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"Methods and measures to enhance resilience against electric power outage in urban vital societal functions"


MEREPUV

Summary of vulnerability assessment from Dordrecht

Deliverable no: 3.1 Dordrecht,

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(approx 15 pages)

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1 Introduction

The city of Dordrecht together with the Safety Region South-Holland South has participated in the MEREPUV project, focusing on the effects of city-wide power outages on healthcare services. A wide range of professionals in both municipal and specialist healthcare services have been consulted, as well as professionals from several essential infrastructure providers for the healthcare services.

2 Methodology and data collection

The assessment conducted is done within the framework of the so-called bow tie model. The model is adapted and specified on basis of purpose, analytical object and main questions to be examined in the assessments. The following risk elements are assessed:

- Probability
- Vulnerability
- Consequences
- Uncertainty

In addition, one other element is assessed:

Steering ability: How manageable are the risks and vulnerabilities attached to the scenario?

To what degree are there available measures which are likely to reduce risk and vulnerability? Vulnerability in health services is the analytical object in the model.

Cascading effects of power outage and failure in health services in terms of influence on other critical functions in society

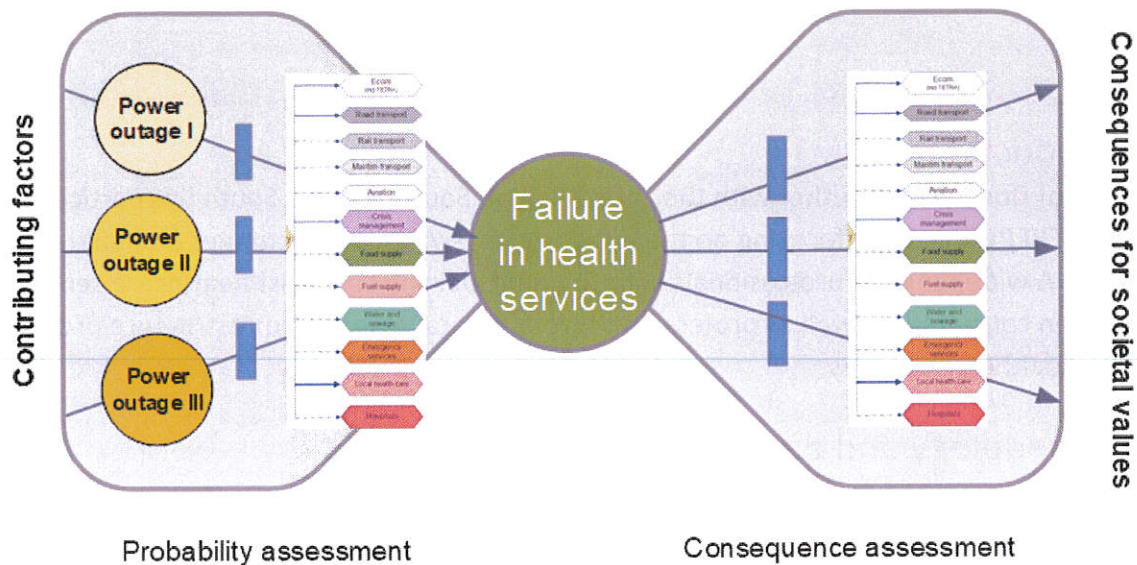


Figure 1. Risk and vulnerability assessment in four steps: 1) How do the scenarios affect other vital functions? 2) How does failure in such vital functions affect health services? 3) How does disruption in health services affect other vital societal functions (interdependencies) 4) What are the consequences for citizens and society?

The probability assessment builds on results and insights from earlier risk and vulnerability assessments and other available existing knowledge and data material.

The probability intervals used are:

- Very low probability: 0-10 per cent likely in 50 years
- Low probability: 10-40 per cent likely in 50 years
- Moderate probability: 40-60 per cent likely in 50 years
- High probability: 60-90 per cent likely in 50 years
- Very high probability: 90-100 per cent likely in 50 years

How do the scenarios affect other vital functions?

In the assessments we are examining whether and how the scenarios affect other critical input factors of which health services are dependent on in order to function.

How are health services affected?

In the assessment we are describing how the different scenarios affect health services, either directly or indirectly, due to failure or disruption in one or several other critical input factors for health services.

