



COLORADO
North Central Region
Healthcare Coalition

North Central Region Healthcare Coalition

2019-2020 Joint Risk Assessment

December 2019

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INTRODUCTION

PURPOSE

The 2019-2020 North Central Region Healthcare Coalition (NCR HCC) Joint Risk Assessment (JRA) provides the NCR HCC, and its associated Governance Board, chapters, and key stakeholders, with the information needed to identify and plan for risks that have the potential to significantly impact the health and medical system within the region. Additionally, this document directly supports the NCR HCC in strategic planning and the prioritization of activities, while helping to direct efforts aimed at addressing the gaps identified within the regional preparedness and response continuum.

The annual NCR HCC JRA is provided to the Colorado Department of Public Health and Environment's Office of Emergency of Preparedness and Response (CDPHE-OEPR) and is incorporated into the CDPHE-OEPR State Jurisdictional Risk Analysis Report. It is also submitted to the Colorado Threat and Hazard Identification and Risk Assessment (THIRA) Review Board in support of the preparation of the annual Colorado State Preparedness Report.

SCOPE

The scope of the NCR HCC JRA is limited to Colorado's ten county North Central Region. The healthcare coalition, and its associated plans and reports, serve to enhance the emergency mitigation, preparedness, response, and recovery activities related to the healthcare component of the emergency response system.

This assessment supports the coalition and its members and is not directive in nature.

PLANNING ASSUMPTIONS

- While there will likely be significant overlap between the NCR HCC Hazard Vulnerability Analysis (HVA), JRA, and the HVA for individual healthcare organizations, these must be separate and distinct processes.¹
- A specific vulnerability may not exist across all NCR HCC member organizations; however, coalition members will generally face many of the same hazards.
- The regional JRA does not supersede or replace risk assessments developed at the organizational, local, or state level.
- The assessment of threats and hazards across the NCR was conducted utilizing a combination of quantitative as well as qualitative data. Components of this analysis are subjective in nature.
- The NCR HCC HVA member data that was utilized, in part, to determine the threats and hazards outlined in this document, was not a comprehensive assessment of all members. Although all members of the HCC were invited to complete the survey and submit their HVA, those who participated were self-selected based on interest. The data provided by these members is influenced by their own organizational initiatives and planning efforts.

¹ U.S. Department of Health and Human Services. MSCC: The Healthcare Coalition in Emergency Response and Recovery. Chapter 5, Section 5.4: Hazards Vulnerability Analysis. May 2009. Accessed 13 March 2019.

<https://www.phe.gov/Preparedness/planning/mscc/healthcarecoalition/chapter5/Pages/hazards.aspx>

- Although this JRA focuses on the impact to healthcare, the HVA and JRA process was inclusive of data from emergency management partners, public health, and other non-traditional health and medical partners.

ADMINISTRATIVE SUPPORT

The NCR HCC JRA is reviewed and revised by the NCR HCC Governance Board, HCC Chapter Leads, and HCC members, on an annual basis. Each subsequent annual update consists of a review of the previous year's JRA and integration of relevant new information, as appropriate. Additionally, the JRA is updated and revised following real events, planned training exercises, and/or the development of After Action Reports/Improvement Plans that impact the information contained in this assessment. The 2019-2020 NCR HCC JRA, as well as any revisions, will be distributed to all NCR HCC members and stakeholders and will be posted to the NCR HCC website.

NORTH CENTRAL REGION HEALTHCARE COALITION

OVERVIEW

Health and medical emergency preparedness planning and coordination in the North Central All-Hazards Region (NCR) is facilitated, in part, through the NCR HCC. The primary function of the NCR HCC is to coordinate and conduct healthcare emergency preparedness activities through the promotion, development, and enhancement of the region's cross-jurisdictional coordination and collaboration to the health and medical component of incident preparedness, response, and recovery. More specifically, the NCR HCC focuses on communication, planning, training, and collaboration, with coalition partners.

Due to its size, the North Central Region Healthcare Coalition is broken up into three chapters: Boulder Health and Medical Response Partnership (HAMR) Chapter, Metro Foothills Healthcare Coalition (MFHCC) Chapter, and Tri-County Healthcare Coalition Chapter. Each chapter covers a portion of the region, broken down by county (Figure 1).

COLORADO'S NORTH CENTRAL REGION HEALTHCARE COALITION CHAPTERS

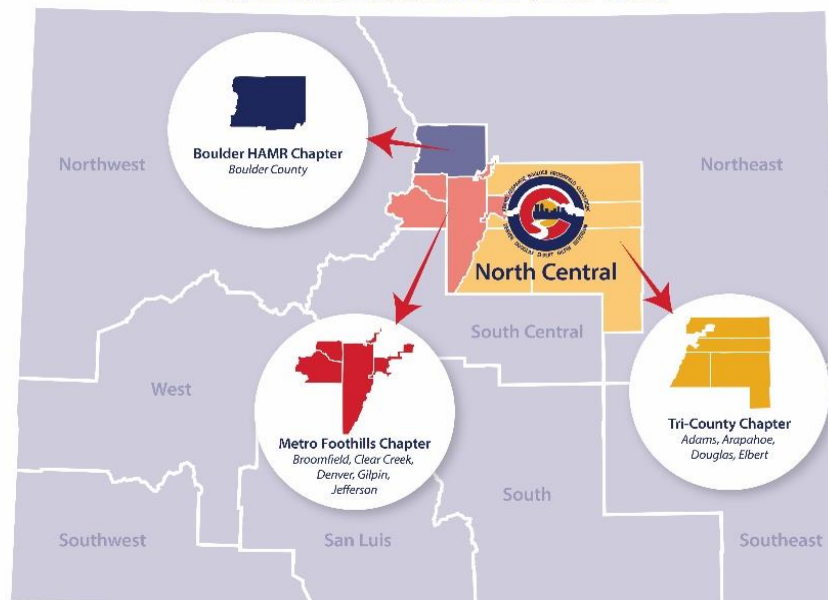


Figure 1: Colorado's NCR HCC Chapters

The NCR HCC Governance Board governs the NCR HCC, and its chapters. This Governance Board functions as an advisory group and is tasked with providing guidance and strategic direction to the region and its associated chapters. The Governance Board includes representation from hospitals, emergency management, public health, emergency medical services, and various community partners (e.g., clinics, behavioral health, etc.) across all three chapters.

NCR HCC MEMBERSHIP

An HCC member is defined as “an entity within the HCC’s defined boundaries that actively contributes to HCC strategic, planning, identification of gaps and mitigation strategies, operational planning and response, information sharing, and resource coordination and management².” Diversity within an HCC promotes an integrated community response and serves to strengthen the healthcare system as a whole.

Per the Assistant Secretary for Preparedness and Response (ASPR), an HCC must include the following four core members:

- Emergency Management (EM)
- Emergency Medical Services (EMS)
- Hospitals
- Public Health (PH)

Although ASPR designates the above disciplines as core members, the health and medical system is much more diverse and the NCR HCC strives to include all partners within the healthcare continuum. This includes, but is not limited to, representation from: behavioral health, outpatient medical services, ancillary healthcare, volunteer groups, and support organizations.

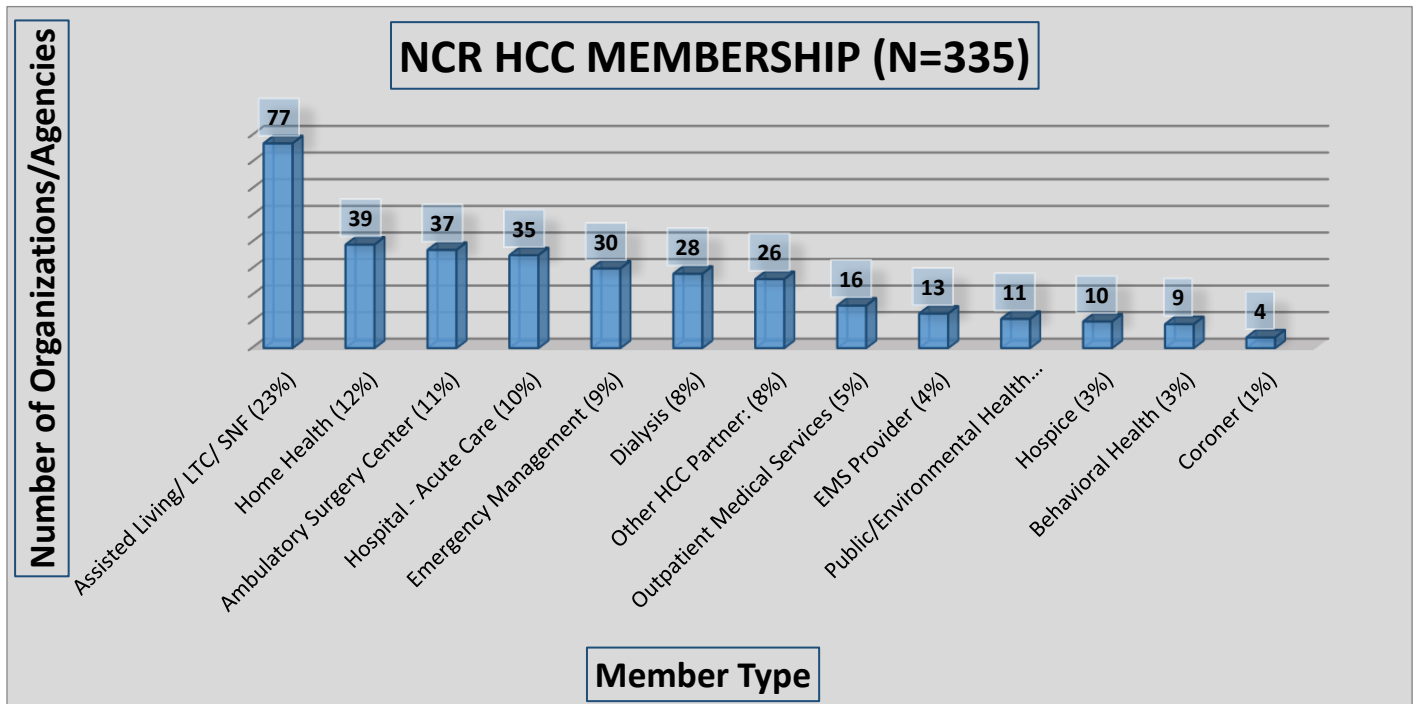


Figure 2: NCR HCC Membership Representation – December 2019

² Assistant Secretary for Preparedness and Response: 2017-2022 Healthcare Preparedness and Response Capabilities. November 2016.

