunik</b>	40	7
<b>Lori</b>	41	7
<b>Kotayk</b>	47	10
<b>Shirak</b>	32	15
<b>Syunik</b>	17	7
<b>Vayots Dzor</b>	8	3
<b>Tavush</b>	27	7
<b>Total</b>	<b>494</b>	<b>125</b>

**Table 3. Agencies that collect climate change and health relevant data in Armenia**

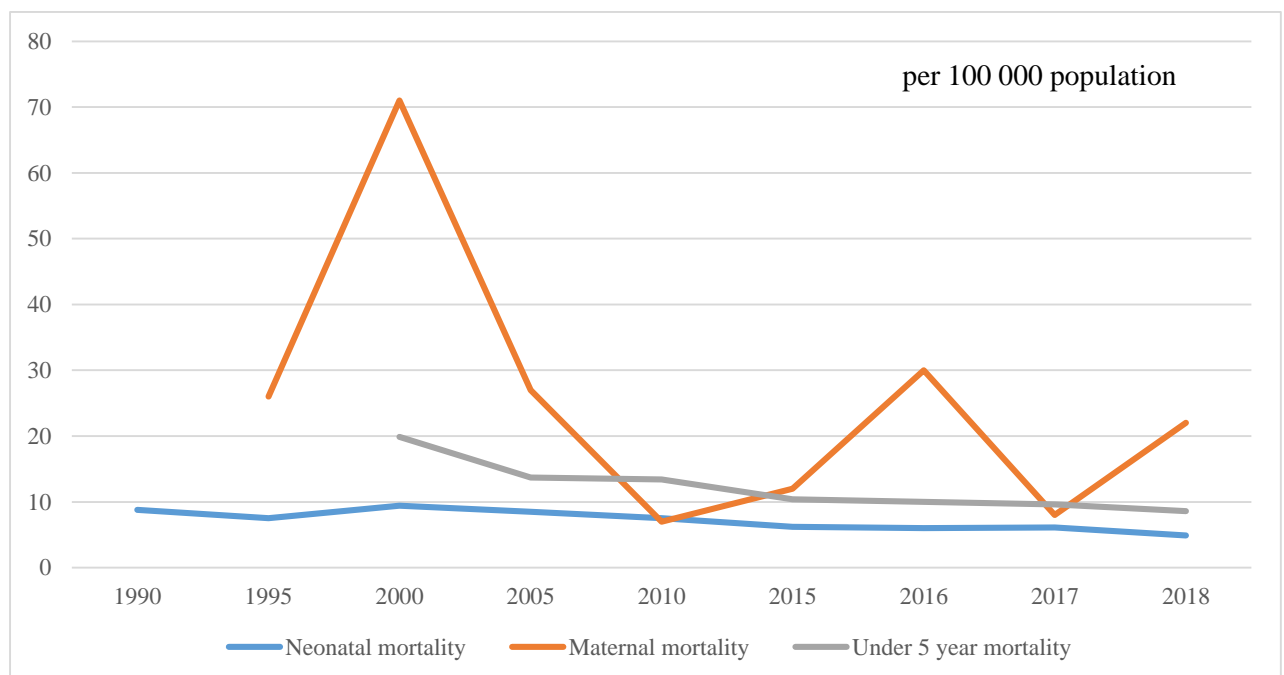
Name of the organization	Type of data
<p><b>The Information Analytic Center of the National Institute of Health Named after Academician S. Avdalbekyan, Ministry of Health</b>  <a href="http://nih.am/am">http://nih.am/am</a></p>	<p>Health statistics</p> <ul style="list-style-type: none"> <li>• <i>Health and Healthcare Statistical Yearbook</i> (key indicators on the activities of health and healthcare system; performance of healthcare facilities; situation with non-communicable and communicable diseases; statistics at marz level, age and gender distribution)</li> <li>• <i>Armenia Health System Performance Assessment</i> (analysis of demographic, health indicators, morbidity and mortality by nosologies, age and gender)</li> </ul>
<p><b>National Center for Disease Prevention and Control SNCO, Ministry of Health</b>  <a href="https://ncdc.am/">https://ncdc.am/</a></p>	<p>Health statistics</p> <ul style="list-style-type: none"> <li>• <i>Reports</i> (epidemiological situation related to infectious diseases, food and chemical poisonings, radiation; disaggregated by age groups, rural and urban population, months and year)</li> </ul>
<p><b>Statistical Committee of the Republic of Armenia (Armstat)</b>  <a href="https://www.armstat.am/am/">https://www.armstat.am/am/</a>  <a href="https://www.armstat.am/en/">https://www.armstat.am/en/</a></p>	<p>Official statistics in Armenia</p> <ul style="list-style-type: none"> <li>• <i>Demographic and Health Survey reports</i> (various health indicators; socio-economic indicators; disaggregated)</li> <li>• <i>Statistical reports</i> (living conditions, socio-demographic status, households, etc.; yearbooks and monthly reports)</li> </ul>
<p><b>The Hydrometeorology and Monitoring Center SNCO, Ministry of Environment</b>  <a href="http://www.mnp.am/am/pages/217">http://www.mnp.am/am/pages/217</a>  <a href="http://www.mnp.am/en/pages/217">http://www.mnp.am/en/pages/217</a></p>	<p>Environmental data (disaggregated daily, monthly and yearly data by location and indicators)</p> <ul style="list-style-type: none"> <li>• <i>Meteorological data</i> (published reports, monthly climate profile and forecasts)</li> <li>• <i>Air quality</i> (pollutants of the air including sulfur dioxide, nitrogen oxides, carbon monoxide, dust and ground-level ozone, sulfur dioxide, and nitrogen dioxide)</li> <li>• <i>Water quality</i> (surface and ground water quality monitoring data; up to 45 physicochemical indicators)</li> <li>• <i>Forest and waste monitoring</i></li> </ul>