Furthermore, an overall assessment is made of how health services are affected in total. The assessment is based on a five-part scale from very low to very high degree.

Cascading effects and consequences for other vital societal functions

By examining other vital societal functions` dependency on health services, we get an impression of vulnerability in society related to failure in health services.

Societal impact

In this assessment we have chosen to assess consequences for society and citizens by focusing on the following societal values / types of impact:

- Human impact / life and health
- Societal stability / social impacts

The impact type "life and health" is further divided into two consequence categories: 1) number of deaths expected deaths and 2) number of severely injured or ill people

The impact type "societal stability" is further divided into two consequence categories: 1) Social and psychological reactions and 2) Challenges in daily life

Uncertainty and steering ability

Assessment of degree of uncertainty is related to an evaluation of the quality of existing knowledge used in the vulnerability assessment as well as an evaluation of to what degree the results are sensitive to changes in the conditions.

Degree of steering ability is evaluated by an assessment of whether efficient measures, of which can reduce the risk and vulnerability, exist and are well known. This is an important evaluation after the results of the risk and vulnerability assessment are ready and alternatives of measures are being addressed.

Datacollection

The data for this research was collected by desk research on available studies, incident-evaluations, and incident emergency plans in the own region and other regions in the Netherlands. In addition several expert meetings were organized.

To get more detailed insight in the cascading effects of power outage relevant for the occurrence of serious disruptions in the Health Care Sector (as usual described in the left side of the Bow-tie), two meetings were organized with the vital infrastructure partners. In these meetings a specially develop tool by the Dutch institute TNO was used. This so called "VITAP method" was used to make all the different interdependencies between the different critical infrastructure organisations visible. Participants in this meetings were the Waterboard "Hollandse Delta" (water managing agency), drinking water company, the national rail infrastructure organisation, the network manager for the electricity infrastructure network (Stedin), the company responsible for gas distribution, an representative of the ICT / telecom companies, the network manager of the city heating system in Dordrecht and the executive agency of the Dutch Ministry of Infrastructure and Water Management.

To get more insight in the impact of power outage and the cascading effects on the Health Care Sector (right side of the Bow-Tie) four expert meetings were organized with representatives of the Health care services, divided in sessions for "cure", "care" and "additional parties". In these meetings we discussed in-depth the consequences of power outage in their sector with representatives of the hospital, general practitioners, pharmaceuticals, midwives, ambulance services, care institutions (like elderly care, physical

and mentally disabled), centre for respiratory home-care, the municipality, housing cooperations and the Dutch National Red Cross. In addition we discussed in one to one meetings these topic with home care services and social teams within the city of Dordrecht, as they were not able to join the expert meetings.

We completed our information gathering having interviews with several experts on resilience, risk management and healthcare crisis management, all in the Safety Region South-Holland South.

A special Core Team gave very useful advice on the organisation of the meetings, the analysis of the information and the conclusions. The Core Team participants were representatives of the municipalities of the Safety Region South-Holland South, the GHOR (coordinating organisation of health care during disasters and crises), the project leader Resilience and an representative of the network manager for the electricity network "Stedin".

Description of the chosen scenarios

Four different scenarios were analysed in this assessment; Power outage with a duration of 4 hours, 12 hours, 24 hours and from 72 hours till a week. These scenarios were chosen as they represent different stages of legal responsibility, crisis response strategies and comparability with other MEREPUV city partners. The 4 hour scenarios was specifically interesting because of the frequency of its occurrence, and the fact that after 4 hours the electricity infrastructural organisation STEDIN can be held accountable for some possible damages. The 12 hours scenario was chosen as a in between point between a relative short power outage, and a long one of 24 hours. The possibility of occurrence decreases strongly when looking at a longer scenario, so a 12 hours scenario was a good middle scenario to assess. 24 hours was chosen as it was also a standard unit in many other assessments and plans. 72 hours to a week was originally chosen as it was deemed to be the longest amount of time we expect people who need medical care would still be in Dordrecht, thus where an assessments of the impacts of power outage would still be relevant.

