DOI: 10.38146/BSZ.SPEC.2021.5.7

Tamás Farsang

The Most Modern Mobile Epidemic Hospital of Europe Was Built in Kiskunhalas

Európa legmodernebb mobil járványkórháza épült fel Kiskunhalason

Abstract
The aim of my presentation is to demonstrate the protection tasks and good practices developed for an unknown situation created by the COVID-19 pandemic starting in December 2019, in the light of the measures taken by the Hungarian Prison Service. The construction of the Kiskunhalas Mobile Epidemic Hospital (hereinafter: Epidemic Hospital) and the increase in the prison service's production capacity for health protection equipment, has become essential because of the pandemic. The well-equipped Epidemiological Hospital with 150 beds, and the means of protective equipment delivered to healthcare institutions within a short time have made a worthy contribution to the protection of the society and to the safety of its citizens. The production of face masks with employment of prisoners, as well as the production of other protective means, became parts of the state's self-sufficiency.
The Epidemic Hospital closed on 31st May 2021, however, the institution may provide an opportunity for immediate future utilization in the case of a new wave, or a new pandemic.

Keywords: epidemic hospital, Kiskunhalas, COVID-19, pandemic

Absztrakt
Jelen tanulmány célja, hogy a 2019 decemberében kezdődő COVID-19-világjárvány kapcsán kidolgozott védekezési feladatokat, jó gyakorlatokat bemutassa, a büntetés-végrehajtási szervezet által megtett intézkedések tükrében. A Kiskunhalasi Mobil Járványkórház (a továbbiakban: Járványkórház) megépítése,

valamint az egészségügyi védőeszközök tekintetében a büntetés-végrehajtás gyártási kapacitásának növelése – a járvány következtében – elengedhetetlenné vált. A társadalom védelméhez, az állampolgárok biztonságához méltóképpen hozzájárult a világviszonylatban is kiemelkedő felszereltséggel rendelkező 150 férőhelyes Járványkórház, illetve a rövid idő alatt megtermelt, az egészségügyi intézményeknek szétosztott védőeszköz-mennyiség. A fogvatartotti foglalkoztatással megvalósuló szájmaszkgyártás, valamint az egyéb védőeszközök előállítása az állami önellátás részévé vált.

A Járványkórház 2021. május 31-ével bezárt, azonban az intézmény lehetőséget biztosíthat a jövőben is arra, hogy egy esetleges új hullám, új világjárvány megjelenésekor azonnal bevethető legyen.

Kulcsszavak: járványkórház, Kiskunhalas, COVID–19, pandémia

Prologue

The COVID–19 pandemic, which began in December 2019, created an unknown situation not only in Hungary, but all over the world. The first confirmed infected person in Hungary was registered on March 4, 2020. The symptoms of the disease show a unified picture, however, virological examinations confirm that the virus is constantly mutating.

In preparation for the involvement of Hungary, the Government established the Operational Body on 31 January 2020. The board takes the epidemiological measures in Hungary, develops the national guidelines and ensures their implementation. The work of the Operational Body is supported by task-specific action groups.

The Action Group Responsible for the Establishment of the Mobile Epidemiologic Hospital (hereinafter: the Action Group) started its work on March 14, 2020, and the Operational Body set one month for the implementation deadline. The Action Group successfully completed its task, and the epidemiological hospital was completed by the set deadline within the premises of the designated prison institution, with a floor area of 3,100 square meters, with the use of 220 containers. The construction took place in an extremely short time, both in domestically and internationally point of view.

Virus history

The first coronavirus was discovered in the 1960s. Later, in 1964, a Scottish scientist, June Almeida, recognized that diseases originally thought to be the flu virus were caused by another virus. The COVID–19 pandemic is an epidemic caused by the SARS-CoV-2 virus, a disease called COVID–19. The first cases were discovered in December 2019 in Wuhan, China. Soon, people with pneumonia appeared en masse in the city, for which there was no clearly identifiable cause. The outbreak was declared a pandemic by the World Health Organization (WHO) on 11 March 2020 (URL1).

In order to prepare for the defence in Hungary, on 31 January 2020, the Government established the Operational Body Responsible for the Control of the Coronavirus Epidemic (hereinafter: the Operational Body).[1] The head of the Operational Body is Sándor Pintér, Minister of the Interior, and Miklós Kásler, Minister of Human Capacities. Other members: Cecília Müller, Chief Medical Officer of State, Károly Papp, Director General of Public Security of the Ministry of Interior, János Balogh, National Police Chief, furthermore the Director General of the National Directorate General for Disaster Management, National Directorate-General for Aliens Policing, Counter Terrorism Centre, South Pest Central Hospital, National Healthcare Service Centre, and the Hungarian National Ambulance Service. The Operational Body immediately published its Action Plan to combat the epidemic. Following the outbreak, a state of emergency was declared on 11 March, bringing a special legal order into force. On March 4, 2020, the Government of Hungary launched an official information website about the coronavirus and a related but technically independent Facebook page (URL2). On February 1, 2020, a spokesman for the Hungarian Prison Service Headquarters announced that the prison service had begun mass production of medical protective masks in the Hajdú-Bihar County Remand Prison with the involvement of inmates. The quantity produced was placed in warehouses in different parts of the country and continuously delivered to healthcare institutions (URL3).