**FIGURES**

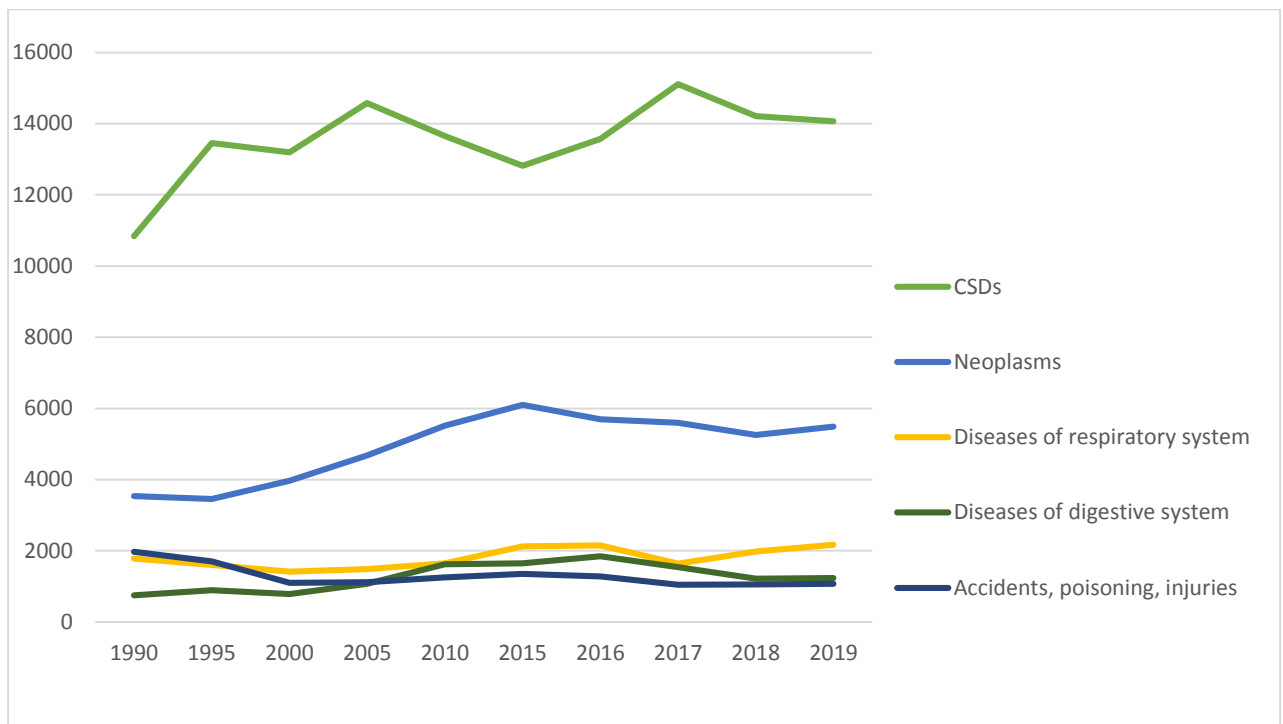
**Figure 1. The WHO Climate-Resilient Health System Framework**



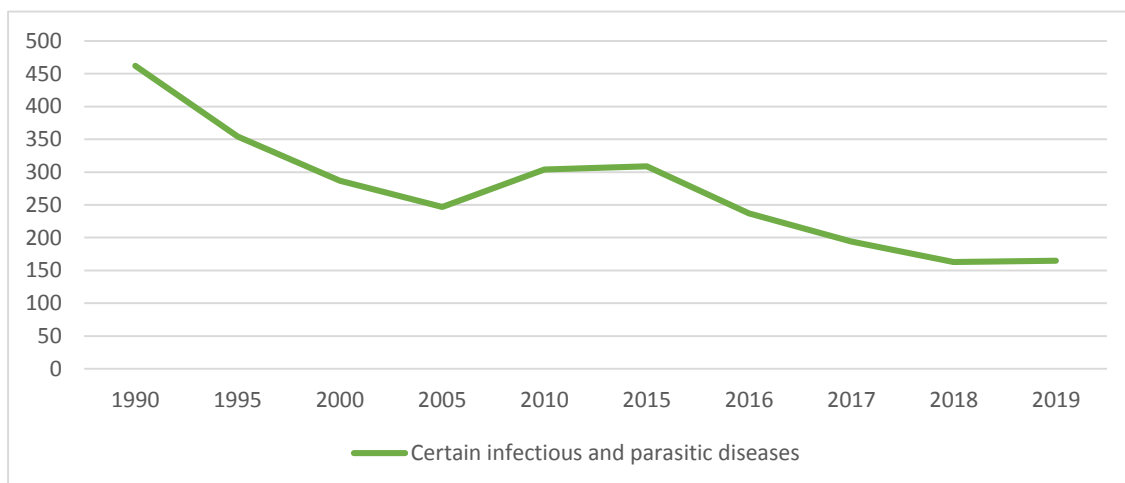
**Figure 2. Trends of neonatal and maternal mortality rates, 1990-2018**



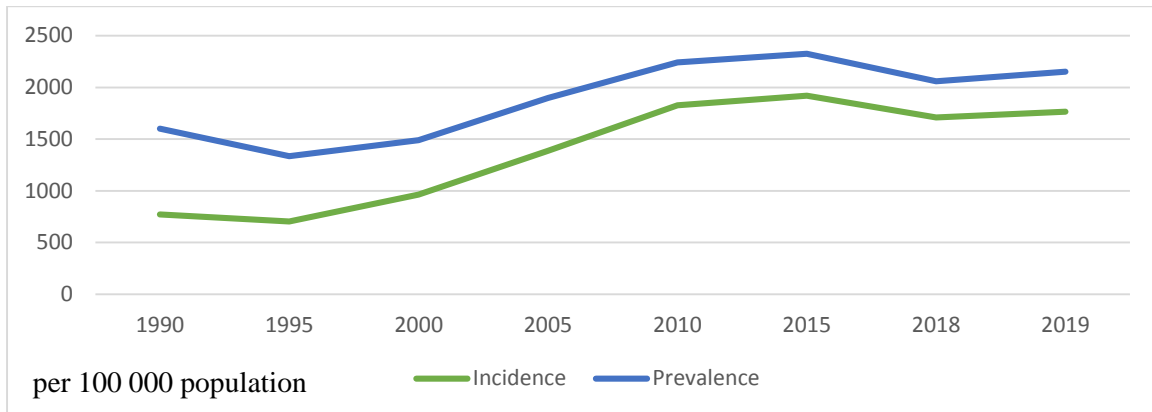
**Figure 3. Trends of common causes of death in absolute values, 1990-2019**