RESPONSE ROLE OF THE NCR HCC

The composition of the NCR HCC is reflective of those partners that have the potential to be involved in the health and medical component of a response, including those key partners who function within Emergency Support Function (ESF) 8/health and medical branch. For this reason, the coalition, and its associated chapters, default to ESF-8, or comparable health and medical branches, as the designated mechanism(s) for the coordination of Federal, State, and local resources related to health and medical needs during an incident(s). These systems primarily operate out of the Emergency Operations Center (EOC), allowing for direct communication and coordination with other support functions and emergency management. HCC members are integrated into the larger emergency response framework via this structure with the intention being that ESF-8/health and medical branches will complement and support existing agency level plans and procedures, not replace them.

The NCR HCC Response Plan exists to support the health and medical system utilizing collaborative and integrative processes during events that exceed jurisdictional and/or system level capabilities and/or capacity. The primary role of the NCR HCC, during a response, is to facilitate information sharing and assist with resource identification. This is accomplished, in part, through the NCR HCC Response Plan Leadership Group and NCR HCC Coordinator.

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DEVELOPMENT

PROCESS OVERVIEW

The development of the 2019-2020 NCR HCC JRA was a collaboration between NCR HCC members and the NCR HCC Governance Board. The development process occurred in multiple phases, with each one building from the previous.

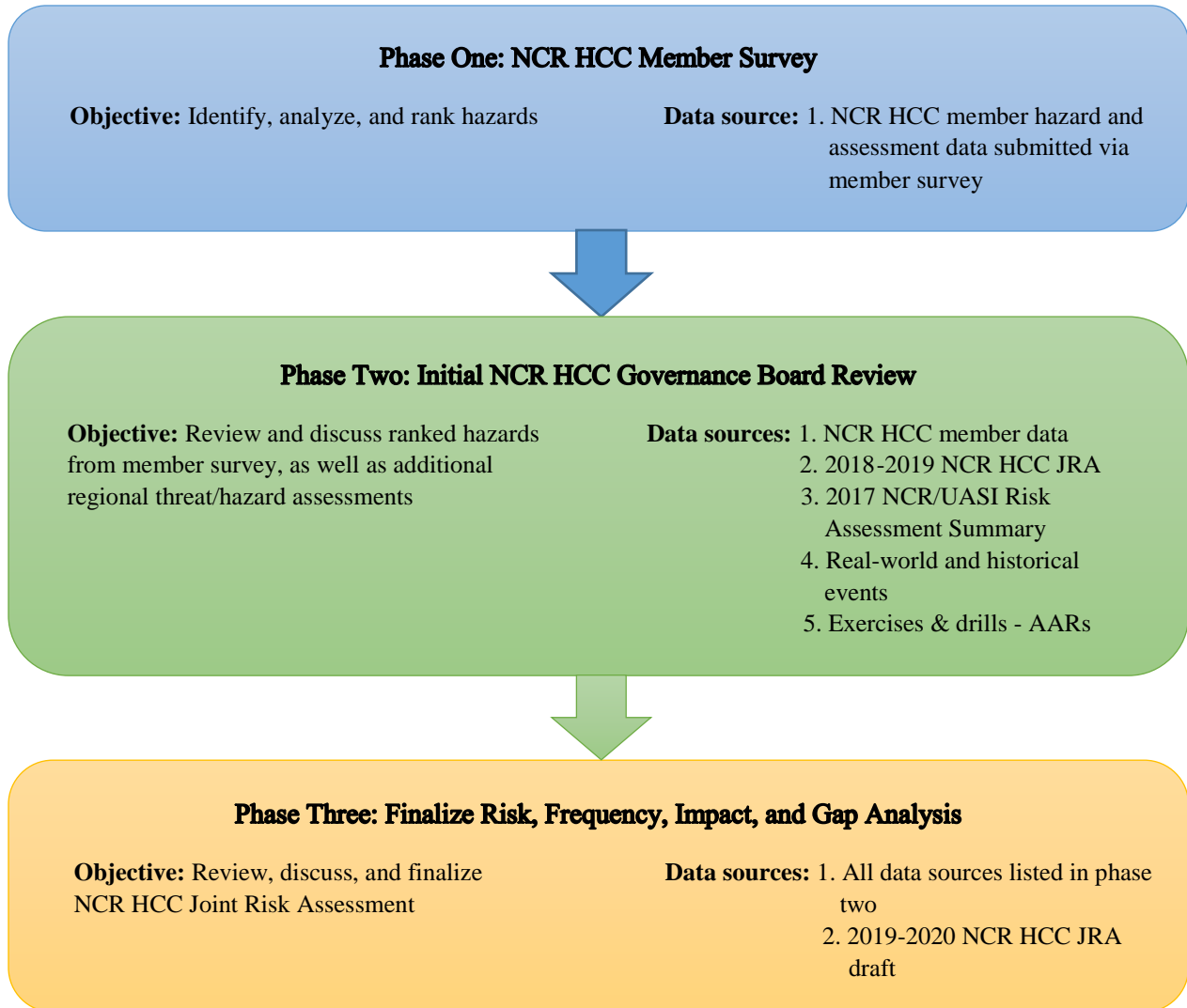


Figure 3: NCR HCC Joint Risk Assessment Development Process

In an effort to ensure that the JRA is representative of the NCR, hazard and threat assessment data was collected from members representing all three NCR HCC chapters, as well as from other state, regional, and local partners. HCC members were asked to complete a survey as well as submit their hazard and risk assessments. A total of ninety-six (96) agencies completed the survey and/or submitted documentation (Figure 4). Only those assessments completed within the last two years were included. Once received, the data was compiled into a single spreadsheet and synthesized to identify the top common risks at the organizational level.

This quantitative data was then reviewed by the NCR HCC Governance Board as part of a facilitated discussion (see Phase Two above for data sources included in this discussion). The outcome of this discussion was a preliminary list of the top threats/hazards pertaining to the health and medical system within the NCR.

Phase three of the process consisted of a review and finalization of the threats and hazards identified in phase two (Table 5: Hazard Identification Assessment) as well as the completion of the following tables included in this assessment:

- Table 6: Risk Identification
- Table 7: Vulnerability Assessment
- Table 8: Summary of Prioritized Gaps

Additionally, this final discussion included a review of the Geography and Population Characteristics, Discussion, and Gaps sections to ensure consensus across the disciplines and chapters.

The final step in this process was a review and subsequent approval by the NCR HCC Governance Board and dissemination of the data to NCR HCC members.

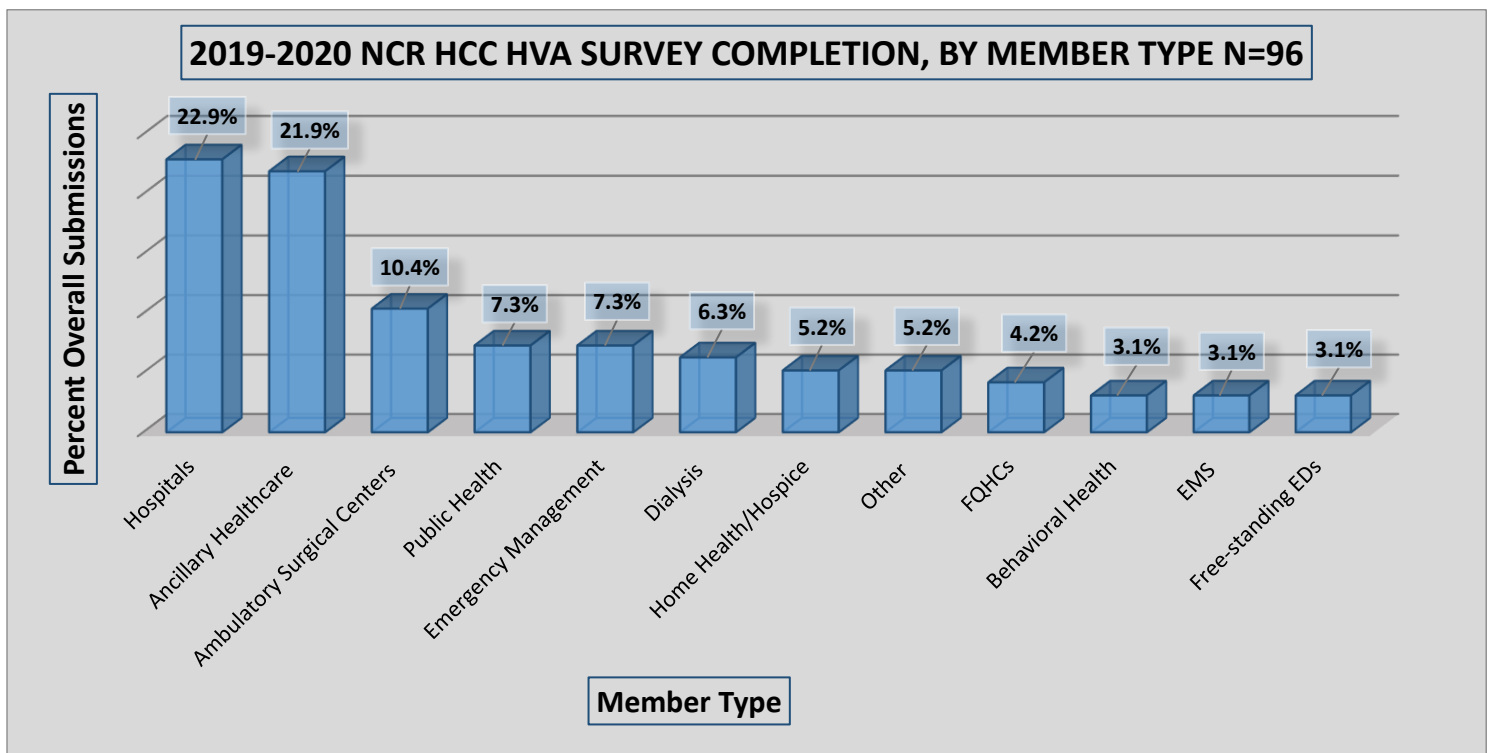


Figure 4: 2019-2020 NCR HCC HVA member participation via HVA survey and submission

NCR GEOGRAPHY AND POPULATION CHARACTERISTICS

GEOGRAPHY

The ten-county North Central Region encompasses just under 7,000 square miles³ of both urban, rural, and mountainous geography. The total population of the region is just over 3.2 million people⁴. Although the region does include a number of rural areas, it is largely a densely populated metropolitan area with an average of 471 people per square mile. The region is also home to the City and County of Denver – the capital of the State of Colorado and the most populous city in the state with 716,492 residents⁴.