The Spread of the virus in Hungary

In Hungary, the first wave of the virus caused mass illnesses in the period from March to August 2020. This period was characterized by an initial sharp increase in the number of infectious cases, followed by a gradual decrease and a subsequent

1 Government Decree 1012/2020 (I.31.) on the establishment of an Operational Body responsible for the control of the coronavirus epidemic.

increase. In the following period, the coronavirus epidemic attacked human health and the economy in several waves. The second wave began between September 2020 and January 2021, and then in March 2021, a third wave caused by the appearance of the British mutant (URL4), which, unlike its previous versions, spread faster and infected younger ones as well. For a long time, the high mortality rate (14%) was a unique feature of the Hungarian statistics next to the low number of cases. The average age of the deceased was 77.5 years. However, the nationally representative survey, the number of deaths, and international experience showed that the low detection caused the discrepancy, as in fact only one in every 14-15 case was identified. In domestic statistics, coronavirus mortality is defined as any case in which a patient tests positive, regardless of whether they may have had another illness. The calculations vary from country to country, so their percentages are incomparable. The first supply of vaccines crossed the Hungarian border in December 2020, when the first authorized Pfizer-BioNTech coronavirus vaccine in Europe arrived (URL5). Thanks to the successful vaccination strategy, the third wave of the epidemic in Hungary ended by June 2021. In parallel with the increase in the number of vaccinated people, epidemiological restrictions were gradually lifted, and after reaching 5 million vaccinated people – in May – a significant part of the restrictions was lifted.

Kiskunhalas Epidemic Hospital

Establishment of the epidemiological hospital

Like all countries and states in the world, Hungary's healthcare system faced a major challenge in dealing with an infectious epidemic of this magnitude. As the infectious disease wards operating in hospitals are small, the reception of the unrealistically increased number of infected patients requiring intensive care has been limited. The course of the virus could not be estimated, and international examples also showed a mixed picture of how effective the methods of protection against the virus prove.

For the above reasons and for the effective implementation of the treatment of the epidemic, appeared the idea of setting up an epidemiological hospital that can be built in a separate location and put into operation quickly and can provide care for a large number of patients with the same symptoms. Concentrated patient placement is also optimal in terms of human resource use. The project also involved the development of a kind of pilot solution that would provide an adequate level of healthcare to a large number of patients in a short period of time.

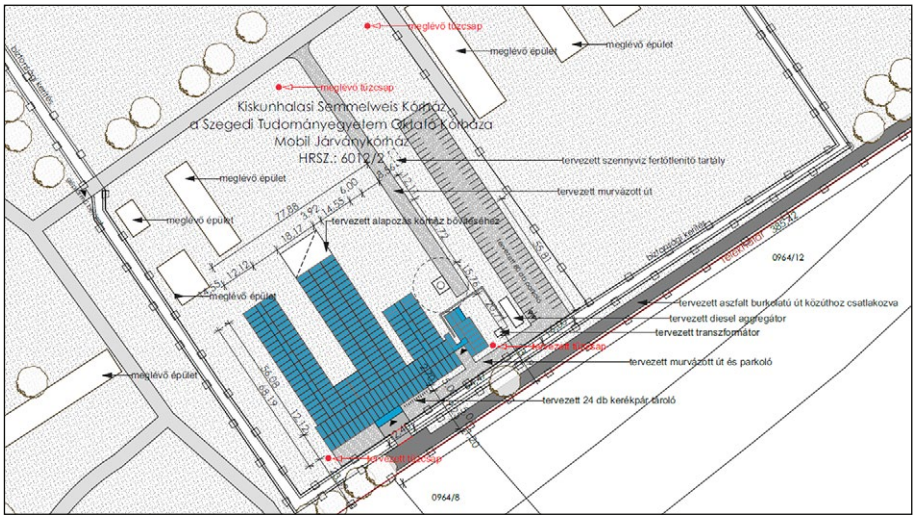
Thanks to the national collaboration, all building materials arrived on time at the installation site. At the same time, more than 500 people worked at the construction site at a strained pace of work so that the epidemic hospital could be built as soon as possible and could perform the health tasks. On 11 April 2020, the Prime Minister held a site visit in which he expressed his satisfaction with the work done and the quality of the construction (URL6).

The selection of the site was based on the orderly ownership, the proximity of the health care facility with the infrastructure, the appropriate size and the existence of utility connections. The construction technology is container-based according to international trends. The Kiskunhalas National Prison seemed to be the most suitable for these criteria (URL7).

The institute was previously the Guarded Centre of the Office of Immigration and Citizenship, which in 2018–2019 was transformed by the prison service into a prison institute. The electrical, water and sewage network was previously built in the object, so the empty area with the appropriate infrastructure was available to start the construction in Kiskunhalas, on Szegedi Street[2].