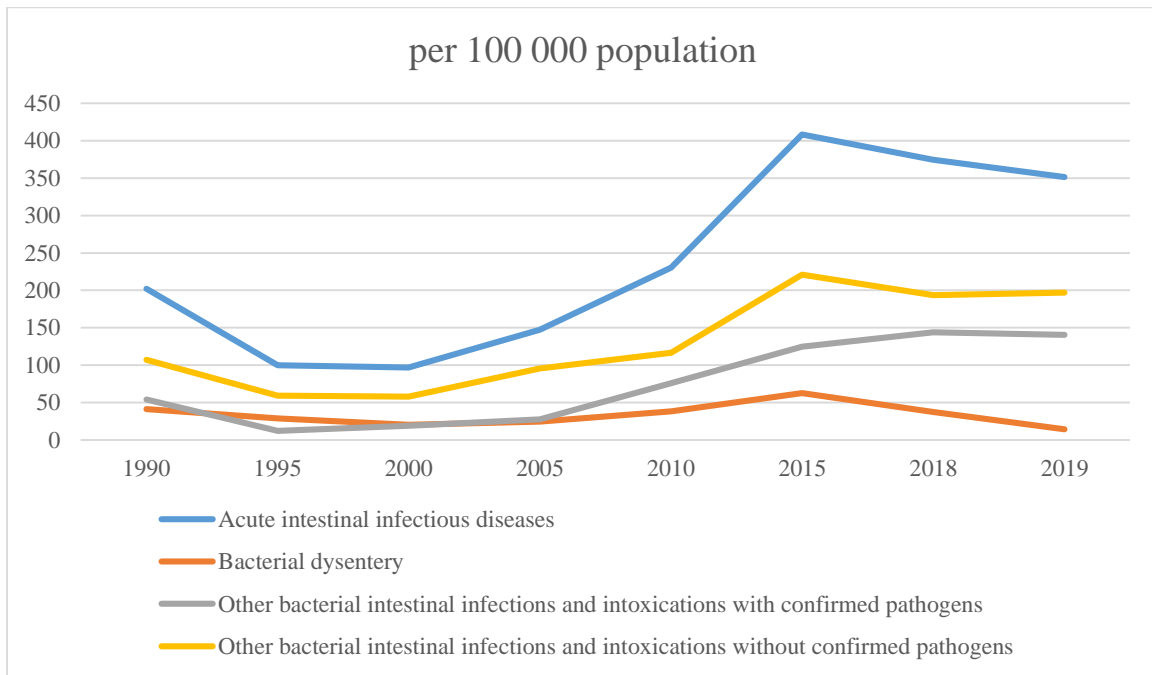
**Figure 4. Number of deaths from infectious and parasitic diseases, 1990-2019**



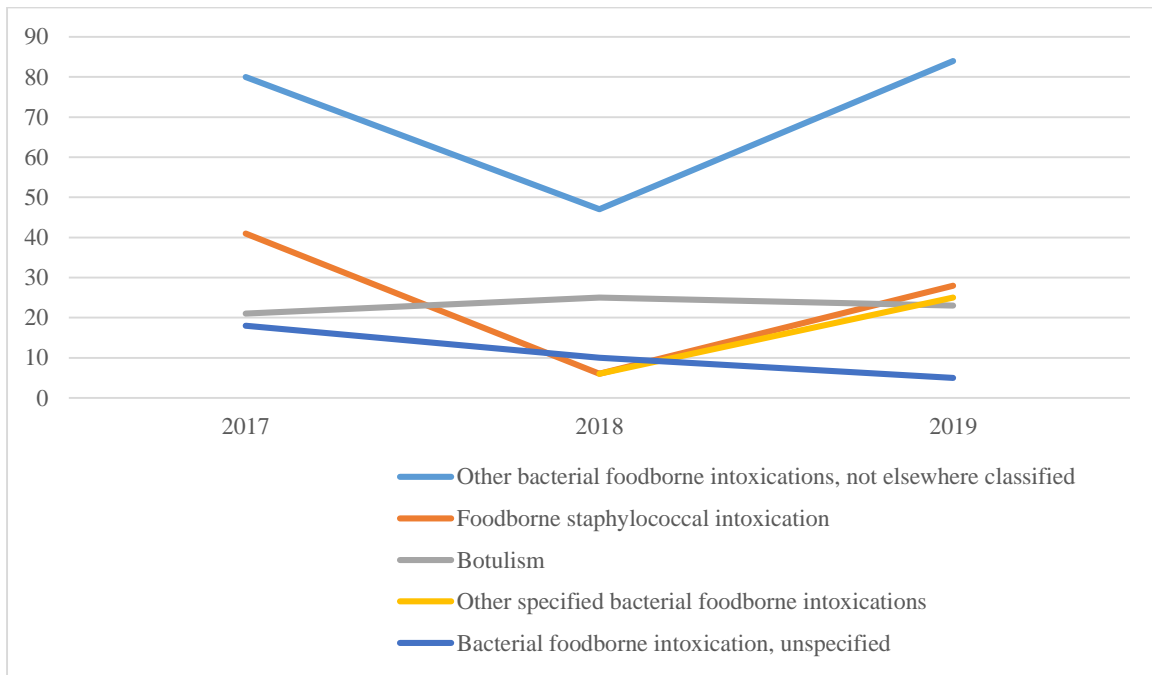
**Figure 5. The incidence and prevalence rates of certain infectious and parasitic diseases among 15 years and above, 1990-2019**