The NCR includes the counties of Adams, Arapahoe, Boulder, Broomfield, Clear Creek, Denver, Douglas, Elbert, Gilpin, and Jefferson.

Table 1: North Central Region Geography and Population: United States Census Bureau Data

County	Population [2019] ⁴	Land Area (sq. miles) [2010] ³	Population per Sq. Mile
Adams County	511,868	1,167.65	438.4
Arapahoe County	651,215	798.10	815.9
Boulder County	326,078	726.29	448.9
Broomfield County	69,267	33.03	2,097.1
Clear Creek County	9,605	395.23	24.3
Denver County	716,492	153.00	4,682.9
Douglas County	342,776	840.25	407.9
Elbert County	26,282	1,850.85	14.2
Gilpin County	6,121	149.90	40.8
Jefferson County	580,233	764.21	759.3
NCR Total	3,239,937	6,878.51	471.1

³ United States Census Bureau – U.S. Census Bureau Geography Division: Quick Facts. 2010 data.

⁴ United States Census Bureau: Quick Facts. July 1, 2019 data.

POPULATION CHARACTERISTICS

The 3.2 million individuals that make up the North Central Region are diverse in both age and race. Understanding the composition of each county, as well as the region as a whole, is an important element of emergency preparedness, response, and recovery.

Pediatric Population

The North Central Region includes approximately 720,682 children under the age of 18, which is 22.1% of the total population (Table 2). With the knowledge that children make up just under one-quarter of the community within the region, and recognizing the unique and specialized care that pediatric patients often require, the NCR HCC, in partnership with its Clinical Advisor, is focusing on the assessing existing gaps in pediatric capability and capacity across the region as well as across the state. The NCR HCC does not yet have a comprehensive dataset related to pediatric care, but the collection and assessment of this data is one of the core elements in the development of the NCR HCC Pediatric Surge Annex.

The NCR continues to collaborate with the state health department on the Colorado Pediatric Disaster Coalition. This coalition, championed by CDPHE-OEPR, includes diverse representation from all areas of the healthcare system and emergency management. The focus is on strengthening the capabilities and increasing the capacity of the health and medical system to effectively prepare for and respond to the unique needs of pediatrics who are involved in disasters. The NCR HCC has broad representation on this coalition, and will continue to support the work being done in this area.

Further, the NCR HCC has a long-standing relationship with Children's Hospital of Colorado (CHCO). This hospital is consistently ranked as one of the top facilities for pediatric specialties, general medical and surgical care. CHCO also has a strong presence in the community through their wellness events and child advocacy programs. Having CHCO as an active member of the NCR HCC allows the coalition to effectively incorporate pediatric needs on a day-to-day basis as well as in times of crisis.

Older Adults 65 Years and Over

Older adults (>65) comprise 12.0% (387,950) of the total population in the NCR. This demographic, as they continue to age, present unique challenges to the field of emergency management. Older adults may have mobility problems, chronic health conditions, and/or be isolated with little to no support. They may be experiencing challenges that come with advanced age, such as hearing or vision problems or cognitive impairment, which may make it difficult to access, understand, and respond to emergency instructions. Additionally, individuals who are receiving assistance from support services (e.g., home healthcare, meal delivery services, or in-home caregivers, etc.) may be cut off from these services for an extended period. These factors must be considered during all phases of emergency management, as they make this segment of the community increasingly susceptible to the disruptions that result from a disaster.

The NCR HCC maintains a robust and active group of ancillary healthcare providers, many of whom serve older adults within the region. The unique needs of this population are addressed through trainings, drills/exercises, and discussions that occur within the NCR Ancillary Healthcare Committee. The outcomes of these activities are then shared with the entire coalition in an effort to promote planning that is inclusive of the entire demographic spectrum of the community.

Table 2: North Central Region Age & Race Demographics: United States Census Bureau Data

County	Birth Rate (Births per 1000 Persons) [2017] ⁵	Children Under 5 [2014-2018] ⁶		Children Under 18 [2014-2018] ⁶		Older Adults 65 Years and Over [2014-2018] ⁶		Older Adults 85 Years and Over [2014-2018] ⁶		Non-White (all persons except white, non-Hispanic) [2017] ³	
		#	%	#	%	#	%	#	%	#	%
Adams County	13.14	36,678	7.4%	135,444	27.2%	49,181	9.9%	5,023	1.0%	251,080	49.9%
Arapahoe County	11.78	40,510	6.4%	153,460	24.1%	78,627	12.3%	8,883	1.4%	254,006	39.5%
Boulder County	8.15	15,070	4.7%	62,925	19.6%	42,068	13.1%	5,138	1.6%	71,276	22.1%
Broomfield County	N/A	3,734	5.6%	15,692	23.7%	8,499	12.9%	903	1.4%	15,787	23.1%
Clear Creek County	N/A	350	3.7%	1,472	15.7%	1,769	18.9%	54	0.6%	1,091	11.4%
Denver County	13.62	43,421	6.3%	139,801	20.2%	78,751	11.4%	10,342	1.5%	321,307	45.6%
Douglas County	10.04	19,924	6.1%	89,484	27.2%	35,801	10.9%	3,171	1.0%	61,822	17.4%
Elbert County	N/A	1,086	4.3%	5,514	21.9%	3,689	14.7%	349	1.4%	6,994	36.6%
Gilpin County	N/A	246	4.2%	962	16.2%	858	14.5%	92	1.6%	740	12.3%
Jefferson County	10.13	29,991	5.3%	115,926	20.0%	88,707	15.6%	10,399	1.8%	124,691	21.7%
NCR Total	N/A	191,010	5.9%	720,680	22.2%	387,950	12.0%	52,451	1.4%	1,108,794	34.5%

ACCESS AND FUNCTIONAL NEEDS

Historically, the region has shown a strong commitment to addressing the needs of special populations through planning, training, and exercises. HCC chapters regularly host trainings on CDPHE's Community Inclusion in Colorado (CICO) maps, and multiple jurisdictions have incorporated access and functional needs populations into exercises and drills, including the statewide Public Health

⁵ United States Department of Health and Human Services (US DHHS), Centers for Disease Control and Prevention (CDC), National Center for Health Statistics (NCHS), Division of Vital Statistics, Natality public-use data 2007-2017, on CDC WONDER Online Database, October 2018. Accessed at <http://wonder.cdc.gov/nativity-current.html> on Nov 22, 2019

⁶ U.S. Census Bureau, 2014-2018 American Community Survey 5-Year Estimates

Emergency Dispensing Exercise (PHED Ex) in June of 2017. HCC members are strongly encouraged to maintain awareness around special populations that may fall under their care and/or who may end up requiring their services because of an event(s). In addition, the NCR HCC has adopted, and trained its members on, the C-MIST framework. This approach is based on a “functional needs framework” which focuses on addressing the functional and access needs of an individual or group, not the specific vulnerability or condition. These needs are organized into five categories: **C** Communication, **M** Medical/Health, **I** Independence, **S** Safety and Support, and **T** Transportation.

In early 2019, the NCR HCC completed the *Hospital Surge: Identifying Needs and Behaviors that Drive Medical Surge* report. This report summarizes providers’ perceptions regarding what drives individuals to hospitals during emergencies, potential medical and non-medical disruptions that may occur during an emergency and ideas around possible healthcare delivery system supports that could prevent stress on hospitals during an emergency. The final report is available on the [NCR HCC website](#), or by clicking this [link](#)

Table 3: North Central Region Disability Characteristics: 2013-2017 United States Census Bureau Data⁷

(Disability definitions on page 13)

County	Total Disability Population		Hearing Difficulty		Vision Difficulty		Cognitive Difficulty		Ambulatory Difficulty		Independent Living Difficulty	
	#	%	#	%	#	%	#	%	#	%	#	%
Adams County	51,764	10.7%	15,576	3.2%	10,331	2.1%	18,239	4.1%	26,047	5.8%	15,839	4.5%
Arapahoe County	55,935	9.0%	16,523	2.7%	10,510	1.7%	20,264	3.5%	26,001	4.5%	18,853	4.0%
Boulder County	26,094	8.3%	8,580	2.7%	4,376	1.4%	10,489	3.5%	10,999	3.7%	7,994	3.2%
Broomfield County	5,321	8.3%	1,932	3.0%	863	1.3%	1,923	3.2%	2,213	3.7%	1,473	3.0%
Clear Creek County	859	9.4%	308	3.4%	144	1.6%	168	1.9%	347	4.0%	175	2.3%
Denver County	64,433	9.6%	18,172	2.7%	13,929	2.1%	24,735	3.9%	31,163	5.0%	22,709	4.3%

⁷ U.S. Census Bureau, 2013-2017 American Community Survey 5-Year Estimates

Douglas County	20,661	6.5%	7,473	2.3%	3,166	1.0%	6,722	2.2%	7,972	2.7%	5,766	2.5%
Elbert County	2,429	9.9%	913	3.7%	300	1.2%	849	3.6%	1,106	4.7%	795	4.2%
Gilpin County	485	8.4%	215	3.7%	101	1.8%	283	5.1%	267	4.9%	142	3.0%
Jefferson County	54,945	9.9%	19,599	3.5%	8,950	1.6%	18,578	3.5%	24,917	4.7%	17,088	3.9%
NCR Total	282,926	9.0%	89,291	3.1%	52,670	1.6%	102,250	3.5%	131,032	4.4%	90,834	3.5%