The building is separate; it is separated from the existing building of the object by a fence. The property can be approached from the entrance road open from Szegedi Street, through a private road with asphalt pavement.

Picture 1: *Plan of the Kiskunhalas Epidemic Hospital*



Note. *Created by the author.*

2 Hrsz.: 6012/2.

The entrance to the building is facing south-east. The walkability of the entire building within the site is ensured. As part of the technology serving the building, a medical gas tank diesel aggregator and transformer station was installed. From the private road, an entrance was established to receive both ambulance and employee and economic traffic, and 80 car parkings were provided for employees.

There is also an entrance on the north-western side of the site, separated from the unit by a fence, where, among other things, medical gas can be filled with large cars.

The building itself can be divided into five main blocks: the patient reception and examination part, the main building consisting of the staff and economic part, the three wings suitable for patient care and the changing room connected to the main building by a corridor. An independent transformer station, a medical gas centre and a hazardous waste collection station have been set up on the site, which allows operation independent from the penitentiary unit.

The facility is capable of accommodating 150 people with confirmed coronavirus infection and patient care at differentiated severity levels. The building is a temporary hospital with a floor area of 68.0 x 79.0 meters, consisting of single-storey prefabricated containers and additional electrical and mechanical technology units. In terms of the structure and the complete system of the building, it consists of simple, quick-to-build, typically modular elements.

The design of the base plate was built by removing humus and filling it with compacted gravel. The medical gas and oxygen tank, as well as the transformer station and the diesel aggregator were also built with a foundation separate from the building.

The supporting and delimiting structures of the hospital were made of containers. The containers were given a solid plasterboard ceiling and PVC cover. The ICU, CT, X-ray and ultrasound rooms are covered with conductive PVC cladding, the side wall and ceiling are designed with painted antiviral paint. A cantilevered steel canopy covered with trapezoidal sheeting was made in front of the ambulance entrance.

An X-ray door was placed from the passageway to the CT and X-ray room and from the controller room to the CT and X-ray room. The wires of the machines placed in the CT and X-ray room were routed in a tradable cable duct and the floor was reinforced with steel plate. As planned, lead windows were installed in the control room.[3]

3 Government Decree 487/2015 (XII. 30.) on protection against ionizing radiation and the related licensing, reporting and control system; Act CXVI of 1996 on Atomic Energy.

The fire section boundaries were designed with fire doors and walls, with fire section boundaries within the facility. Overview windows were built into the sluices and from the nurse's desk.

The walls and ceilings of the rooms are made of plasterboard. The structures were designed by providing the possibility of later installation of the food delivery boxes in the patient rooms. The mechanical pipes and wires were covered with plasterboard in all rooms, in accordance with the cleaning and infectological guidelines. Due to the need to perform disinfectant cleaning on all horizontal surfaces at least once a day, free, uncovered piping could not remain. The water blocks were made of a normal container with an impregnated plasterboard cover, in such a way that each ward has a separate washbasin, toilet and shower.

Mechanical design

The water supply of the facility is provided from an existing utility connection. The water block containers are fed one by one from a KPE bypass built around the building.[4]

The hot water supply is provided locally by means of electric water heaters, given that it was not possible to build a circulating disinfection system that could be heated to 65 °C in the short time available for construction.

No rainwater drainage system has been installed in the building. The rainfall is dried in a gravel bed around the facility.

According to the medical technology regulations[5], internally rotated air heating / cooling equipment cannot be used in the patient care units of the building, so the heating and cooling task was realized with ventilation air ensuring the required air exchange. The building complex is served by a total of 5 air handling units with the amount of air prescribed by the medical technology. In addition to the distribution of air, the ventilation distribution network also ensures the maintenance of the pressure conditions prescribed by medical technology. The unit operates with 100% fresh air.

Strong and weak current design

The property had no electricity supply. Due to the extremely short construction deadline, no natural gas supply was built. Based on the negotiations and the

4 High density or hard polyethylene pipe. The types of which are now widely used to transport drinking water or irrigation water.

5 4/2009 (III. 17.) EüM decree on medical devices.

pre-calculated energy needs, a new power supply transformer station was established near the building complex. During the planned design, the operation of building services systems and general use is based solely on electricity. Accordingly, a new, independent place of use and a new electricity network have been developed. The facility is supplied with electricity by the transformer station, the reception is done at medium voltage.

A fire alarm system, a structured system[6] and a nurse call have been set up throughout the facility. A camera network has also been set up in the building to facilitate the work of the staff and to monitor movements in the areas in front of the buildings and in the public areas of the building.

Presentation of medical technology design

An essential consideration in the design of the epidemiological hospital was that only laboratory-certified COVID–19 patients should be treated, basically those who either show mild symptoms but require hospital supervision for their other chronic illnesses or their severe COVID–19 symptoms require supervised care. Construction and design were severely limited by the amount of container available and the maximum compliance of infectious rules. It was not appropriate to mix proven sick or potentially infected individuals.