System description of the analytical object (health services)

Description of the societal function health services included in the assessment, and what is not included and why

The Dutch Health care sector is very complex. Next to several layers of healthcare (preventive measures, general practitioner, specialized care, general hospitals and specialized hospitals) there are different organisation on regional scales and legal responsibilities. The central principle of Dutch healthcare is based on well-known international principles: access to healthcare for everyone, solidarity by a obligated but accessible healthcare insurance and good quality healthcare. The overall health care is organized along 5 lines. The line "zero" is the preventive healthcare, that is done for everyone without them even requesting is. It are measures and campaigns aimed at preventing health issues. The first line is directly accessible, these are general practitioners, dentist, home care and other directly accessible health care. The second line is specialized health care, you need a referral from a professional in the first line to use the health care in the second line. These are specialized healthcare professionals, mental health workers, homes for patients with special care needs and elderly homes. The third line includes the academic hospitals and specialized care institutes like blood research institutes. In general they support the care given in the second line, all doctors in academic hospitals are included in this. The fourth line includes health care on the highest level. Patients are helped very quickly, different health care tracks are brought together into one service for a patient, and there is a smooth transition of the patients and the info between the different institutions.

Other institutions that organize parts of the health sector that have been included in this assessment are the crisis response agencies, and the municipality. The municipality has a role in the organisation of the home care, and preventive measures (line zero and one) for anyone within their municipality who requires healthcare assistance during their daily life. The crisis response agencies have a role of organizing the response during a crisis, with the safety region as the central coordinating agency (including the emergency health care like ambulances), and the GHOR (Regional Medical Assistance Organisation) who has a responsible in directing, advising and supporting the health organisations during an crisis. The GHOR makes agreements concerning crisis response with the different healthcare organisations, including the ones who don't have a direct responsible in the crisis response agency. The healthcare insurance agency have been analysed in this assessment. All the aforementioned organisations have been included in the workshop sessions, with exception of the insurance organisations, and the home care organisations. In case of the home care organisation, they were contacted numerous times in different methods, however they were unable to participate. This indicates the capacity problem they already have during a non-crisis situation, and the feeling of responsibility these organisations have in relation to crisis management.

Description of the roles and responsibilities for the health services

Recently local municipalities have become responsible for certain types of healthcare, and they can organize it within broad boundaries. So how healthcare is organized can be different between different municipalities. The fact that the healthcare has both private as

public elements, makes that most people can make their own decisions how they would like to receive healthcare. A huge amount of the decision making process is in the control of the healthcare insurance agencies. They make deals and agreements with the hospitals and other healthcare organisations, on the number and type of treatments that are available. They can do this because they control the money flow. They regulate the healthcare sector, which has had a negative effect on the disaster preparation, as this is not their responsibility. The health care organisation (especially the smaller organisations) do not have the financial means to organize this themselves. A further complication is that the legal responsibilities and obligations differ between different parts of the health care system.

Description of the legal framework regulating the services in terms of preparedness in case of power outage

Legal responsibility for crisis response are mostly delegated to the local level and the safety region, with the mayor of the largest municipality within the region as the "commander". The mayor is considered to be the one who is ultimately responsible for the choices made. There are multiple laws in place that indicate the legal responsibilities the different health organisations have. The general principle is that the healthcare organisations and individual professionals (like general practitioners), are responsible for ensuring quality healthcare to their patients, also during a power outage or other crisis. So they have to prepare for crisis situations, and make sure they can continue to function in a certain manner. The health organisation have to report their preparation to the safety region. The GHOR as part of the crisis management network will advise, support and makes agreements with the health organisations has a coordinating role in this. The safety region always pays special attention to the health care section in their risk analyses and crisis management planning. As they have a coordinating role, the health sector is always an important factor and partner in their preparations and crisis response plans.