Disability	Definition
Hearing Difficulty	Deaf or serious difficulty hearing
Vision Difficulty	Blind or serious difficulty seeing even when wearing glasses
Cognitive Difficulty	Serious difficulty concentrating, remembering, or making decisions due to a physical, mental, or emotional condition
Ambulatory Difficulty	Serious difficulty walking or climbing stairs
Independent Living Difficulty	Difficulty doing errands alone due to a physical, mental, or emotional condition

Table 4: North Central Region Language Characteristics⁷

County	Language Isolation: Non-English households that speak English less than well		Most prevalent isolated non-English language	2nd most prevalent isolated non-English language	3rd most prevalent isolated non-English language
	#	%	Language	Language	Language
Adams County	51,784	11.5%	Spanish	Other Asian and Pacific Island languages	Other Indo-European languages
Arapahoe County	51,476	8.8%	Spanish	Other and Unspecified languages	Other Indo-European languages

Boulder County	14,782	4.9%	Spanish	Other Indo-European languages	Other Asian and Pacific Island languages
Broomfield County	2,431	4.0%	Spanish	Other Asian and Pacific Island languages	Other Indo-European languages
Clear Creek County	76	0.9%	Spanish	German or other West Germanic languages	Other Indo-European languages
Denver County	66,522	10.5%	Spanish	Other and unspecified languages	Other Indo-European languages
Douglas County	6,799	2.3%	Spanish	Other Indo-European languages	Other Asian and Pacific Island languages
Elbert County	136	0.6%	Spanish	German or other West Germanic languages	French, Haitian, or Cajun
Gilpin County	86	1.5%	Spanish	Other Indo-European languages	Korean
Jefferson County	17,551	3.3%	Spanish	Other Indo-European languages	Russian, Polish, or other Slavic languages
TOTAL REGION	211,643	4.8%			

SOCIAL VULNERABILITY

Social vulnerability refers to the socioeconomic and demographic factors that affect the resilience of communities⁸. Evidence, as well as historical events, have shown that those who with higher social vulnerability are more likely to be adversely affected during a disaster. These members of the community, when impacted by disaster, are less likely to recover and are more likely to die.

There are a number of variables that can influence vulnerability to hazards, including age, income, the strength of social networks, and neighborhood characteristics. Further, many of these vulnerability variables occur in combination. Evidence shows that the poor are more vulnerable at all stages of a disaster: before, during, and after. This is also the case for individuals with access and functional needs, racial and ethnic minorities, children, and elders.

Due to the high likelihood that members of a vulnerable community will experience reduced resiliency, identifying these communities should be incorporated into the mitigation and planning activities at the

⁸ Flanagan, Barry E.; Gregory, Edward W.; Hallisey, Elaine J.; Heitgerd, Janet L.; and Lewis, Brian (2011) "A Social Vulnerability Index for Disaster Management," *Journal of Homeland Security and Emergency Management*: Vol. 8: Iss. 1, Article 3.

local, state, and federal level in an effort to provide those residents with increased assistance over the course of a disaster.

To help identify at-risk and vulnerable populations, the Center for Disease Control (CDC) created the Social Vulnerability Index (SVI)⁹. The information within the SVI can support emergency management systems identify areas with higher social vulnerability and levels of access and functional needs. With this information, those in emergency management can develop preparedness, response, and recovery processes that support the needs of the community.

The CDC's SVI uses 15 social factors from the U.S. census to develop themes as well as an overall ranking at the county level (please refer to Appendix A for a list of all 15 factors). SVI scores range from 0 (lowest vulnerability) to 1 (highest vulnerability).

In the NCR, Adams County ranked the highest on the SVI scale (0.6332). This is the only county in the region with a rating that is defined as "moderate to high." Denver and Arapahoe Counties are both rated as "low to moderate," and the rest of the seven counties are all rated as "low." The regional average is 0.1761, which falls into the "low" category.

Social Vulnerability data, including data from the SVI, can shed light on those areas within a community that are at risk of experiencing higher levels of mortality, limited resources, and decreased resiliency during a catastrophic event. Being able to identify socially vulnerable areas within the region supports the overall goal of increasing health and resilience through diversified planning, the development of processes and plans that are tailored to the specific needs of the community, and building stronger networks while increasing engagement within population groups that are often at-risk and underserved.

SVI data has also shown to be an asset during response and recovery operations as it has the ability to identify those highly vulnerable areas and support targeted response operations and recovery planning. Further, the SVI can be leveraged to prioritize the allocation of scarce resources to those who are more likely to be adversely affected during a disaster and are less likely to recover.

Although there is awareness of the SVI across the region, the NCR HCC is looking to better integrate this tool into all sectors of emergency preparedness planning, response, and recovery through the development of guidance and resource documents.

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⁹ Agency for Toxic Substances and Disease Registry/ Geospatial Research, Analysis, and Services Program. Social Vulnerability Index 2014 Database Washington. Centers for Disease Control and Prevention. <https://svi.cdc.gov/map.html>. Accessed on 11 March 2019.

NCR Overall Social Vulnerability Index Rating, by County (2016)

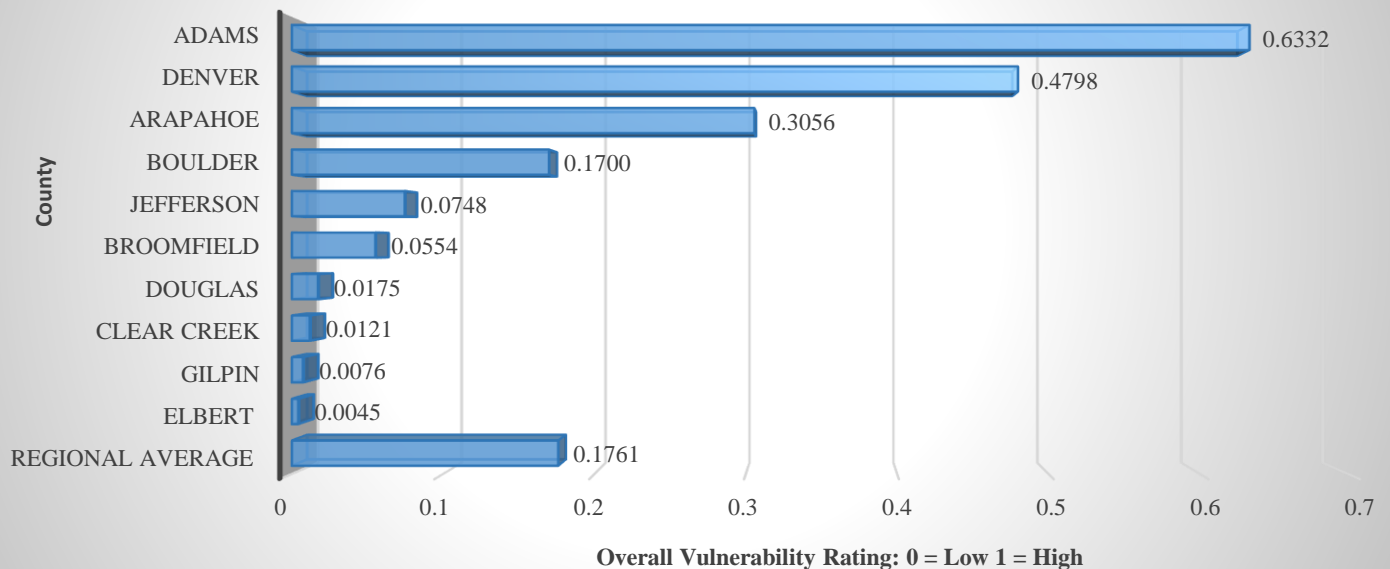


Figure 4: Overall Social Vulnerability Index ratings, by county, for the 10-county North Central Region

THREAT AND HAZARD ANALYSIS

DISASTER DECLARATIONS

According to FEMA¹⁰, the State of Colorado has experienced 83 natural disasters from 1953 - 2018. The vast majority of these disasters were fire related (72%), followed by flood (16%) and severe storms and snow (both at 4%). Twenty-six (26) of these natural disasters have impacted counties within the North Central Region, resulting in 93 declarations at the county level.

- Fire (wildfire) has received the highest number of declarations across the region with 12 declarations, followed by flood at eight (8) declarations, and snow at two (2) declarations. Coastal storm (Hurricane Katrina evacuations), drought, severe weather, and tornado each had one (1) declaration.
- At the county level, Boulder County has the highest number of disaster declarations in the region at 13 declarations. This is followed by Jefferson (11), Adams, Douglas, and Elbert (10), Arapahoe and Denver (9), Clear Creek (7), Gilpin (6), and Broomfield (4).
- In addition to the declarations listed above, there have been four (4) statewide declarations for flood (2) and fire (2).

¹⁰ Federal Emergency Management Agency (FEMA). Data Visualization: Disaster Declarations for State and Counties. <https://www.fema.gov/data-visualization-disaster-declarations-states-and-counties>.

RECENT EVENTS

Hepatitis A Outbreak: October 2018 – Present

Colorado has been managing an outbreak of Hepatitis A since October 2018. Predominately impacted populations include those individuals experiencing homelessness, substance use issues, incarceration, and men having sex with men. As of December 26, 2019, there have been 315 confirmed cases with two (2) deaths and 227 hospitalizations statewide. To date, the NCR has had 149 confirmed cases (47%) across eight (8) of the ten (10) counties¹¹.

- Regional planning efforts related to this event:
 - Vaccination clinics continue to across the region. A total of 20,083 vaccines, state-wide, have been administered through public health funding
 - Coordinated public and healthcare-specific messaging and resource/tool development
 - Sustained focus on information sharing between local, regional, and state partners
 - Focused and strategic partnership building with healthcare, community, and government entities
 - Integration with CDPHE Incident Command Structure

STEM School Shooting: May 2019

On May 7, 2019, two students opened fire inside of the STEM School Highlands Ranch, located in Douglas County. STEM School, a public charter school, serves grades K-12 and has approximately 1,850 students. Although both shooters were taken into custody within minutes of the first shots being fired, the shooting did result in one (1) fatality and eight (8) casualties¹². The communications center that serves Douglas County utilized EMResource to query nearby hospitals for mass casualty incident (MCI)/trauma bed availability (i.e., red, yellow, green) and requested information on each facility's pediatric capabilities. This early EMResource notification provided hospitals with critical time to begin activating patient surge protocols. Additionally, hospitals received a notification when the last patients were transported from the scene. This allowed facilities to re-assess staffing and resource needs.