An important aspect of the installation was the maximum possible separation of the different patient pathways without crossing according to the rules of the profession.[7] Patient delivery can take place in two possible ways: indirectly from the direction of the main building or directly from the patient care wings. The economic entrance is located on the short side of the building, separately. Laundry and waste are transported through the rear entrance of the wings and are stored in a refrigerated hazardous material container until transport. Staff can access the 100-person locker room directly through the staff entrance, which has separate men's and women's locker rooms and an associated water block. There were two-compartment lockers in the locker rooms placed, separate for street clothing and separate for hospital clothing. The changing room unit is connected to the main building by a closed corridor.

The patient wings and the changing room, which can be accessed through the staff entrance, are connected by the main building. The head unit contains the examiners, the diagnostic unit with CT and X-ray equipment, the consumables

6 Structured cabling is a universal network system for the transmission of data (computer network, Internet), voice (telephone) and image (television, camera systems).

7 Decree 60/2003 (X. 20.) ESzCsM on the minimum professional conditions necessary for the provision of health services.

stores for the care, as well as the staff living room, the medical room and the on-call/on duty room. The unit has a so-called 'green zone' design, as staff wear a disposable protective gown for hospital clothing, work in a headgear, mouth mask and gloves, and a person with a confirmed coronavirus infection can only be moved by ambulance/patient transport cart, chair with appropriate protective equipment (mask, blanket, protective cover).

The hospital has a nationwide coverage, patients are delivered to the building by ambulances from the Hungarian National Ambulance Service – after telephone notification – and the first examinations are performed at the transferring site.

The staff enters the transferring site through a sluice system in full protective gear and, after triaging (URL8), places the patient in the wing designed for patients with mild, moderate or severe, intensive care, depending on their condition. In addition to all beds, there is a nurse call. The nurse call centre is located in the nursing station of the given wing. The building wings were designed according to the severity of the patients with the following differentiation:

- Building wing 'A': patients with mild symptoms – primarily requiring observation and infectious and internal medicine treatment. The chance of a complication is unlikely. Care is provided on 64 beds in 16 rooms. The beds have oxygen and secretion absorption, so the masked oxygen therapy can be solved.
- Building wings 'B' and 'C': patients with moderate symptoms – their oxygen supplementation, in some cases using a ventilator, as well as their infectious and internal medicine treatment, requires close monitoring. The chances of complications are high. Within the women's section 'B' it is also possible to accommodate pregnant women in a maximum of 2 rooms on 8 beds. Care is provided on a total of 64 beds in 16 rooms. The beds are connected to oxygen, secretion absorption and compressed air intake at 5.0 bar at 2/3 of the bed.
- Building wing 'D': patients with serious symptoms – their intensive care is required 24-hour supervision, including the treatment and care of patients primarily in need of respiratory support on 16 beds, 8-8 of which have been set up in an air space with a common nurse's desk. The wing also has two isolator rooms, monitored by a single person camera.
- Design of the unit: in addition to the nursing station in the middle, 2x7 and 2x1 beds are provided; each bed is connected to oxygen, vacuum and compressed air. Each patient bed was equipped with a patient-check monitor,

infusion pumps, medication pumps, and a ventilator. If necessary, several ECMO[8] devices can be used to maintain the circulation of critically ill patients.

Internal structure of patient care units: all three departments can be accessed through sluices, which are designed separately for staff and patients. The staff sluices are three-way, each wing has a central aisle design. Patient rooms and wards with doors with overview windows open from this central corridor. In the unit, the staff is in full protective equipment,[9] in 4-hour shifts, with rest time.

To avoid 'unnecessary' staff-patient encounters, a two-compartment transfer cabinet was designed in the patient-facing wall at each patient room. In the upper compartment food, clean tools, while in the lower compartment the waste and laundry generated in the room can be dispensed. The cabinets are locked against simultaneous opening. Due to the short delivery deadline, the openings were first designed and the cabinets were retrofitted. The openings have been closed, meals and supplies are provided through the door, and the mixing of the air in the corridors and the ward is ensured by the differential pressure conditions exhibited by the air technology.

Patients are accommodated in four-bed wards, except in ward 'D' (intensive care). Each patient room has a separate water block with hand basin, shower and toilet.

Patients are fed by the Semmelweis Hospital in Kiskunhalas, and food is delivered at least three times a day, in an individual tray system.

A disinfection[10] room has been set up in all three departments, where bed dishwashing, disinfecting dishwashing detergent, cleaning agent and temporary laundry storage are also provided.[11] Used trays and cutlery are collected on tray carts and thus pushed into the laundry and container collection room. The unit is organized on a separate dirty and clean side. The collected trays on the cars arrive on the dirty side. Here, the staff puts the waste from the trays in the carts into lidded containers, then the trays, plates and cutlery are washed in the dishwasher[12] and only the washed, disinfected dishes are returned to the central kitchen of Semmelweis Hospital in Kiskunhalas.