Results of the assessment of power outage

Scenario 1: 4 hour power outage

Impact on critical input factors for health services

The impact of a power outage of 4 hours on the critical infrastructure is relatively low. Organisations that manage what is considered critical infrastructure (Power supply, ICT, water supply, gas-network, Sewage system) are required by law to take precautionary measures to deal with the effect of power outage. Those measures for the most part ensure that the effects of a 4 hour power outage are minimal. The electrical company will have to fix the problem and repair the network within 4 hours, or else they will have to pay for some of the damages. They are both technically and legally unable to restore the power to certain key locations first in case of a power outage (i.e. hospitals). Both the gas network and water supply will continue to function, as the companies will be able to keep "pressure" on the infrastructure, ensuring the supply of gas and water. However in high buildings the water pressure will only reach up to the second floor, because the local Hydrophore will fail if there is on power back up. As the water is also used for sprinkler systems that are used in case of fire, if these do not functioning, it is obligated by law that the building should be evacuated. The city heating network and sewage system will stop to function, however impact is expected to be relatively low depending on the weather. If there is a heavy rainfall event at the same time or extreme heat or cold, the impact could be much bigger. Sewage could be dumped in open water if the system reaches capacity, and water will rise in the lower parts of Dordrecht. This could lead to blocking tunnels and causing damages due to waterlogging in houses, and sewage water coming up through the toilets in homes. If there is a power outage in the winter special care must be taken to ensure that patients are warm. However health organisations have indicated that extreme heat could be a bigger problem. This could be very dangerous for certain patients, and hospitals could be limited in their functioning if cooling and air circulating systems do not function.

Transportation and the road network are expected to experience larger delays, and public transport will mostly stop functioning, with the exception of busses. Tunnels will be closed off and bridges will no longer be operable by a central system. This will cause large delays, and could be very harmful in case of delayed emergency vehicles. The ICT and Telecom infrastructure will experience heavy impact in case of a 4 hours power outage. As all wifi connections will fail instantly, all phones, laptops and other internet devices will try to connect to the mobile network, overloading it and causing it to crash. Although some have a power back up for a couple of hours, they are still expected to fail. Emergency numbers will be able to function for a while, and people can call these using landline phones, however experiences show that these will be overloaded with callers.

Cascading effects and impact on other vital functions

During a power outage of 4 hours most health organisations will be able to (partly) continue to function. All organisations will face difficulties, especially the ones who do not have an emergency power system. It is however not expected to cause immediate loss of life. The hospital will be able to continue to function, however they will only supply the necessary care, and will stop all non-critical appointments and treatments. Other health organisations indicate that they will improvise or fall back on regional organisations who will still have

power. Because the impact will be manageable, the cascading effects are deemed to be minimal. Although it is expected that the increased demand for communication will be very difficult due to the problems expected in the ICT / telecom sector.

Consequences for societal values

The capacity of the healthcare organisation will diminish, however critical care will be able to continue to function. The only exception are the very vulnerable home care patients, who require machines to continue to live. This can be taken over by individual care, however if this is not supplied immediately by health care professionals or family members, there is a substantial risk for fatalities. Both the ICT / Telecom as well as the public transport are expected to be not functioning, while there is an increased demand for these services. This is not expected to cause any societal unrest.

Identified vulnerabilities, existing barriers and proposals of measures

The dependence of the health organisation and society overall on ICT and telecom are a large vulnerability, especially considering these systems are expected to largely cease to function the moment there is a power outage. Next to this the homecare health organisations are expected to not have the capacity to deal with the consequences of the power outage. Experiences show that they have a large degree of flexibility and motivation to help in such situations, however the small scale of these organisation creates extra vulnerability. There is no overview and likely no possibility to contact the local people of those organisation, who have crucial information and skills. This is also a barrier, the problem of getting the information of home care patients, their location and healthcare needs, and the capabilities of the home care organisations. Furthermore it is often unclear who in case of power outage will communicate about the consequences and the expected moment the power will be restored. There is no clear division of responsibilities to communicate between the home care organisation, power supply company and crisis organisations. Possible measures are start communicating to raise the awareness about possible consequences due to a power outage, and to stimulate health organisations (especially homecare) and patients themselves to take more precautionary measures. Preparations can be taken to ensure a quick transfer of critical information from homecare organisation to crisis organisation, in order to quickly dispense emergency healthcare to targeted location. Concerns due to privacy laws will have to be solved. This is considered as a measure that could solve one of the biggest possible impacts and problems that will occur due to a power outage.

Scenario 2: 12 hour power outage

Impact on critical input factors for health services

The expected impact during a 4 hour power outage scenario is also expected to occur during a 12 hours power outage. Furthermore it is expected that transportation and public transport will further diminish in capacity, although people by this time will have adapted to the new situation, so there is also a smaller demand. It could however still cause large problem for emergency services. The possibility to communicate via ICT and TELECOM will further decrease, batteries of transceivers (walkie-talkie) will run-out, decreasing the already limited possibility for health organisations to communicate internally and externally even

further. The water supply, sewage department, and gas network are not expected to experience any further impact.