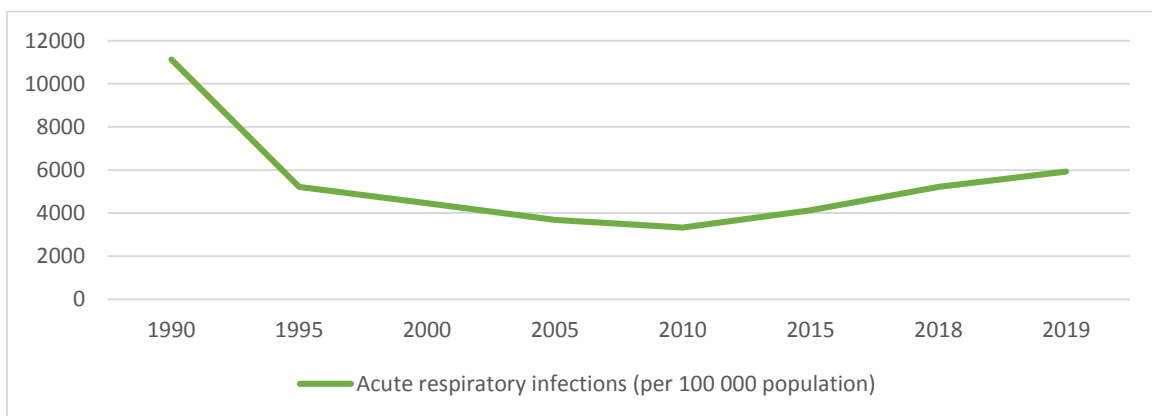
**Figure 6. The prevalence rates of acute intestinal infectious diseases, 1990-2019**



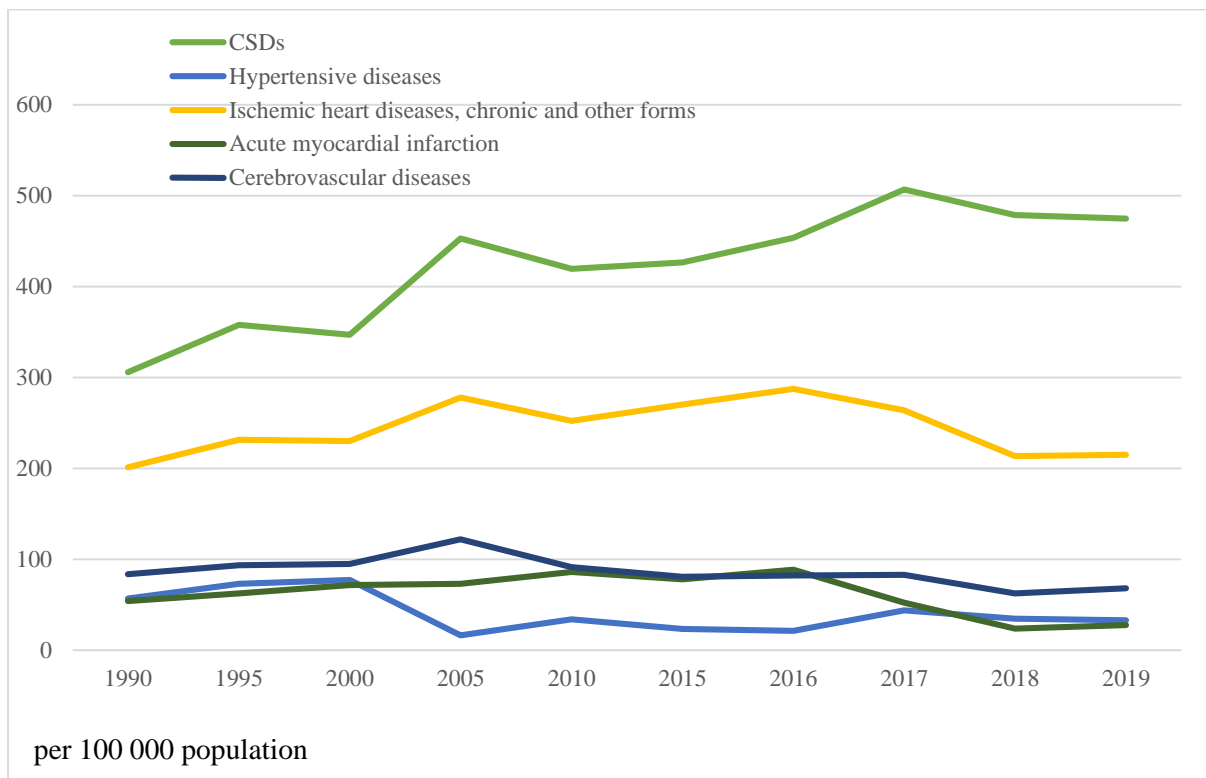
**Figure 7. Number of foodborne bacterial intoxications, 2017-2019**