8 Extracorporeal membrane oxygenation: an extracorporeal technique that provides long-term heart and breathing support to individuals whose heart and lungs are unable to provide adequate gas exchange or perfusion to sustain life.

9 Disposable hospital gown with overalls, double gloves, FFP2 or FFP3 mask, hair net, goggles and / or shield.

10 Disinfection= antiseptic.

11 Decree 60/2003 (X. 20.) ESzCsM on the minimum professional conditions necessary for the provision of health services.

12 The dishwasher also has an 85 ° C disinfection rinsing system and a drying condition, thus preventing the possibility of infecting the city hospital.

Presentation of mouth masks used during defence

Mask History

Epidemics have showed up in several places and in several versions in the course of human history, so we have come to realize for a very long time that it is worth covering our faces and preventing the spread of the virus by frequent hand washing and disinfection.

The masks used in the late 19th and early 20th centuries were not much more effective than a piece of textile held in front of a face. The mask was a piece of textile material that loosely covered the face, but had no real protective ability (URL9).

Picture 2: *Bettmann/Getty Images Hungary*

Note. URL10.

Just as surgical masks used in healthcare today are not designed to filter out airborne particles, the only expectation at the time was that the doctor should not cough into an open wound during surgery. During the world wars, full-face, air-filtered masks became popular, in which it was not too easy to fight. It is difficult to breathe through the fiberglass filter and the wearer's face quickly

warms up under the mask. This is why it was not widely used on construction sites, even after the dangers of asbestos were recognized.

After the war, the U.S. government determined the need for a lightweight, disposable, safe dust mask in the industry. A company called 3M was licensed in 1972 to mass-produce the N95 mask known today. The fiberglass was replaced to make it easier to breathe, and a molten polymer (Soltani & Macosko, 2018) was compressed into several layers of tiny fibres with high-pressure air. Virus or silicate particles passing between the fibres are trapped in the rod-like fibres to obtain filtered air. As the particles accumulate, the mask becomes more effective, so the longer we wear it, the better it protects (URL11).

Mask types

- Mouth mask
  Masks intended to cover part of the wearer's face, in particular the mouth and nose, are marketed as so-called mouth nasal masks.
- Protective mask
  In the case of protective masks, the protective function comes to the fore. Depending on the purpose of the defence, we can talk about medical devices (surgical mask) or a respirator, which can be classified as a personal protective device, especially a particle filtering face pieces.[13] In principle, medical devices or personal protective equipment can only be placed on the market in the European Union if they comply with the Medical Devices Directive[14] and the relevant EU regulation[15] and are CE marked (URL12).
- Medical mouth-nasal mask
  A medical mouth-nasal mask is a medical device worn by healthcare and nursing staff to protect the person being treated from potentially infectious saliva and mucus droplets through the mouth or nose of the person treating them. In addition, a medical mouth-nasal mask can protect the wearer's nose and oral mucosa from larger mucus droplets from the person being treated or from the touching of contaminated hands (contact infection). Its main properties are defined in the Medical Devices Directive and in its national implementing regulations, as well as in the European standard EN 14683.[16]

13 Filtering Face Pieces – FFP.
14 Council Directive 93/42 / EEC of 14 June 1993 concerning medical devices.
15 EU Regulation 2016/425 on personal protective equipment.
16 Medical masks - Requirements and test methods.

- Filtering Face Pieces – (FFP mask)
  Medical mouth-nasal products are not suitable for protecting the wearer from airborne viruses or other contaminants from the environment. This requires a respiratory protective device, in particular an FFP mask, which is used against sprays (aerosols) from solid or liquid, non-volatile particles. FFP masks are subject to the Personal Protective Equipment Regulation, their regulations and marketability are governed by the European Union Personal Protective Equipment Regulation 2016/425 and the European Standard EN 149 (URL13). The Personal Protective Equipment Regulation is directly applicable in all EU Member States. European standard EN 149 distinguishes protection classes FFP1, FFP2 and FFP3. Total leakage is the most important nature for the protective effect of a respirator. This is due to the permeability of the filter and the so-called fit leakage, which develops between the leakage of the fit line of the mask and the face of the wearer of the mask. According to EN 149, both properties are tested for FFP masks. FFP1 masks have the least protective effect, the greatest protection is provided by FFP3 masks (URL14).

Mouth mask protection capability, product requirements

Each garment has its own physiological protective function (e.g. protection from heat, cold, moisture). Regulation 2016/425 (EU) on the safety of personal protective equipment explicitly excludes from its scope personal protective equipment intended for protection against non-extreme weather conditions. Mouth masks may also have some protective function (URL15). They can form a physical barrier that, with proper application and use of materials, can reduce the spread of larger droplets and / or contact infection (e.g. contact of the oral and nasal mucosa with an infected hand), such as when the mask wearer coughs. However, this barrier function does not change the purpose of the mouth mask for clothing. This means that it remains a garment and does not qualify as either personal protective equipment or a medical device.