Cascading effects and impact on other vital functions

During a power outage of 12 hours the impact on the health care sector will continue, however the strategy will remain the same. Organisation will still be able to ensure any critically needed healthcare. The impact on the other vital functions will therefore be relatively similar with the 4 hours scenario. There will be an increased demand for assistance by crisis organisation, and patient who receive health care at home will also require more assistance. When this concerns patients who stay at special care institutions this could become problematic, as they could possible cause harm to themselves or their environments. If these problems occur it will cause an increased demand for assistance from other health organisation to deal with these problems. How this will be organized and communicated is unclear.

Consequences for societal values

The capacity of the health care system on the Island of Dordrecht will continue to decline, especially within the hospital. The general practitioner also expects an increased volume of questions from patients, although they could possibly not be received due to the communication issues. No extra victims are expected, with again the exception of home care patients receiving critical care. As these patients are in need of constant care, and very vulnerable to any changes, the risk for fatalities will increase. Furthermore some patients who are housed in (semi-) closed housing, could cause unrest if they are no longer in the closed housing institutions. The expected chaos in traffic and public transport is expected to decrease, as people adopt to the new situation, as long as there is no extreme weather (cold / rainfall) the overall societal impact is considered to be low.

Identified vulnerabilities, existing barriers and proposals of measures

Any home care systems that run on batteries will have run out during the 12 hours, in case of no spare batteries constant care will be needed. There is a demand for fuel to power emergency generators supplying health care locations. Finally the increased use of electrical cars within health care organisations will decrease the mobility of health care professionals. Existing barriers are the increased demand for assistance that several health care organisation will have, however they will not be able to communicate this via any systems. Furthermore the emergency hospital located in Utrecht will possible be activated, however as they have only 100 beds, it could be that there is a further demand for capacity. The transport of the patients will also be a limiting factor, as there are only a limited number of emergency vehicles available. Possible measures that can be taken are the organisation of extra assistance of material and people from outlying regions, as the distance is very short, extra capacity can be brought in very quickly. By supplying information to organisations and home care patients about the possibility and consequences of a longer power outage, further preventive measures could be stimulated, like the supply of back up batteries of vital medical apparatus people use at home.

Scenario 3: 24 hour power outage

Impact on critical input factors for health services

Again all the impact that is expected during a 4 and 12 power outage is also expected during a 24 power outage. A power outage of 24 hours is considered to be extremely harmful by most organisation, between the 12 and 24 hours changes occur in the critical infrastructure system, that will require a longer repair period. The strategy of most health organisations will change when they consider a 24 power outage situation. Almost all organisations will start evacuating around this time, already there are deals in place with regional organisations to help each other during such an event. If there is a power outage of 24 hours the communication systems of the crisis organisations will be less reliable, and could partly stop to function. Even without rainfall tunnels will fill up with water at this time, as the water is no longer pumped out. Localized flooding could occur from open water bodies, as the larger pump of the polder area will no longer function. Fuel shortages are expected to increase within Dordrecht. The city wide central heating system will have cooled down to a point, where heating the water used for heating homes will take a long time, giving an exact time estimate is not possible.

Cascading effects and impact on other vital functions

In case of a power outage of 24 hours, most healthcare organisations indicate they will start evacuating their patients to outlying regions. Evacuating the hospital will require a large number of emergency vehicles, this is most likely the limiting factor of the time needed to evacuate. The evacuation will be hindered by the closing of tunnels, but will still be possible. Most organisations indicate that if there is a power outage of 24 hours, all patients will be evacuated, and the regional health care providers and organisations will help. Crisis organisation have a central role in coordinating this response, and although there will be many difficulties, they are expected to be able to cope with the situation.

Consequences for societal values

Between 12 and 24 hours general practitioners expect a large increase of questions from people and elderly in their neighbourhoods, that need medical attention or are worried given the situation. This could cause unrest, as the capacity of the health care organisations will further decrease during this period. They also expect problems with staff and resources, that will be no longer sufficient to deal with the demand for healthcare. That is why most organisation will have chosen to evacuate around this time. The evacuation will be risky for some patients, but staying within Dordrecht in such a situation is considered to be more harmful. The national government will have taken steps to assist with the crisis management, during such a situation.