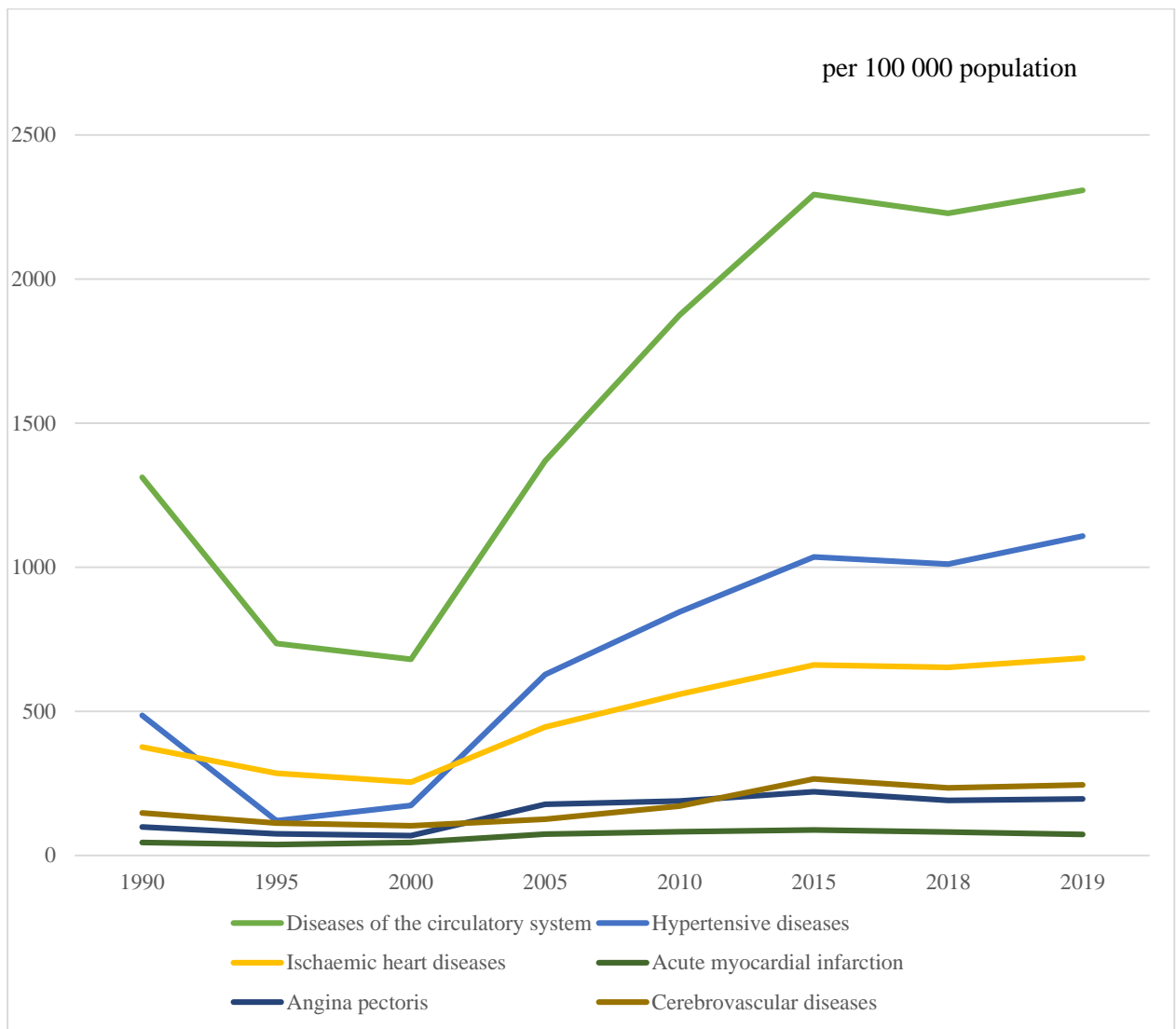
**Figure 8. The prevalence rates of acute respiratory tract infections, 1990-2019**



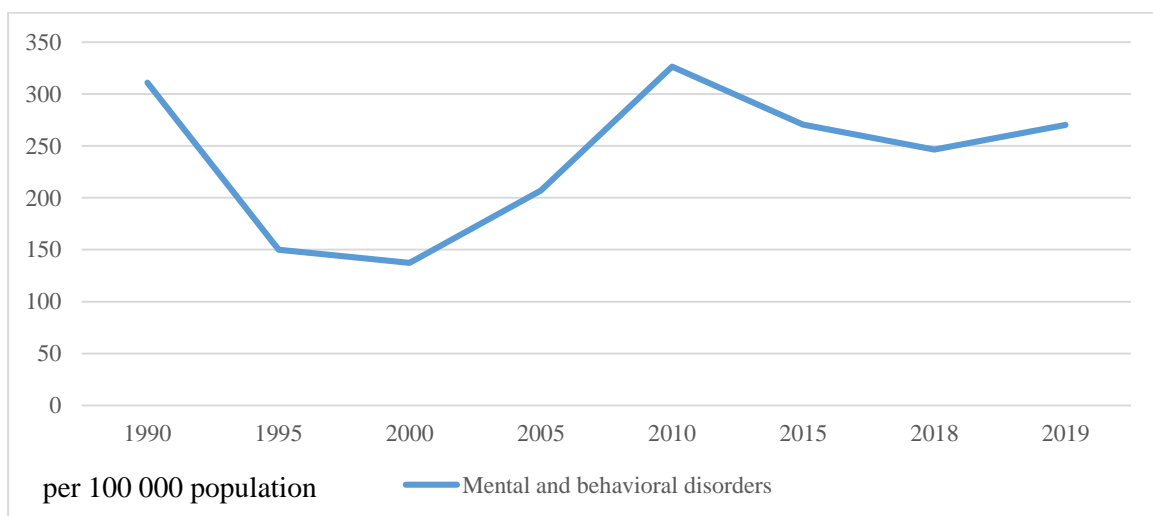
**Figure 9. CSDs mortality rates per nosologies, 2009-2019**