In terms of fit, thinner fabrics, knitted fabrics, and nonwovens fit more easily to the shape of the head around the mouth and nose. A properly optimized cut pattern also helps the mask fit well. In addition, the construction of the masks should allow it to always fit tightly during wear. In order to provide a certain filtering effect of the product, the mask must be made of a fabric with a tight knitting structure or of a combination of fabric and nonwoven or nonwoven fabric. It is preferable to use the same or different fabrics (woven, knitted, nonwoven) in several layers, however, it is not good to create too strong breathing resistance, therefore low or impermeable laminated or multilayer fabrics should not be used.

Reusable mouth masks (possibly also suitable for washing with a suitable disinfectant) must be made of a material that can be cooked but can be washed at a temperature of at least 60 °C or 75 °C. If possible, it is necessary to specify the maximum number of wash cycles, in addition to which the mask retains its water-repellent or other important function. Care must be taken to ensure that the masks do not get wet too quickly. Wetting increases the risk of droplets (which may be infectious) penetrating the mask.

Mask production line, raw materials

The automatic mask production line used for mask production in connection with the employment of prisoners by the Hungarian Prison Service may be able to produce 80 masks per minute, provided that the requirements specified for its operation are met.

Technological and physical characteristics of the machine:

- ultrasonic welding technology,
- automatic work from dosing to making nasal wrinkles and ear buds and closing the side to the finished product,
- the structural frame of the machine is made of aluminium profile elements, so it is stainless, durable, easy to clean and light.

The specification of the machine-made mask is 175 x 80–100 mm, 1–4 layer, non-woven, face-mounted, filter type mask. The raw material is automatically fed, with nose bridge insertion and cutting and ear loop welding. The production stations of the machine: 1 BLANK MASK body maker and 2 ear loop ultrasonic welding stations.

The machine automatically adjusts the raw material roll required for the production and for the three layers. Symmetrically, ultrasonically presses and welds both sides of the outer and filter layers as well as the inner layer. The proportioned material is compressed by the roller and then cut to the specified size. This is followed by bi-directional sorting and transfer to the two separate ear-loop welding stations, so that the production line is balanced and high productivity is achieved. The finishing operation is the welding of the ear cups and the automatic transfer of the finished goods to the digital counter. The ear loops are made automatically by ultrasonic cutting and welding. The nasal wire is also incorporated into the upper edge of the mask by automatic proportion and cutting, which ensures its ergonomics.

Picture 3: *Disposable medical face mask production line*

Note. Created by the author.

The basic material of mouth masks belongs to the group of non-woven fabrics. Nonwovens have an important place among the products of the textile industry. The name itself is not accurate, because although they are indeed fabrics that are not made by classical weaving, they are not knitted or braided either. The name is a mirror translation of the English term 'nonwovens', which was then literally adopted in other languages, to the Hungarian terminology as well. The group of 'non-woven fabrics' in this sense is a collective name for fabrics which are not made up of intersecting or interlocking yarns but are more or less tangled, albeit consisting of a sheet-like spread of fibres (webs) where the fibres are fastened together by mechanical or chemical means.

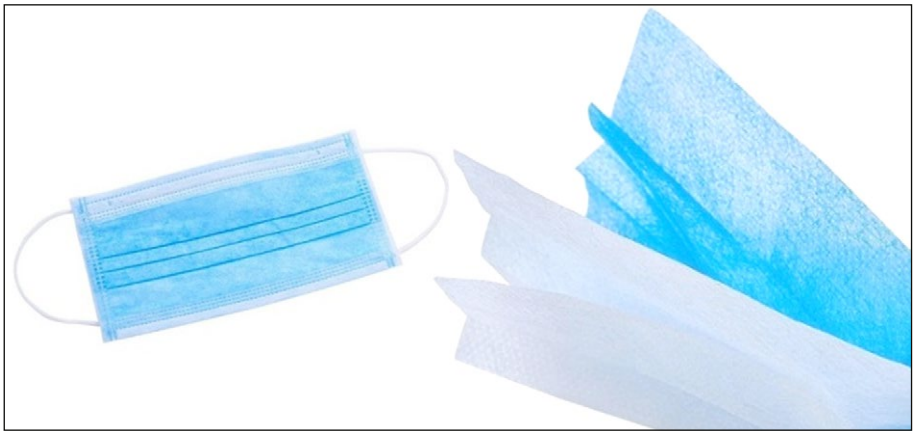
Face mask production

The production of mouth masks is carried out by one of the limited companies, the Bv. Holding Ltd. – in Hajdú-Bihar County Remand Prison, in Kiskunhalas National Prison, and in the Sátoraljaújhely Strict and Medium Regime Prison. Continuity of production is guaranteed by the amount of raw materials available

and the prolonged work of the detainees. The manufactured protective masks are deposited in several parts of the country; they can be delivered immediately according to the needs of the applicant. In order to increase the effectiveness of the control against the epidemic, in addition to the production of mouth masks – at the site of the Kiskunhalas National Prison – the production of disposable, water-repellent laboratory coveralls used in healthcare is also carried out. The confectioning of the protective overalls is continuous according to the incoming needs.