Identified vulnerabilities, existing barriers and proposals of measures

There are various vulnerabilities that have been identified given a 24 power outage scenario. There will be an increased demand for healthcare, predominantly from people who receive healthcare at home, and elderly, at the same time the capacity for healthcare will drastically decrease. Furthermore cooled medicines and food will no longer be usable / edible, and the capacity of the staff is expected to decrease. Existing barriers during this scenario are the capacity of emergency vehicles, that can be used in an evacuation. With previous large scale evacuation of patients, this proved to be the limiting factor. Furthermore there is no central database with information about people who receive homecare that can be accessed by crisis organisations. Possible measures that could be implemented, is the realisation of local support points in the neighbourhoods, that can give information and supply to the people

living there. Also the evacuation of the island could be coordinated, to make sure several organisation don't decide to evacuate at the same time, resulting in long delays before evacuations are actually completed.

Scenario 4: 72 hour / 1 week power outage

Impact on critical input factors for health services

All previously mentioned impacts expected in the other scenarios are also expected to occur during the scenario of a power outage of 72 hours to 1 week. It has proven to be more difficult to assess what the expected impact is for this scenario, compared with the previous scenario's. An real life example with similar circumstances as are in Dordrecht has not occurred, and most organisation don't see a week long power outage as a realistic scenario. The only situation which has been researched before in which there would be a power outage of a week, would be a large scale flooding of Dordrecht. However this would create a crisis on a different scale, and would include a complete evacuation of the island, and complete destruction of most critical infrastructure. The only expected extra impacts on the critical infrastructure during a weeklong power outage, is that fuel available will further decrease, decreasing the mobility of people and healthcare organisations. If the water sanitation plant is not functioning for a week, it will need 3 weeks to start up again, as the biotope has to be recreated.

Cascading effects and impact on other vital functions

As all health care organisation indicated that they would evacuated fully within three days, no further impact is expected on the critical infrastructure or other vital functions.

Consequences for societal values

Patients on intensive care will have to be moved to other hospitals in the region, and possible the national emergency hospital in Utrecht. Moving patients on the intensive care will involve serious risk, however the hospital can no longer give the care needed to these patients. Overall unrest will increase, not only within the health sector. No further consequences for the societal values were identified, as most organisation expect to be fully evacuated within 3 days.

Identified vulnerabilities, existing barriers and proposals of measures

It was difficult for organisations to imagine this scenario, reports also did not give a complete overview of the expected impacts. The chance of such a period of power outage in Dordrecht is extremely low, which may explain the very limited preparation for such an occurrence. This is a vulnerability in the (extreme small) chance that it does occur. Possible measures could be the support for the evacuation plans of the local health organisations, to complete this as fast as possible.

Uncertainty and transferability

Degree of uncertainty in the results

For the first three scenarios there was both literature available, as the possibility to discuss possible impacts with the different health organisation, professionals and critical infrastructure organisations. The results from the work sessions reflected the same conclusions in the already available literature. Also the reports of power outages that actually occurred present the same overall picture. Decisions that local organisations said that they would take at a certain moment, were mostly also executed by similar organisations that experienced a power outage. However small differences can have a large effect on the expected impact. If there is a large rainfall event during a power outage, the impact and consequences for critical infrastructure and healthcare organisations in Dordrecht would increase greatly. Furthermore the final scenario of 72 hours to 1 week has proven to be difficult to analyse. Most organisation could not imagine such a situation, and there was only limited literature and previous experiences available. The degree of uncertainty increases with the duration of the power outage. Finally although most organisation were included in the workshops, the home care organisation have proven to be a very difficult group to reach out to. Various methods were tried, and only very limited response was ever received. This does indicate the problems that will only grow during a power outage, the small organisation will have large difficulties to cope with changing situation, and especially crisis situation like power outages. Because there is currently not a properly functioning working relationship between these organisation and the crisis organisations, during an actual crisis the organisations will be slow to respond and organize help if they need it.

To what degree can the results be transferred to other cities?