**Figure 10. CSDs incidence rates per nosologies, 1990-2019**

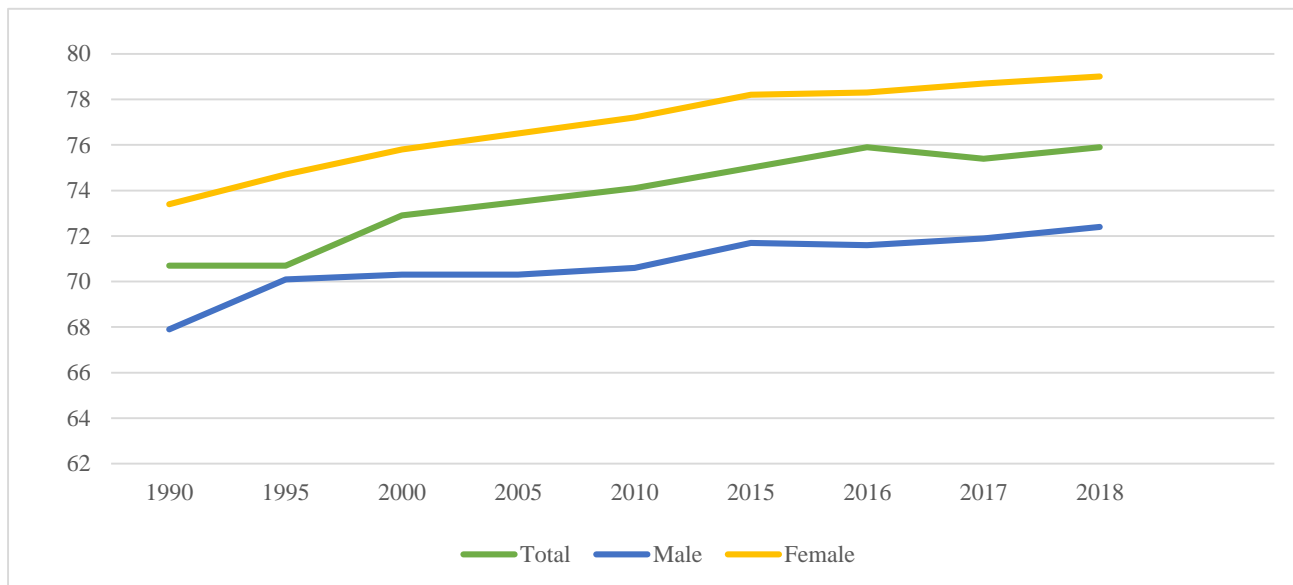


**Figure 11. Incidence rates of mental and behavioral disorders, per 100 000 population, 1990-2019**





**Figure 12. Trends of life expectancy by gender, 1990-2018**



## ANNEXES

### Annex 1. List of organizations involved in the qualitative assessment

<b>Organizations</b>	<b>Number of participants</b>
National Center for Disease Control and Prevention of the Republic of Armenia	3
“Hydrometeorology and Monitoring Center” State Non-commercial Organization	2
National Institute of Health of the Republic of Armenia	1
Yerevan State Medical University after Mkhitar Heratsi	1
Health and Labor Inspection Body of the Republic of Armenia	1
Food Safety Inspection Body of the Government of the Republic of Armenia	1
UNICEF	1
Ministry of Emergency situations of the Republic of Armenia	1
Ministry of Environment of the Republic of Armenia	1
Armenian Red Cross Society	1
Non-governmental organizations (NGO)	1
Independent experts	1

## Annex 2. In-depth interview guides for experts

### In-depth interview guide for MOH experts

*Let's talk about climate change, its health impacts, adaptation measures, and its **governance**.*

1. What do you think about the possible impact of climate change on the Armenian population?
2. Please describe the activities that MOH is undertaking in the field of climate change? Please specify any ongoing and past adaptation activities/programs in managing climate-sensitive health outcomes.
  - a. Please specify any past or ongoing health adaptation projects. What can you say about their effectiveness?
3. How much climate change adaptation measures are prioritized by the Armenian government? How does the climate change addressed in the policy development, planning and management of climate-sensitive health diseases (*e.g. non-communicable diseases, vector-borne diseases, nutrition, infectious diseases, disaster risk reduction*)?
4. What legal documents (policies, strategies, and procedures) guide health adaptation measures in Armenia?
  - a. How much are those policies inclusive and targeted (*health vulnerability, socio-economic factors, gender equity*)? What gaps do you see in this regard? How those policies can be strengthened?
  - b. What bodies are responsible for developing adaptation policies or measures? What structures, units, working groups exist in the health sector to manage climate change health impacts? What are their main responsibilities?
5. What **multi-sectoral partnerships/collaborations** are established at the national level between the MOH and main stakeholders to deal with climate change and its health impacts? (*e.g. Health and Labor Inspection Body, Meteorological services, Ministry of Environment, Ministry of Emergency Situations, Ministry of Territorial Administration and Infrastructure, Ministry of Labor and Social Affairs etc.*).
  - a. How would you describe cross-sectoral intersections between health and health-determining sectors in terms of information and activities – and where are the key gaps and cross-sectoral barriers?
  - b. How would you describe existing multi-sectoral collaborations to prevent health risks related to disasters, water, waste, food and air pollution (*e.g. environmental health; vector control; water, sanitation and hygiene; disaster management; health information systems; policy; and finance*)?
  - c. Please describe any gaps and barriers that hinder the effective multi-sectoral collaborations between the MOH and other stakeholders including NGO's. How can it be improved?

6. How do the existing information on climate change and health is used by the health system? How the National Communication Reports are interpreted and used? Who are responsible for these activities?
  - a. Please comment on the research capacity of the health system on the link between climate change and human health. How it can be strengthened? What are the needs of the health system in this regard?
7. Please describe how does health communication take place in health sector (internal within sector, external to public, and external to other sectors)?
8. What are the main challenges that hamper health adaptation in the country?
  - a. What do you think about the availability of **financial** resources allocated for health sector adaptation measures to climate change?
  - b. Please comment on availability of the **essential health products and equipment** for managing climate-sensitive health risks (*e.g. vaccines for climate-sensitive diseases*). Please identify barriers if any.