Structure of mouth masks produced by the service

Picture 4: *Disposable medical mouth mask*



Note. URL16.

The manufactured mask body consists of three material bindings, the adhesion of the layers together is ensured by ultrasonic technology. This can be done with two types of production, called 'spoundbond'[17] and 'melt blowing'[18] technology.

17 Spoundbond technology can only be used on non-woven fabrics made of synthetic fibrous material, in which the polymer granules are melted and the melt is formed into continuous fibres (filaments) by an 'extruder'. The extruder emits a very large number of fibres side by side through its openings, which are solidified by cooling and conveyed to a conveyor belt in a disordered state. The web thus formed is held together by the fact that the slightly still warm fibres adhere weakly together, but this does not provide enough strength so that the web does not require an additional consolidation process.

18 Since the 2000s, the so-called melt blowing process, in which the polymer melt is extruded through micro-sized nozzles surrounded by high-speed blowing gas, has become increasingly important. During blowing, randomly arranged fibres are formed which are spread on a sheet in an unordered state, so that the fibres, after cooling, form a nonwoven fabric which can be used for filtration, sorbents, clothing and drug delivery systems. Significant advantages of melt blowing are simplicity, high specific productivity and solvent-free operation.

The base material of the outer layer is a non-woven polypropylene[19] (PP) fabric with a basis density of 17 g / m2 and a production technology of SBPP (spunbond). The base material of the middle and filter layer is a polypropylene (PP) non-woven fabric with a basis density of 25 g / m2 and a production technology of MBPP (melt blowing). The base material of the inner layer is also a non-woven fabric of polypropylene (PP) with a basis density of 20 g / m2 and a production technology of SBPP (spunbond). The product can be made with ear rubber made using lycra or with a polypropylene bandage. The fit of the mask to the face and nose saddle is ensured by one or two cores[20] of 3 mm thick white plastic coated wire (URL16).

The limited companies of the prison service has a tradition dating back to 2015 in the production of disposable medical face masks on an automated line. In the framework of central supply, the sale to the group of beneficiaries, i.e. mostly to the state health inpatient care, started at that time. At its first meeting on 31 January 2020, the Operational Body adopted an Action Plan, in which it instructed the Hungarian Prison Service Headquarters to switch to the production of protective equipment. On February 1, 2020, at the Hajdú-Bihar County Remand Prison, the production of health protective masks was presented at a press event. Due to the increased demand and the task defined in the Action Plan of the Operational Staff, the organization moved from 8 hours of production per day to 12 hours, and then, after training the detainees, within a short time, 2 x 12 hours per day, i.e. 0–24 hours.

The number of infections identified in Italy began to rise sharply in March 2020, when a decision was made to purchase additional automated lines that could produce a disposable medical mouth mask. Prior to the delivery of the lines, the limited companies with sewing competence began to manufacture mouth masks with a sewing machine from washable and reusable textiles or of nonwovens, disposable materials. The newer machines arrived at the institutions in April and May 2020, first to Sátoraljaújhely and then to Kiskunhalas. After the assembly of the production lines and their test operation, the detainees carry out the production and packaging in a 4–12 hour shift, 24 hours a day. Currently the machines are not in operation during mandatory breaks, maintenance and any necessary repairs; apart from this the production is continuous.

The effective cooperation of the entire prison service – in addition to the indisputable merit of effective defence – is also supported by the fact that it was able

19 Thermoplastic polymer.

20 The core is a metal fibre placed inside the plastic of the nose wire. The name of one or two cores is adapted to the number of metal fibres placed in the plastic.

to provide not only a stable supply of basic disposable health masks for defence, but also an initial production capacity of 25,000 / day increased to an average of 100,000 pieces per day. In order to meet the increased demand, a measure was taken for the extraordinary procurement of raw materials and supplies, the procurement time and price of which increased significantly. Procurement was further hampered by the fact that one of the centres for the production of the necessary nonwovens and filter layers was China, where a significant number of factories did not produce due to the coronavirus. In those provinces where the epidemic still allowed production, or accumulated stocks were still available, either domestic mask production was served there, or the countries of the world obtained some raw materials by bidding to each other.

Closing words

Since the appearance of the first wave of the epidemic, the prison service has been focusing on the defense against the virus with constant attention and energy. The organization will do everything in order to meet the repeatedly increased need for defense equipment and to fulfill every related task.

An outstanding example of this is the Mobile Epidemiological Hospital of Kiskunhalas, which construction has been achieved with unprecedented cooperation, which has never been seen before in the national construction industry. The construction, both nationally and internationally, took an extremely short time – from earthworks to handover – it took only 19 days. Despite the mobile support structure, the inner space meets the minimum health requirements in all respects. In terms of equipment, design and appearance, a modern – meeting the conditions of the 21th century – hospital was established. The hospital is operational in the long run after the external insulation work has been carried out and is suitable for everyday use even after the epidemic has passed.