The situation in Dordrecht has comparable elements with other cities and countries, however it does have some unique characteristics. The increased use and reliance on ICT and telecom within the health sector is a shared characteristics between EU countries, although on different levels. It is becoming more common for people to stay longer at home, or more quickly be discharged from hospital, and receive the care they need at home. The amount of people who are not able to be self-reliant without the home care is increasing, these people often rely on certain powered systems for their health. Another shared characteristic is the change in the energy network used by cities. It used to be that power was created at several large power stations, and diverted via a network from large national infrastructure to a fine grid within cities. Because of the energy transition most countries are going through at the moment, it is shifting to a much more complex and dynamic network. This comes with more vulnerability, and therefore a higher risk for power outages. A unique characteristic for the Netherlands is the actual make-up of the large part of the country. Where most countries experience rapid growth of only the biggest cities, the western part of the Netherlands grows quickly, but in many different cities at the same time. Because of this the health care are not all located in a relatively small area, but dispersed over a larger region, within various mid-level cities. This creates a flexibility in the network, as organisations can support each other, when certain regions experience difficulties. This dispersed urbanized structure creates a level of resilience.

Way forward

Steering ability

From the analyses and research done as part of this project, several measures have been identified. These measures can be implemented within the crisis and health care organisations. Already a large number of measures exist, in case these do not within certain organisation, this is often a case of lack of funds, capacity or knowledge. Especially with the smaller organisation which have become more numerous in the past years, there is little preparation and possibility to take measures themselves. The largest problem is identified as people receiving home care, because this is a quickly increasing complex group, and because the organisations supporting these people, is a very diverse and complicated network of small organisations. Preventive measures can be very beneficial in decreasing risks for people at home, however for this awareness has to be created, and the home care organisations should have a vital role in this process. For a full list of the recommended measures, see the list below.

Recommendations

Critical infrastructure

1. Increasing understanding of interdependencies between different critical infrastructure partners, and increase the business continuity of the critical infrastructure organisations
2. Create clear plan and structure of communication message internally for the critical infrastructure organisation, and between the different organisation. Clarity is needed on who communicates what.
3. Work together with a national program on critical infrastructure and decreasing vulnerabilities.
4. Suppliers and health care organisations should create a back-up plan detailing the important steps to be taken in case of power outage, but do not go into detail as this can only be done given the exact impact of the power outage.
5. Local solutions at home can be combined with the larger energy transitions, like including a battery for local power supply when installing solar power cells.

Crisis management organisation and Municipality

1. Increased cooperation between crisis organisation and the Electricity power grid company (STEDIN) given the energy transition.
2. Create an interagency communication plan given several power outage scenario, to clearly distinguish the responsibilities and actions including who communicates to whom about what, between the crisis organisations, health organisations and other organisations.
3. Create prevention focussed action plan to create more awareness with home care organisation and patients, in order to increase self-reliance.

4. Crisis organisations have to organize a process in which data can be made available during crisis situations, on patients' needs and locations, in order to actively and directly offer the needed assistance.
5. Informing at the start of a crisis about other possible communication methods that will be used, if other (regular) systems fail.

Healthcare

1. The GHOR (organisations that coordinates healthcare during crisis situations) organises a closer working relationship with the homecare organisations.
2. By increasing the awareness and showcasing of possible measures people can take themselves their resilience can be increased, to decrease the possible impact of a power outage.
3. Make the general tasks and responsibilities of the crisis organisations known to the large group of small homecare organisations, to make sure they know where to ask for help during a crisis situation.
4. Because the home care organisations have proven to be a difficult group to reach and to include within this research and the overall network. New methods have to be used to incorporate them within the standard crisis organisations network. The possible impact due to a power outage should be presented to them in an easy and attractive format, in order to create sufficient awareness and feeling of necessity within the organisations.
5. The health care organisation need to be able to quickly supply needed information during a crisis situation. In order for this to be done data services need to be accessible during a crisis situation and people need to be trained to do this quickly.
6. It may be better instead of sharing data with crisis organisations, to ensure it can be accessed by the health organisation themselves during a crisis, so they are in a position to answer any questions from the crisis organisations.

Remarks on the findings – any unexpected findings? Need for further assessments?