*Let's discuss the **health workforce** and it's capacity for health sector adaptation.*

9. What do you think about the health sector's organizational capacity to address climate change health impacts (*e.g. sufficient health personnel in case of extreme weather events and outbreaks, capacity-building plans, communication plans, enough health facilities*)?
10. Please comment on human resources (*including providers, health managers, experts, scientists, researchers etc.*) and their competencies (*e.g. to understand and use climate information for health, participate in decision-making, engage in cross-sectoral monitoring, conduct research and interventions, and effectively manage changing risks to health and health system performance*).
11. What do you think about the technical and professional capacity of healthcare professionals to deal with the health risks of climate change? (*e.g. knowledge on climate change health risks, their responsibilities, the capability to identify and provide appropriate health services*).
12. Please identify the main gaps in the health system's organizational capacity to cope with the health risks of climate change?
  - a. Do you see a need in further interventions to improve health workforce competencies (*e.g. trainings*)?
13. Please comment on the accessibility of healthcare facilities by the healthcare workers and the public in case of emergencies related to climate change such as floods (*e.g. transportation*). Are such issues considered in the policy development level?
14. Please comment on the availability of open spaces (*e.g. green space*). Does the MOH monitor its availability level? Do you see a need for such research/information?

*Let's conclude the interview.*

15. Please suggest what measures will enhance the adaptive capacity of Armenia to respond to climate change? What opportunities do you see to strengthen the health sector response?

## **In-depth interview guide for NCDC experts**

*Let's talk about climate change, its health impacts, adaptation measures*

1. What do you think about the possible impact of climate change on the Armenian population?
2. Please describe the main responsibilities of the NCDC in the implementation of climate change health adaptation measures, both direct and indirect.
3. What specific actions are implemented at the national, regional, and community levels for climate change health adaptation. Please also describe the engagement of the public and private health sectors. How does the NCDC coordinate those measures?
  - a. Please specify any past or ongoing health adaptation projects. What can you say about their effectiveness?
4. Which organizations does the NCDC collaborate for implementation of the aforementioned measures? What are the strongest and the weakest aspects of those collaborations?
5. What informational technologies are employed to improve health system resilience (*e.g. mobile communications for improving emergency response, e-Health for accessing and analyzing the connections between environmental and health data, satellite-based remote sensing of the meteorology and environmental conditions*)?
6. In your opinion, are the health risks of climate change comprehensively identified in the vulnerability and adaptation assessments (V&A) in Armenia in the National Communication reports? What shortcomings can you identify in V&A assessments (*methodology*)? What can be done for making the V&A assessments more compatible and effective for supporting evidence-based policymaking?
7. What interventions have been implemented in response to V&A assessment results, specifically targeting climate change health adaptation? How else are the V&A assessment results used to prioritize the allocation of resources and for designing effective interventions in health and related sectors?
  - a. Which communities are most sensitive to climate change health risks? What actions are implemented to support climate change health adaptation in those vulnerable communities?
  - b. For example, in climate-sensitive areas, such as Vayots Dzor, or in the management of climate-sensitive diseases.
8. What surveillance systems exist to monitor and manage the main climate-sensitive health risks and diseases (*both infectious and non-communicable*) identified by the V&A assessments? For example:
  - c. Early detection tools (*e.g. rapid diagnostics*) to identify the changing incidence of climate-sensitive diseases.

- a. Tracking of geographic and seasonal distribution of the health risks and outcomes (*e.g. risk mapping*).
  - b. Establishment of early warning systems for the relevant extreme weather events and climate-sensitive diseases (*e.g. heat-stress, zoonotic diseases, undernutrition*).
9. Please describe the existing practices of the health sector to access, interpret and apply climate-related data and information.
- a. What type of data on climate change and health is being collected?
  - b. How does the health sector access, interpret and apply climate-related data and information? How meteorological information is being used to protect human health? How it is communicated to the main stakeholders?
  - c. Are there existing mechanisms of data exchange between the Hydrometeorological service and the MOH? Who are responsible? Who/what does specific MOH department/agency get this information?
  - d. How often and how does this information communication take place?
  - e. Do you request them to provide specific meteorological data? How it is decided what data should be requested?
  - f. How the information is further analyzed and communicated down to all levels of health service delivery and related agencies?
  - g. How the information is communicated by MOH/health services with the general public and vulnerable groups?
  - h. How the information on environmental determinants of health (*air quality, water quality, food quality, housing safety and waste management*) and epidemiological trends are collected, analyzed and interpreted? Who are responsible for these activities? Please identify gaps in these activities?
  - i. How the data is used in the design and implementation of public health, disease control, and prevention policies and strategies at national, sub-national and local levels?
  - j. How are the risk maps and seasonal trends used in the prevention of climate-sensitive diseases?
10. Please comment on the research capacity of the health system on the link between climate change and human health. How it can be strengthened? What are the needs of the health system in this regard?

*Now we will discuss the climate sensitive disease control and service delivery.*

11. How are the ongoing national programs on various health issues linked to the management of climate change sensitive health risks?
12. Please describe what actions are implemented to address the following health risks:
- a. Extreme heat and thermal stress
  - b. Water-borne and foodborne diseases
  - c. Zoonotic and vector-borne diseases
  - d. Allergic diseases and cardiopulmonary health
  - e. Nutrition
  - f. Mental health and disability
  - g. Storms and floods

13. What gaps and barriers would you identify in the implementation of climate-sensitive disease control?
14. How does the health system mobilize its resources to respond to extreme weather events or delivery of interventions to control outbreaks of infectious diseases?
15. What contingency plans does the health sector have for risk reduction, preparedness, and response during extreme weather events? Are those in line with the international recommendations?
16. How would you characterize the preparedness of the health system/facilities for the emergency response? What about the regional and community levels?
17. To what extent does the public support work on climate change? What is the local communities' role in emergency preparedness and response? What is being done to develop the local communities' capacity to identify risks, prevent exposure to hazards, and take action to save lives in extreme weather events?