While this event did not overwhelm the NCR's medical transport (EMS) or hospital/emergency department trauma surge capabilities, it did reinforce the importance of integrated cross-jurisdictional and cross-disciplinary planning and preparedness efforts.

- Regional planning efforts related to this event:
 - Review of current Hospital Incident Command System (HICS) positions, and opportunities to expand upon the existing structure
 - Continued focus on training, education, and access to EMResource across the region
 - Additional training and exercise of the NCR Regional Hospital Coordination Plan
 - Ongoing integration of disaster behavioral health resources, with a focus on first-responder and hospital staff needs

¹¹ The Colorado Department of Public Health and Environment. Current incidents: Hepatitis A response. December 27 2019. <https://sites.google.com/state.co.us/cdpheoprsa/home/current-incidents?authuser=0>

¹² NBC News. Colorado STEM school shooting: One dead, 8 injured, 2 in custody. December 20 2019. <https://www.nbcnews.com/news/us-news/least-2-people-injured-colorado-stem-school-after-shooting-reported-n1003001>

Bomb Cyclone: March 2019

In March of 2019, the NCR, as well as the eastern part of the state, experienced a winter blizzard described as a “Bomb Cyclone.” This type of event is defined by a drop in barometric pressure that exceeds 24 millibars in 24 hours¹³. The storm left hundreds of thousands of residents without power, stranded more than 1,000 motorists, shut down Denver International Airport (DIA), and resulted in one fatality. Record setting non-thunderstorm winds clocked in at 80 MPH at DIA and major roadways were shut down. The storm led the Governor to declare an emergency and the National Guard was activated to assist with search, rescue, and life-saving efforts.

- Regional planning efforts related to this event :
 - Region-wide *Oxygen Management During Disasters* workgroup has been formed and will be working to address identified gap including, but not limited to: oxygen supplies/vendor agreements, power outages, storage and transportation of oxygen, and personal/community preparedness
 - Continued focus on sheltering and mass care capabilities across the region
 - Re-emphasis on Memorandums of Understanding (MOU), supply chain assessment, par levels, etc.

REGIONAL THREATS AND HAZARDS

The review, assessment, and discussion process outlined in the “[Development](#)” section of this document resulted in the following incident types being identified as the top threats/hazards to the NCR’s health and medical system:

Table 5: North Central Region Hazard Identification Assessment

(Frequency and Severity scales on page 19)

Hazard	Frequency	Severity (to people, property, crops, or facilities)
<i>Communicable Disease/Epidemic</i>	High	High
<i>Severe Weather</i>	Very High	Elevated
<i>Facility Evacuation</i>	Moderate	Severe
<i>Utility Failure</i>	Moderate	Elevated
<i>Information Technology (IT) Failure, including Cyber-Terrorism</i>	High	Elevated
<i>Medical Surge</i>	High	Severe

¹³ The Denver Post. Denver weather: Storm subsides in metro area after day that saw governor declare emergency. March 13 2019. <https://www.denverpost.com/2019/03/13/denver-weather-march-13-bomb-cyclone/>.

Frequency Scale	
Frequency Ratings	Definition of Frequency Ratings
Very High	Likely annual occurrence or more
High	Likely bi-annual occurrence
Moderate	Likely within a 5 year period
Low	Likely within a 10 year period
Very Low	Likely within a 50 year period

Severity Scale
Low
Guarded
Elevated
High
Severe

RISK

To identify risk levels for each threat and hazard, the NCR HCC utilized a scoring system that was provided to all Colorado HCCs by the Colorado Division of Homeland Security and Emergency Management (DHSEM). The risk calculation takes into account the level of threat, system weakness, and impacts and consequences. These three variables produce a final risk score for each threat or hazard. This risk score is broken up into six levels ranging from low to severe. It is important to note that, although this scale is subjective in nature, a comprehensive review of the data was conducted at all levels: facility, system, local, regional, and state. This data was used to support the risk calculations provided below.

A full breakdown of each scale used in Table 6 is included on page 20.

Table 6: NCR HCC Risk Identification

Hazard	Threats & Hazards Scale 1-4	System Weakness 1-4	Impacts & Consequences 1-4	Risk = T x W x I
Communicable Disease/Epidemic	High (3)	Medium (2)	High (3)	Guarded (12)
Severe Weather	High (3)	Medium (2)	Medium (2)	Guarded (12)
Facility Evacuation	Medium (2)	High (3)	High (3)	Elevated (18)
Utility Failure	Medium (2)	High (3)	High (3)	Elevated (18)
Information Technology (IT) Failure, including Cyber-Terrorism	Medium (2)	High (3)	High (3)	Elevated (18)
Medical Surge	High (3)	High (3)	High (3)	High (27)

Threats and Hazards Scale	
1	Low: Little or no credible threat posed by adversaries, natural disaster, or technological failure
2	Medium: Potential threat posed by adversaries, natural disaster, or technological failure
3	High: Credible threat posed by adversaries, natural disaster, or technological failure
4	Critical: Definite threat posed by adversaries, natural disaster, or technological failure

System Weakness Scale	
1	Low: Few or no weaknesses with multiple layers of protective measures or countermeasures in place with proven effectiveness
2	Medium: Few weaknesses with some protective measures or countermeasures in place with proven effectiveness
3	High: Multiple weaknesses with some protective measures or countermeasures in place with proven effectiveness
4	Critical: Multiple weaknesses with no protective measures or countermeasures in place with proven effectiveness

Impacts and Consequences Scale	
1	Low: Little or no effects on the system or patients/clients
2	Medium: Moderate effects leading to injury or economic loss, including possible disruptions to healthcare delivery
3	High: Serious effects leading to loss of life, serious injury, or economic loss, including disruptions to healthcare delivery
4	Critical: Grave effects leading to significant loss of life, serious injury, or economic loss, including total disruption to healthcare delivery

Risk Scale	
1-7	Low: At least two factors Low or one Low with none Critical
8-15	Guarded: All factors Medium/High or at least two High or Critical with one Low
16-23	Elevated: Two factors Critical or one Critical with no Low or at least two High with none Low
24-35	High: At least two factors High or Critical with no low
36-64	Severe: All factors minimally High with at least one Critical

VULNERABILITY AND IMPACT

Vulnerability, as it relates to emergency preparedness, can be described as the susceptibility of people, property, industry, resources, and environment to the negative impact(s) of a disaster. There are four main types of vulnerability:

1. Physical Vulnerability
2. Social Vulnerability
3. Economic Vulnerability
4. Environmental Vulnerability

These vulnerabilities, when exposed during an event, have the ability to create cascading impacts that can significantly reduce response and recovery capabilities.

Vulnerability, and the resulting impact(s), can and should be identified at all levels: facility, system, local, regional, state, and federal. For this assessment, the NCR HCC focused on regional vulnerabilities that have the potential to impact the health and medical system. The elements identified below (Table 7) were selected utilizing a variety of data sources available to the NCR HCC, including: regional After Action Reports, data submitted by NCR HCC members through the HVA survey, NCR HCC chapter meeting topics and discussions, the 2018-2019 NCR HCC JRA, and the NCR HCC 2018-2019 Strategic Plan. Trends pulled from these sources were then discussed and reviewed by the NCR HCC Governance Board, which resulted in the vulnerabilities and impacts described below.

Table 7: NCR HCC Vulnerability Identification Assessment

Vulnerability	Impact on Healthcare Delivery
High level of economic and environmental diversity within the region	The NCR covers large areas of densely populated urban cities, rural plains, and small mountain towns. Additionally, due in part to geography, the NCR has an economically diverse population. These factors impact health and medical resources as well as access to these resources. To be effective, regional planning must take into account this variability and its impact to healthcare delivery.
Geographic isolation	The NCR, including Colorado’s capital city, Denver, is geographically isolated. Denver is the largest city in a 500-mile radius. This isolation impacts the following response areas: <ul style="list-style-type: none"> • patient movement out-of-state • mobilization of out-of-state resources

<p>Volume of ancillary healthcare facilities that are at the early stages of emergency preparedness</p>	<p>Over the last two years, the NCR has experienced a significant increase in ancillary healthcare providers who have been tasked with the development and implementation of new emergency preparedness programs. This, in part, is due to the 2017 Centers for Medicare and Medicaid Services (CMS) Emergency Preparedness Rule.</p> <p>The region has worked extensively to support these organizations, but they often are working with limited funding and limited experience in emergency preparedness and response. Should a threat or hazard significantly impact a large number of these facilities, a considerable amount of regional resources would be required to support this sector of the healthcare system. This, in part, is due to lowered capabilities of these facilities to manage quickly evolving and/or large-scale events. The strain on resources results in cascading impacts on the other healthcare sectors as well as on the community as a whole.</p> <p>The NCR HCC will continue to support program development, implementation, and evaluation in an effort to increase the emergency preparedness and response capabilities within the ancillary healthcare system. As these capabilities expand, this vulnerability, and its impacts, will decrease.</p>
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DISCUSSION

The threats and hazards identified in this regional JRA all possess the ability to significantly impact the health and wellbeing of individuals and/or facilities located in or near the affected area(s). When health and safety is compromised, oftentimes the medical system and its associated components are immediately affected in some capacity. In addition, as the size and scope of an incident fluctuates, different components of the health and medical system may be impacted in different ways. Due to the densely populated North Central Region, the human impact due to a single event, or a combination of events, has the potential to be significant and rapidly escalate into a multi-jurisdictional and/or region-wide response.

In addition to the human impact, these incidents have the ability to disrupt and/or destroy critical infrastructure. Cyber-attacks, in particular, are becoming increasingly common and can be catastrophic on both an economic as well as an operational front. Natural disasters, such as severe weather and floods, have the capacity to shut down cities and wipe out infrastructure in a matter of hours. With the region’s strong reliance on these systems (e.g., electricity, cell phone communication, IT/computer networks, etc.), any significant disruption would greatly impact the health and medical system as well as those individuals within the affected area(s). During a prolonged event where infrastructure is impacted, there is the potential for cascading effects, which can result in additional stress being put on the health and medical system. This is especially true for individuals in the community who may need additional assistance during an emergency, includes those with access and functional and/or complex medical needs.