There have been numerous unexpected findings. The expectations that the ICT and Telecom sector would fail quickly was expected, just as the fact that other critical infrastructure partners would most likely (partly) continue to function. What was a surprise was that most of those organisations did not foresee that their own communications system that they use daily would also be unavailable, and did not prepare fully for this in their crisis plans. Another unexpected finding was that originally there was an idea that a possible preventive measure was the selective repairing of the network, in order to restore the power to certain vital functions first (hospitals, elderly homes). This however turned out to be impossible, both legally as well as technically.

It was unexpected that most organisations would already start a large scale evacuation after 24 hours. Around this time it was deemed to be better for the patients to evacuate to surrounding regions, in comparison with staying with the area with no electricity. Because of this most organisations could not indicate possible impacts within the 72 hours to 1 week scenario, as they would have already left at that point. The last unexpected finding was that it proved impossible to involve the homecare organisations within the project and the specific workshops. Even individual appointments were not possible, while we tried to contact multiple organisations, professionals and on several levels of the organisation. This will need further assessments, as there are indications of the impact, but not as clear as compared with the other organisations. Furthermore large benefits in crisis response could be made if these organisations take or stimulate preventive measures, or are involved with the crisis response of the safety region. There is a need for further progress in the possibility of sharing information during a crisis situation, by the municipality or home care organisations. This currently has both legal as well as practical limitations, while the information is vital for a proper disaster response during a long power outage. Based on the expert meeting where the results were presented, the idea arose of instead of sharing the information, ensuring that health organisations could access the information during a power outage, in order to answer relevant questions from crisis organisations.

Following up on the findings

Based on the findings the Safety Region together with the cities Bergen, Stavanger and Valmiera felt the need for development of an inter-sectoral response plan. Therefore a proposal is made for the DG Echo call of Prevention and Preparedness Projects for Civil Protection and Marine Pollution (UCPM-2019-PP-AG). By including the national level in Latvia and the Netherlands, and in Norway the County level in the supervisory board, there will be national knowledge obtained and dissemination to other regions and cities.

Plan for dissemination of the results to other cities/relevant stakeholders

A workshop will be organized in which all organisations that have participated in the assessment will be invited, to discuss the current results and proposed measures. Through this discussion the conclusions will be sharpened and hopefully broadly shared and accepted between the different organisations. The proposed measures will be discussed and possible expanded or changed according to the expertise of the different organisations. This will also create partial ownership of the current results, in order to increase the likelihood of adoption of the possible measures.

Experience with the method and process

Strength and weaknesses with the method used, need for new approaches?

The strength of the method is the structured approach towards the assessment. As a power outage would have large consequences, and many follow up impacts, it needs to be approached with a broad perspective. The sequence of assessing the impacts first on the critical infrastructure network, secondly of the health organisation and thirdly back on the critical infrastructure was a logical sequence, and allowed for a complete mapping of the likely impacts. It allowed us to properly assessing the impacts for the health organisation, by adding the most recent knowledge from the critical infrastructure partners on what the organisations can expect. However the assessment of impact from the health organisation back on the critical infrastructure was fairly minor, or at least did not result to many identified impacts. This could be due to the structure of the Netherlands, with a decentralized network of critical infrastructure and health organisations, creating over capacity and flexibility in the system, in case a certain area experiences problems.

Involvement of stakeholders. Possibilities, limitations, challenges

The approach of bringing all the stakeholders together in single workshop, was a possibility for most organisations to compare with other similar organisations and gain immediate insight into their own possibilities. This made the larger workshops very beneficial, both for the overall project, as well as for the partaking organisations. However due to capacity issues it proved difficult to involve all the different organisations. In general it can be said that how smaller the organisation, and the more it was involved in decentralized home care, the more difficult they were to involve in the assessment. With the ultimate example of the home care organisations, which we were unable to directly involved in this assessment, this was a big challenge in the assessment.

Which stakeholders have been involved in review of the report before its closure?

After each session the results of the session were shared with the participants. In the final stages of this assessment all stakeholder have been invited for the last general workshop. All results and conclusions will be discussed, and the report and recommendations have been adopted giving the commentaries en feedback that have been received. A written "summary brief" will be distributed to all the partners so that they can comment on the most salient points, without the need to go through the complete project report. All the time the coreteam meeting consisting of the municipality, the safety region, the GHOR and the electricity infrastructural organisation STEDIN was involved throughout the workshops and the writing process. And the concept conclusion have been discussed with them, and adopted according to their input and feedback.