Our companies also continuously perform quarantine-related printing tasks for epidemiological control. To warn about the epidemic we also produce warning signs, stickers, transit leaflets, information leaflets in foreign languages and maps in coordination with the Task Force on-call center. We are constantly monitoring the relevant needs of the health care system, so instead of thinner, less useful protective cloaks, we have switched to the production of protective cloaks that provide greater protective capacity. And we have further increased our production capacity in this regard.

The portfolio of prison service is extremely wide. Our product range of medical protective equipment includes the disposable medical mouth mask, the

FFP2 mask, the sluice gown, the sluice pants, the sluice shirt, the shoe cover, the visitor's jacket and the doctor's cap.

The prison service has played and continues to play a key role in the defense against the epidemic. We sought to participate effectively in the control of the coronavirus epidemic with an increased number of employees and an increased number of working hours. The results obtained and the quantities produced have shown that as part of national self-sufficiency realized by the employment of detainees, public bodies dedicated to protecting society can survive even the most critical periods, thereby guaranteeing the security of citizens.

References

Soltani, I. & Macosko, W. C. (2018). *Influence of rheology and surface properties on morphology of nanofibers derived from islands-in-the-sea meltblown nonwovens. Polymer, 145*(6), 21–30. https://doi.org/10.1016/j.polymer.2018.04.051

Online links in the article

URL1: *Coronavirus disease (COVID-19) pandemic*. https://www.who.int/emergencies/diseases/novel-coronavirus-2019

URL2: *Tájékoztató oldal a koronavírusról*. https://koronavirus.gov.hu/

URL3: *Naponta húszezer egészségügyi védőmaszk készül a debreceni börtönben*. https://www.dehir.hu/debrecen/naponta-huszezer-egeszsegugyi-vedomaszk-keszul-a-debreceni-bortonben/2020/02/01/

URL4: *Országos tisztifőorvos: teljesen teret hódított a brit mutáns Magyarországon.* https://koronavirus.gov.hu/cikkek/orszagos-tisztifoorvos-teljesen-teret-hoditott-brit-mutans-magyarorszagon

URL5: *Átlépte a magyar határt az első vakcina-szállítmány.* https://koronavirus.gov.hu/cikkek/atlepte-magyar-hatart-az-elso-vakcina-szallitmany

URL6: *Európa legmodernebb mobil járványkórházát kereste fel Orbán Viktor.* https://koronavirus.gov.hu/cikkek/europa-legmodernebb-mobil-jarvanykorhazat-kereste-fel-orban-viktor

URL7: *Kiskunhalasi Országos Büntetés-Végrehajtási Intézet*. https://bv.gov.hu/hu/intezetek/kiskunhalas/kapcsolat

URL8: *Lexiq – Triázs*. https://lexiq.hu/triazs

URL9: *Maszktörténet. Az orvosi maszkok használatának múltjából*. https://semmelweismuseum.blog.hu/2020/05/15/maszktortenet

URL10: *Why the 1918 Flu Became ‚America's Forgotten Pandemic.* https://www.history.com/news/1918-americas-forgotten-pandemic
URL11: *Kis maszktörténet.* https://fszek.hu/Entities/93/Events/2002kis-maszktortenet
URL12: *A CE jelölés alapjai.* https://www.ce-jeloles.hu/
URL13: *EN 149 Védő maszk tesztek*. https://www.ceisaret.com/hu/en-149-koruyucu-maske-testleri/
URL14: *Útmutató: Védőmaszk és száj-orrmaszk*. https://www.innovatext.hu/sites/default/files/csatolmany/utmutato_a_maszkokhoz._mi_a_kulonbseg_kozottuk_es_mire_figyeljunk_a_termek_gyartasanal.pdf
URL15: *Összefoglaló az arc/szájmaszk gyártók illetve forgalmazók számára*. https://www.ogyei.gov.hu/osszefoglalo_az_arcszajmaszk_gyartok_illetve_forgalmazok_szamara___20200316
URL16: *3 rétegű eldobható maszk*. https://ffp3maszkok.hu/termek/orvosi-eldobhato-maszk/

Legislation used

Government Decree 1012/2020 (I. 31.) on the establishment of an Operational Body responsible for the control of the coronavirus epidemic
Council Directive 93/42 / EEC of 14 June 1993 concerning medical devices
Act CXVI of 1996 on Atomic Energy
Decree 60/2003 (X. 20.) ESzCsM on the minimum professional conditions necessary for the provision of health services
EU Regulation 2016/425 on personal protective equipment
Government Decree 487/2015 (XII. 30.) on protection against ionizing radiation and the related licensing, reporting and control system
Government Decree 253/1997 (XII 20) on national town planning and construction requirements (OTÉK)
4/2009 (III. 17.) EüM decree on medical devices

Reference of the article according to APA regulation

Farsang, T. (2021). The Most Modern Mobile Epidemic Hospital of Europe Was Built in Kiskunhalas. *Belügyi Szemle*, *69*(SI5), 163-182. https://doi.org/10.38146/BSZ.SPEC.2021.5.7