THREAT AND HAZARD DESCRIPTION AND IMPACT

Communicable Disease/Epidemic Description

A disease outbreak, according to the World Health Organization (WHO) is the occurrence of disease cases in excess of normal expectancy. The number of cases varies according to the disease-causing agent, and the size and type of previous and existing exposure to the agent. Disease outbreaks are usually caused by an infection, transmitted through person-to-person contact, animal-to-person contact, or from the environment or other media. Outbreaks may also occur following exposure to chemicals or to radioactive materials. Occasionally the cause of an outbreak is unknown, even after thorough investigation¹⁴. Additionally, it should be noted that there is the potential for disease to emerge because of deliberate introduction through bioterrorism.

According to a 2007 WHO report, infectious diseases are emerging at a rate that has not been seen before. A 2014 study titled, Global rise in human infectious disease outbreaks¹⁵ found that the total number of outbreaks and richness of causal diseases have each increased globally since 1980 (figure 3).

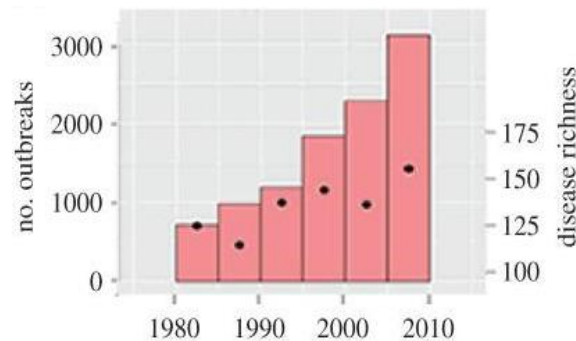


Figure 3: Global number of human infectious disease outbreaks and richness of causal diseases 1980 – 2010

When examining the impact that a communicable disease outbreak/epidemic might have on a community, it is important to note the added complexity of emerging infectious diseases. These diseases are infections that have recently appeared within a population or those whose incidence or geographic range is rapidly increasing or threatens to increase in the near future. The cause of emerging infections include¹⁶:

- Previously undetected or unknown infectious agents
- Known agents that have spread to new geographic locations or new populations
- Previously known agents whose role in specific diseases has previously gone unrecognized
- Re-emergence of agents whose incidence of disease had significantly declined in the past, but whose incidence of disease has reappeared

Disease outbreaks and epidemics often require an expansive level of coordination amongst a wide variety of partners. The current Colorado Hepatitis A outbreak exemplifies the complexity of an extended infectious disease response. The outbreak, as of December 2019, has been going on for just over a year. Over the course of the past fourteen (14) months, the response has grown to include, but

¹⁴ World Health Organization - Environmental Health Emergencies:

https://www.who.int/environmental_health_emergencies/disease_outbreaks/en/

¹⁵ Global rise in human infectious disease outbreaks Katherine F. Smith, Michael Goldberg, Samantha Rosenthal, Lynn Carlson, Jane Chen, Cici Chen, Sohini Ramachandran J R Soc Interface. 2014 Dec 6; 11(101)

¹⁶ Baylor College of Medicine: <https://www.bcm.edu/departments/molecular-virology-and-microbiology/emerging-infections-and-biodefense/emerging-infectious-diseases>

is not limited to: local and state public health agencies; a variety of healthcare provider types (e.g., hospitals, primary care, outpatient clinics, etc.); jails; community healthcare and specialty service providers; restaurants and retailers; emergency management; public information officers; and EMS providers.

Communicable Disease/Epidemic Impact

A communicable disease outbreak or epidemic has far reaching implications for the entire health and medical continuum, not only due to the surge in need, but also due to the impact on staff, the economic impact, and the cascading effects that can threaten the overall health and safety of a community. Further, these incidents can strain the local, state, and even federal response and health and medical systems due to an extended response period and propensity to spread regardless of jurisdictional or state lines.

These events can quickly result in resource and supply shortages, hospital and clinic surges, significant staff shortages, and the implementation of Crisis Standards of Care ([Colorado Department of Public Health and Environment Crisis Standards of Care Plan](#)).

Severe Weather

For the purposes of this assessment, severe weather includes damaging hail, severe thunderstorms, tornadoes, drought, floods, and severe winter weather. According to the World Meteorological Organization, the definition of severe weather: is an extreme meteorological event or phenomenon, which represents a real hazard to human life and property. The definition of severe weather is most often impacts based, and usually defined by "local/regional" thresholds that are related to the inability for the "local/regional" populations to safely conduct normal business, to the point of being life threatening¹⁷.

The Disaster Declarations section of this assessment outline those natural disasters that have resulted in one or more declarations within the ten-county NCR, but there are additional severe weather events that have not resulted in disaster declarations. These events have been captured by the Western Water Assessment Team, which is affiliated with the National Oceanic and Atmospheric Administration (NOAA) and the University of Colorado Boulder. This database¹⁸ lists historical high-impact weather and climate events in Colorado from 1862 – 2017:

- A total of 38 severe or high-impact weather events have impacted the NCR since 1862
- The most frequent event was flooding (17), followed by: winter storm (6), wildfire (4); high-wind, hail, and drought (3); tornado (1); and cold wave (1)
- 220 fatalities have been attributed to these severe weather events (202 attributed to flooding alone)

Severe Weather Impacts

Severe weather, in its many forms, has the potential to cause significant disruptions within the health and medical system. These weather events often create surges of demand for healthcare while simultaneously threatening the continuity of that care. Building damage and/or loss of utilities (including power) from a high impact weather event(s) can immediately cause a disruption to service delivery, which may result in evacuation (full, vertical, and/or horizontal) as well as injuries to patients, staff,

¹⁷ World Meteorological Organization (October 2004). ["Workshop On Severe and ExPOO Events Forecasting"](#). Archived from the original on 2017-01-03. Accessed on 13 March 2019.

¹⁸ Western Water Assessment (February 2018). ["Historical High-Impact Weather and Climate Events in Colorado, Wyoming, and Utah, 1862-2017"](#). Accessed on 13 March 2019.

and/or visitors. Further, the effects of severe weather on the community may result in transportation disruptions and reduced staffing. As with many of the threats and hazards reviewed in this assessment, there are cascading or secondary impacts from severe weather which can affect other facilities within the region that were not primarily impacted from the initial event. These secondary disruptions can include medical surge as well as supply and resource shortages.

Healthcare Facility Evacuation

There are numerous events throughout history that have caused the evacuation of at least one healthcare facility due to the primary hazard and/or cascading impacts. These evacuations often make the news because they can be complex, chaotic, and dangerous. A few recent natural disasters that have resulted in healthcare facility evacuations include the flooding during Hurricane Katrina (2005), California's Tubbs (2017) and Kincadee fires (2019), and Colorado's 2013 floods and Spring Creek Fire (2018). As the world continues to see the frequency and intensity of natural disasters rise¹⁹, we are likely to see the number of significant healthcare infrastructure impacts, including facility evacuations, tend upward. The impact(s) of these natural disasters, specifically those that result in power outages, are also greater due to the healthcare system's growing reliance on technology and electricity to facilitate patient care.

In addition to natural disasters, healthcare facilities may also experience internal events that require patient evacuation (e.g., fire, flood, loss of IT, etc.). Therefore, although the hazard is contained within one facility, the cascading effects of an evacuation have the potential to effect the region's health and medical system. In reviewing the NCR HCC member HVAs, it was noted that many of the partners in the NCR have at least one of these hazards listed towards the top of their HVA. This is a critical piece of data that ties into regional planning efforts.

The number of large healthcare facility evacuations in the NCR is relatively low, but the region is highly susceptible to this type of event due to the high number of healthcare organizations and the types of natural hazards that are likely to impact one or more counties within the region. Per the earlier cited FEMA disaster declaration data, wildfire and flood hold the top two spots for declarations in the NCR and, as recent events have demonstrated, both of these hazards carry with them the potential to force facility evacuations.

Healthcare Facility Evacuation Impact

Healthcare facility evacuations, depending on their size and scope, have the potential to affect all elements of the healthcare system. Prioritization of patients, patient tracking, safe movement of those that are critically ill, coordinating medical and non-medical transport, managing the potential surge into other facilities, and supply management are just a few of the complex challenges that must be managed and supported. To further complicate the event, oftentimes these evacuations are occurring as fires are burning and floodwaters are rising as has been seen in recent national and local disasters.

From the regional perspective, one of the most significant gaps in an evacuation event is transportation. Although the NCR is the most resource rich region in the state, medical transport assets are still limited and a formal process for transportation coordination does not exist. This coordination gap extends to non-medical transport assets as well. Through the integration of ancillary healthcare partners into the coalition, the region has recognized that these organizations have the ability to support a large healthcare facility evacuation by providing transportation and staffing resources. However, without a process for allocation and coordination, these assets cannot be utilized effectively.

¹⁹ 2018 Münchener Rückversicherungs-Gesellschaft, NatCatSERVICE – As at December 2019

The NCR is currently working on developing processes, structures, and platforms to facilitate the implementation of an EMS Multiagency Coordinating Group (MAC) in an effort to help address these transportation gaps. Although the probability and regional implications of a healthcare facility evacuation remains elevated, the EMS MAC initiative, combined with the region's focus on coordinated planning, training, and exercising, have the potential to mitigate the impact to the healthcare system and community.

Information Technology (IT) Failure, including Cyber-Terrorism

The world is becoming increasingly reliant on technology to support daily activities, and the healthcare system is no exception. The healthcare industry has become reliant on the digitization of data and the automation of processes to maintain and share patient information and to deliver patient care more effectively and efficiently. However, with these benefits comes a certain level of vulnerability and risk.

Information technology failures can be the result of utility disruptions, system blackouts, and/or cyber-attacks. The outages can occur at the facility level (e.g., damage to a server room) and/or off-site (disruption to service at a remote data center). Failures within IT can have far-reaching impacts, including: patient safety, fiscal, continuity of care, and workflow. These effects can also ripple out to surrounding facilities, depending on the type and scope of the disruption.

Cyber-terrorism, or cyber-attacks, within the healthcare industry have been increasing in numbers and in sophistication over the past decade. Health-information technology, which provides critical life-saving functions, consists of connected, networked systems and integrates wireless technologies, which leaves these systems more vulnerable to cyber-attacks²⁰. A 2017 IBM study that tracked cybersecurity incidents around the globe, found that attackers who target healthcare providers focused on small to medium entities, as these targets require the least time, effort, and money to exploit. In 2016, an estimated \$6.2 billion dollars was lost by the U.S. Healthcare System due to data breaches²¹.