*Let's conclude the interview.*

18. Please suggest what measures will enhance the adaptive capacity of Armenia to respond to climate change? What opportunities do you see to strengthen the health sector's response?



## **In-depth interview guide for experts from hydrometeorological service**

1. What do you think about the possible climate change health impact on the Armenian population?
2. Please specify any activity that your organization is undertaking in the field of climate change? Do they include human health component? How impactful are those activities? Please describe.
3. What data is being collected in your organization directly or indirectly related to health (*e.g. climate, air and water quality etc.*)?
4. What partnerships and collaborations are established between the Hydrometeorological Service and MOH to deal with climate change and its health impacts? Please describe the collaboration between the Hydrometeorological service and MOH.
  - a. What specific responsibilities does your organization have in addressing climate change sensitive health risks?
  - b. Please describe existing multi-sectoral collaborations between you and other stakeholders to prevent health risks related to disasters, extreme weather event etc.
  - c. What are the strongest and the weakest aspects of those collaborations? Please describe any gaps and barriers that hinder the effective multi-sectoral collaborations between your organization and MOH and others. How can it be improved?
5. Please describe the existing practices of communication of climate data between Hydrometeorological service and the MOH. How does the health sector access climate-related data and information? How it is communicated to the main stakeholders (particularly MOH)?
  - a. Are there existing mechanisms of data exchange between the Hydrometeorological service and the MOH? Who are responsible? Who/what does specific MOH department/agency get this information?
  - b. Do you receive requests to provide specific meteorological data to the MOH? How it is decided what data should be shared?
  - c. How often and how does this information communication take place?
6. What gaps do you see in information communication mechanisms? What can be done to strengthen this capacity? Do you have enough research capacity to analyze and interpret climate data? How the research can be improved? Do the research in your organization involve health component?
7. Is there any suggestion for improving the research capacity of the health system on climate change and health?

## **In-depth interview guide for experts from other sectors**

*Let's talk about climate change and its health impacts.*

1. What do you think about the possible climate change health impact on the Armenian population?
2. Please specify any activity that your organization is undertaking in the field of climate change? Do they include human health component? How impactful are those activities? Please describe.
  - a. What specific responsibilities does your sector/organization have in addressing climate change sensitive health risks?
3. How would you characterize the current health adaptation measures in Armenia? Can you specify any past and ongoing climate change health adaptation programs/projects?
4. How much they are prioritized by the Armenian government? How does the climate change addressed in the policy development, planning and management of climate-sensitive health diseases (*e.g. non-communicable diseases, vector-borne diseases, nutrition, infectious diseases, disaster risk reduction*)?
5. What partnerships and collaborations are established between your organization and other stakeholders to deal with climate change and its health impacts? (*e.g. Ministry of Health.*)
  - a. For example, does your organization communicate to other stakeholders about your activities and experience?
  - b. What are the main intersections between your and health sector in terms of information and activities in the field of climate change?
  - c. What are the strongest and the weakest aspects of those collaborations? Please describe any gaps and barriers that hinder the effective multi-sectoral collaborations between your organization and other stakeholders. How can it be improved?
6. What are the main challenges that hamper health adaptation in the country?
7. Please identify the main gaps in the health system's organizational capacity to cope with the health risks of climate change (*efficiently use the resources, information, knowledge, and processes employed by the system*)?
  - a. What do you think about the availability of financial, human and technical resources allocated for health sector adaptation measures?
8. How does your organization contribute to climate-related data generation? How the information is disseminated/communicated to other stakeholder groups (including to MOH)? How MOH communicates climate-related health information with your organizations?

*Let's conclude the interview.*

9. Please suggest what measures will enhance the adaptive capacity of Armenia to respond to climate change? What opportunities do you see to strengthen health sectors response?

### Annex 3. Current and ongoing climate change adaptation relevant initiative in the health sector

Name of the initiative	Climate change considerations
<b>Communicable/infectious diseases</b>	
National Immunization Program 2016-2020 (Decree N 10)	Not reflected
2011-2015 state program for prevention of malaria invasion and ecesis in the Republic of Armenia, and the list of 2011-2015 measures for prevention of malaria invasion and ecesis (Decree N 23)	Somewhat reflected*
2012-2016 strategy program for preventing and fighting against infectious diseases, and the list of measures to be implemented under the strategy program (Decree N 1913-N)	Somewhat reflected*
Common infectious diseases control program for human and animals and the list of measures to be implemented under the program (Decree N 50)	Not reflected
The program for fighting against infectious disease transmitters in Armenia and 2014-2018 schedule for implementation of measures under the program (Decree N 22)	Somewhat reflected*
Regulations and sanitary norms for the control of disease transmitters (rodents and insects), implementation of disinfection measures and protection of health of workers (Decree N 13-N)	Not reflected
<b>Non-communicable diseases</b>	
National strategies for controlling non-communicable diseases responsible for the highest share of mortality: cardiovascular diseases, malignancies and diabetes (Decree N 11)	Not reflected
Healthy lifestyle strategy (Decree N 50)	Not reflected
2016-2020 program of most common non-communicable diseases (Decree N 4)	Not reflected
2015-2020 program on trauma and list of measures for preventing trauma and trauma-related complications (Decree N 55)	Not reflected
<b>Drinking water quality control</b>	
2018 monitoring program of drinking water quality (Decree N 363-A)	Not reflected
2018 program to monitor the quality of drinking water of the lake water taps and soil in the coastal recreation and swimming zones of Lake Sevan (Decree N 642-A)	Not reflected
<b>Microclimate indicators</b>	
Sanitary norms of the microclimate of manufacturing rooms SN N 2.2.4-001-05 (Decree N 842-N)	Not reflected
<b>Disaster risk reduction</b>	
National disaster risk reduction strategy and disaster risk reduction action plan (Decree N 281-N)	Reflected

\*Climate change was mentioned as a risk factor for the spread of communicable/infectious diseases, however, no specific considerations of climate change and its variability were reflected.