Information Technology (IT) Failure, including Cyber-Terrorism – Impact

An IT failure that disrupts the right system can result in a temporary closure of part or all of a healthcare facility. In 2015, a California hospital emergency department had to shut down after the Electronic Health Record (EHR) and data system failed. These failed systems resulted in issues with properly dispensing medications, verifying physician orders, reviewing labs and other diagnostic procedures, and led to an inability for clinicians to review patient records. Another, similar event, also took down e-mail systems throughout the entire facility.

Cyber-terrorism, including ransomware attacks, can expose sensitive patient information, result in substantial financial costs to address and recover from the attack, and oftentimes require the coordination of diverse resources and support to respond to and minimize the impacts of the cyber-attack. These incidents also affect patient care and safety, and failing to address cyber issues can negatively impact an organization's credibility and trust within the community.

Depending on the scope of the failure, there is potential for the regional healthcare system to be impacted by an IT failure/cyber-terrorism. The failure/attack could involve multiple facilities and systems, creating a widespread outage, or it could be limited to a single facility, which has to alter

²⁰ U.S. Department of Health and Human Services and Healthcare & Public Health Sector Coordinating Councils. (2018). Health Industry Cybersecurity Practices: Managing Threats and Protecting Patients.

²¹ Donovan, Fred. "Healthcare Data Breach Costs Remain Highest Among Industries." Health IT Security. Last modified July 12, 2018. <https://healthitsecurity.com/news/healthcare-data-breach-costs-remain-highest-among-industries>.

operations as a result. Both of these plausible scenarios puts stress on the system as a whole and can result in decreased capacity and capability to meet the medical needs of the community.

Medical Surge

The term medical surge, for the purposes of this assessment, refers to sudden, unanticipated escalations in health system demand caused by exceptional events (e.g. natural hazard disasters, pandemics, mass casualty incidents (MCI), etc.)²² and is inclusive of both trauma and non-trauma surge.

At the regional level, a medical surge event can quickly deplete available resources and capabilities for the surge event as well as day-to-day activities for both hospitals and EMS providers. Medical surge can be further complicated due to factors such as contamination (chemical, biological, radiological), safety and security of healthcare facilities and providers, loss of communication modalities, and limited situational awareness if the surge is part of a fast-moving event.

In instances of non-trauma surge, the region will need to support both a sustained surge in healthcare needs, as well continued resource depletion that is likely also being experienced throughout the state, nation, and/or worldwide. This type of surge is also more expansive as the large number of non-acute care hospital facilities located in the region will likely be significantly impacted (e.g., long-term care, home health, skilled nursing, dialysis, etc.).

Medical surge incidents in the NCR have been the result of natural hazards, human caused events, and infectious disease:

- Natural Event - 1993 Pope Visit to Denver: In 1993, during Pope John Paul II's visit to Denver, over 20,000 individuals fell victim to the extreme heat. Those who were ill or injured were moved to makeshift field clinics at the rate of 500 per hour. Reports from this event show that the sheer volume of medical needs overwhelmed the medical system, in its entirety.
- Intentional Human Act - Mass Shootings: The region has also experienced a number of shooting events that have impacted the region's pre-hospital and hospital systems, most notably the 1999 Columbine High School shooting and the 2012 Aurora Theater Shooting.
- Infectious Disease – 2009 H1N1 Influenza Pandemic: In 2009, Colorado was hit with the H1N1 influenza pandemic. Per the CDC, the pandemic stretched from April 2009 – April 2010, with a pandemic officially being declared in June of 2009²³. Data from Colorado hospitals and public health agencies from October 2009 paints a picture of the state and region right around the first peak²⁴:
 - State-wide: 14 deaths and 700 hospitalizations
 - Of the 14 deaths, six of those were people 18 and under
 - Lutheran Medical Center reported seeing 20-50 extra patients per day in the emergency department with the influenza
 - HealthOne hospitals reported seeing about 25 percent more emergency department patients than normal

²² Watson, S. K., Rudge, J. W., & Coker, R. (2013). Health systems' "surge capacity": state of the art and priorities for future research. *The Milbank quarterly*, 91(1), 78–122. doi:10.1111/milq.12003

²³ Centers for Disease Control and Prevention (2010). The 2009 H1N1 Pandemic: Summary Highlights, April 2009 – April 2010. Accessed on 5 December 2019

²⁴ The Denver Post (October 2009). "[H1N1 cases in Colorado may be peaking](#)". Accessed on 5 December 2019

- Many hospitals reported that they had called on staff to work extra shifts to triage flu patients
- Some facilities, and community partners, reported shortages of masks
- H1N1 hit Colorado approximately two months before the vaccine
- Schools reported having high numbers of students absent with the flu and some closed down completely (temporarily)

Medical Surge – Impact

Regardless of the causal event(s), medical surge is complex in nature and has the potential to affect all facets of the healthcare continuum.

Trauma Surge

The initial impact is a surge in both pre-hospital and hospital care. This surge may or may not come with an initial notification or situational awareness. The first few minutes, or even hours, of a trauma surge are chaotic and require a significant amount of resources. Because of the limited control or awareness in the early stages of an event, the impact is oftentimes disproportionate.

Beyond the initial needs for triage, transportation, trauma, and surgical capabilities, the secondary or cascading impacts from a trauma surge, or MCI, can include:

- Communication breakdowns (e.g., loss of cellular networks)
- Prioritization of care and surge on emergency departments (ED): as evidenced in past events, those that are minimally injured often arrive first to the closest emergency departments. This can result in EDs being maxed out with lower-acuity patients, which limits the care they can provide to those with more traumatic injuries
- Demand surges for supplies and equipment, including blood products
- Electronic medical record (EMR), and other internal patient registration and tracking systems, becoming overloaded
- Convergence of non-injured individuals at the hospitals (e.g., press, family members, volunteers, etc.)

Most trauma surge events, depending on the location and size of the incident, will require the region to work together closely to mitigate and manage what impacts they can. This can include notification, prioritization and allocation of resources; patient distribution; information sharing; and public information. Further, once the initial impact of the event has diminished, activities begin to transition to recovery. As seen in the 2012 Aurora Theater shooting, recovery efforts can last years and are oftentimes supported by non-hospital regional HCC partners.

Non-Trauma Surge

Although events that result in a surge of non-trauma cases oftentimes are slower to evolve and provide an opportunity for the healthcare system to plan and prepare for the surge, the impact is still significant.

The region's hospitals, similar to the rest of the nation, routinely operate at or near full capacity. Their ability to rapidly increase services is limited due to bed/space availability and staffing shortages. With many hospitals already operating with reduced staff, the loss of approximately 30% due to an infectious disease event significantly affects continuity of healthcare service delivery.

Extended non-trauma surge events will require the allocation of limited healthcare resources in a manner that does the greatest good for the greatest number of patients. The process for prioritization

and allocation of scarce resources can be complex, especially when the entire region is impacted and the shortages are widespread.

If a non-trauma surge is related to an infectious disease, there is the potential for the surge to last months. This puts additional stress onto the healthcare infrastructure and workforce and may necessitate the early introduction of behavioral health resources to support staff resiliency.

Utility Failure

Although they often operate in the background, utility systems play a key role in the ability of an organization to function effectively and provide safe and reliable patient care. Healthcare facility utility systems can include: mechanical (e.g., heating, ventilation and cooling); electrical (i.e., normal power and emergency power); hot and cold water and other plumbing systems; technology systems, including communications and data systems; elevators; fire alarm and suppression systems; fuel systems; access control; duress alarm and security/surveillance systems; air and vacuum systems; and medical gases²⁵.

There are a number of points in the system where a utility failure can occur: at the utility system source, at a major utility distribution point, and/or at local utility distribution or usage points. Failures at the utility source can be classified as internal (e.g., fire alarm control panel, boiler, etc.) and/or external (e.g., utility lines, water utility to a building, etc.). Disruptions at major utility distribution points can include piping that connects multiple boilers, data switch rooms, and connections that serve multiple pieces of equipment (e.g., medical gas tanks, vacuum pumps, air compressors, etc.). Local utility distribution failures can include items such as electrical closets, isolation room exhaust fan, etc. It is important to recognize that failures at any one, or at multiple points, in the system have the capacity to significantly impact normal operations and the ability for the organization to provide safe patient care.

Disruptions in utilities can be classified and responded to in two different ways: 1) the primary event impacting the facility, which is not tied to an additional threat or hazard or 2) a secondary event or the result of another hazard. Although both of these result in similar impacts to the facility, and elicit similar response activities, those utility failures that are caused by another event are oftentimes complicated by the needs and impacts of that disaster (e.g., a power outage that occurs due to severe weather – the facility must manage the consequences of the severe weather in addition to the power outage).

Utility Failure – Impacts

Due to the complex nature of utility systems within most healthcare facilities, the vast majority of minor day-to-day utility failures can be managed at the facility level and rarely rise to the level of significantly impacting patient care. Additionally, many facilities have built-in redundancies in their utility systems to mitigate the impact of utility disruptions. The ability of a healthcare facility to respond to and mitigate against these smaller incidents results in a stronger and more resilient healthcare system throughout the region. The concern, for the NCR, is when multiple facilities are effected by a significant utility failure(s) and/or when one facility experiences widespread or debilitating disruptions. The loss of one or more acute care hospitals, due to a major utility failure, would be felt immediately within the region, especially if the disruption results in the need for a facility evacuation. The consequence(s), from both of these scenarios, is reduced capability and/or capacity to provide safe and effective care.

²⁵ Health Facilities Management. Planning for hospital utility failures and recovery. July 5, 2017. <https://www.hfm magazine.com/articles/2975-planning-for-hospital-utility-failures-and-recovery>. Accessed 13 March 2019.

GAPS

In addition to the identification of regional hazards and threats, the NCR HCC also identified and prioritized gaps that impact the preparedness, response, and recovery activities within the health and medical system. A summary of the gaps, as well as the identified next steps to address these gaps, is included in Table 8.

Table 8: Summary of Prioritized Gaps

Identified Gaps	Identified Next Steps to Address Gap
<p>Lack of an implemented regional health and medical communications framework</p>	<p>The NCR HCC developed a regional health and medical communications committee in 2018. To-date, this multi-disciplinary committee has created a strategic plan and developed a final draft version of the NCR Regional Health and Medical Communications Framework. This framework includes an operational element, which aims to deconflict and standardize regional communications, where appropriate.</p> <p>The framework will be the focus of a regional workshop in early 2020, with training, exercise, and implementation projected for late 2020.</p>
<p>Gaps in regional information sharing during an event</p>	<p>The NCR HCC, through the development of the HCC Response Plan and operationalization of the healthcare coalition, has focused on the development of processes and documents to facilitate cross-jurisdictional, cross-disciplinary, and regional information sharing.</p> <p>The region is currently working on the finalization of a regional Essential Elements of Information (EEI) form, jurisdiction-level ESF-8/health and medical branch response flow-charts, and the integration of the NCR HCC into information sharing activities during a regional event. In addition, the region is participating in a statewide assessment of information sharing platforms.</p>
<p>Regional implementation of NCR Regional Hospital Coordination Plan</p>	<p>A special project, supported by the Denver Urban Areas Security Initiative (UASI), funded the development of the NCR Regional Hospital Coordination Plan. This plan is currently being exercised and socialized throughout the region. It has yet to be implemented region-wide, but this is projected to occur in early 2020.</p>

<p>Limited ability to identify and allocate resources at the regional level</p>	<p>The NCR HCC, through the development of the HCC Response Plan and operationalization of the healthcare coalition, is in the development phase of formalizing processes for regional resource identification and resource allocation. Allocation decisions primarily occur within ESF-8/Health and Medical Branch with support from the healthcare coalition.</p> <p>Over the past eight (8) months, the NCR HCC has worked extensively to address the identification and allocation of limited medical transport assets through the development of a regional EMS Multiagency Coordination Group. Work on this initiative will continue through 2020.</p>
<p>Gaps in processes related to cross-jurisdictional and cross-disciplinary coordination</p>	<p>This gap continues to be addressed through the development and/or revision of facility, local, regional, and state plans. The NCR HCC acknowledges the need to deconflict these plans and conduct comprehensive training and exercising to support effective implementation.</p> <p>The NCR HCC Response Plan and NCR Hospital Coordination Plan are currently being reviewed throughout the region in an effort to deconflict and align critical elements.</p>

The North Central Region’s Healthcare Coalition, in partnership with the region’s health and medical systems, has been building relationships, developing local emergency response plans and procedures, and working collaboratively for many years. As a result, the region has strong healthcare coalition chapters, dedicated ESF-8 and health and medical branch leads, and well-documented processes around health and medical response and support on a local level. These systems have been tested through exercises and real-world incidents on multiple occasions, resulting in lessons learned and improvement activities; all of which have strengthened the preparedness, response, and recovery network.

As is often stated in emergency management, “all disasters start local.” This saying reinforces the importance of having a strong foundation at the local level. However, for capability and capacity to be optimized, the planning and collaborative efforts must broaden to the regional level. Acknowledgement of the potential for a regional event to impact the NCR has driven the HCC to prioritize projects, exercises/drills, and planning initiatives that support regional coordination, communication and situational awareness. The gaps detailed above, as well as the next steps in addressing these gaps, directly align with increase capacity and capabilities at the *regional* level while capitalizing on the successful efforts at the local level.

CONCLUSION

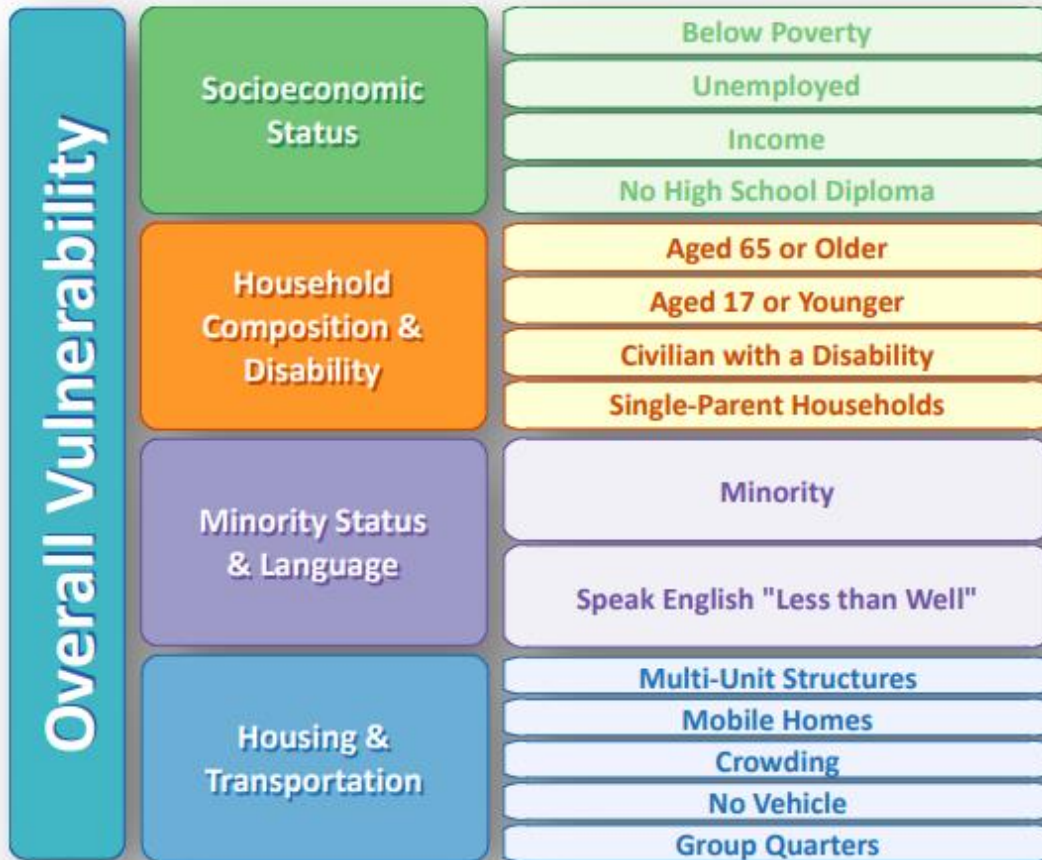
The combination of a detailed analysis of risk assessment data pulled from various sources throughout the region and collaborative discussions amongst regional partners, the North Central Region Healthcare Coalition was able to identify the top threats and hazards to the region's health and medical system: communicable disease/epidemic; severe weather; healthcare facility evacuation; information technology (IT) failure, including cyber-terrorism; utility failure; and medical surge. All of these events carry the potential for significant human, infrastructure, and/or economic impact resulting in disruptions in healthcare service delivery. Although the NCR HCC takes an all-hazards approach to planning, it is important to recognize those threats and hazards that carry an increased risk to the region.

In addition to identifying the top regional threats and hazards, the NCR HCC outlined gaps in the current preparedness, response, and recovery systems and structure. The gaps presented in this assessment include: lack of an implemented regional health and medical communications framework; gaps in regional information sharing during an event; regional implementation of the NCR Regional Hospital Coordination Plan; limited ability to identify and allocate resources at the regional level; and gaps in processes related to cross-jurisdictional and cross-disciplinary coordination. The coalition is committed to continue working to address these gaps collaboratively with the goal being to increase capabilities on a regional level, which, in turn, will support the planning, and response initiatives aligned with those hazards and threats that present the greatest risk.

The coalition, and its key stakeholders, to develop and prioritize planning, training, and exercise initiatives moving forward, will utilize the information included in this NCR HCC Joint Risk Assessment. This includes the development of the 5-Year NCR HCC Strategic Plan, completion of annual work plans, revisions to existing regional plans, and the development of clinical annexes to support the NCR HCC Response Plan. Additionally, the outcomes of this assessment will support the future funding of HPP projects within the region. As has been done in the past, all of these efforts will be coordinated and aligned with the more broad regional and state emergency management systems.

APPENDIX A – SOCIAL VULNERABILITY INDEX VARIABLES

American Community Survey (ACS), 2012-2016 (5-year) data for the following estimates:



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²⁶ Center for Disease Control. CDC’s Social Vulnerability Index (SVI): A tool to identify socially vulnerable communities. <https://svi.cdc.gov/Documents/FactSheet/SVIFactSheet.pdf>. Accessed 12 March 2019.

APPENDIX B – ACRONYMS

Acronym	Term
AAR	After Action Report
ACS	American Community Survey
AFN	Access and Functional Needs
ASC	Ambulatory Surgery Center
ASPR	Assistant Secretary for Preparedness and Response
BH	Behavioral Health
CDC	Centers for Disease Control
CDPHE	Colorado Department of Public Health and Environment
CDPHE- OEPR	Colorado Department of Public Health and Environment – Office of Emergency Preparedness and Response
CHCO	Children’s Hospital of Colorado
CMS	Centers for Medicare and Medicaid Services
DHSEM	Division of Homeland Security and Emergency Management
DIA	Denver International Airport
ED	Emergency Department
EHR	Electronic Health Record
EM	Emergency Management
EMR	Electronic Medical Record
EMS	Emergency Medical Services
EOC	Emergency Operations Center
ESF	Emergency Support Function
FEMA	Federal Emergency Management Agency
FQHC	Federally Qualified Health Center
HAMR	Health and Medical Response
HCC	Healthcare Coalition
HPP	Hospital Preparedness Program
HVA	Hazard Vulnerability Assessment
IT	Information Technology
JRA	Joint Risk Assessment
MAC	Multiagency Coordination
MCI	Mass Casualty Incident
MFHCC	Metro Foothills Healthcare Coalition
MOU	Memorandum of Understanding

Acronym	Term
NCR HCC	North Central Region Healthcare Coalition
NOAA	National Oceanic and Atmospheric Administration
PH	Public Health
PHED Ex	Public Health Emergency Dispensing Exercise
SVI	Social Vulnerability Index
THIRA	Threat and Hazard Identification and Risk Assessment
UASI	Urban Areas Security Initiative
WHO	World Health Organization

APPENDIX C – REFERENCES

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