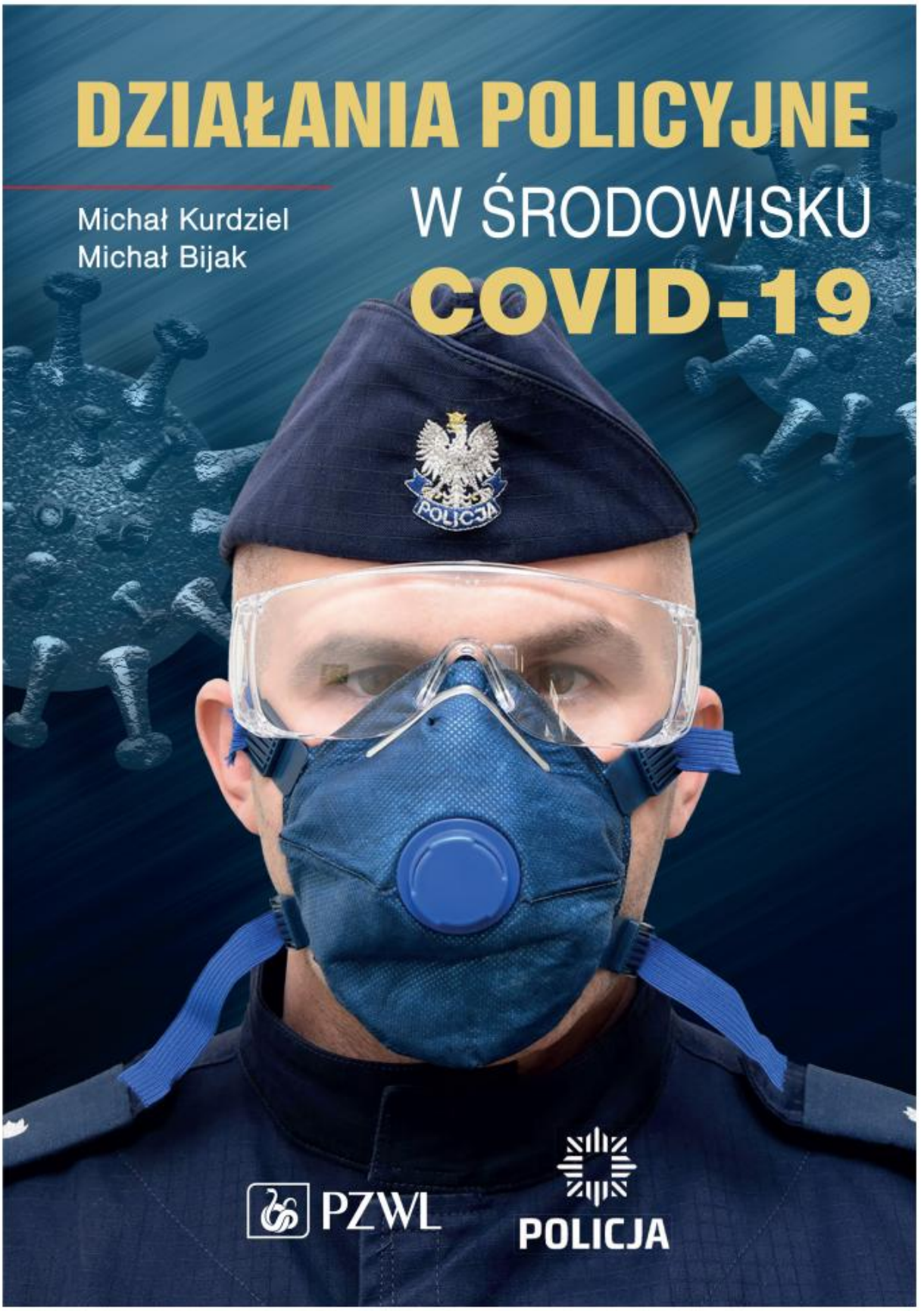

[Police actions in COVID-19 environment]

DZIAŁANIA POLICYJNE W ŚRODOWISKU COVID-19

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Michał Bijak

PZWL

POLICJA

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INTRODUCTION

Biological threats, including pandemics, have accompanied mankind since the beginning of our species. Everyone is familiar with the term “Black Death” which refers to the plague pandemic that struck Europe in the 14th century and the term “Spanish flu” which refers to the last pandemic that took place on our planet between 1918 and 1920, caused by the H1N1 influenza virus.

The development of medicine in the twentieth century and the introduction of mass vaccinations have made us feel that we have won this war and are safe when it comes to infectious diseases.

In case of services, including the Police, the hazard of biological agents over the past years has been associated with a potential terrorist attack that could exploit highly virulent pathogens.

The emergence of another global pandemic after 100 years (announced by the World Health Organization on March 11, 2020), caused by a new virus species called SARS-CoV-2, which causes COVID-19 disease, requires a complete overhaul of the approach to such threats and a rapid response to its rapid spread. The SARS-CoV-2 virus appeared in China in mid-December 2019 and by 01.04.2020 it had reached virtually all countries on the globe, infecting a total of 930,000 people and causing the death of more than 46,000 of them.

Due to the epidemiological situation, law enforcement services, and in particular the Police are particularly vulnerable to SARS-CoV-2 infection during the performance of their tasks. This requires that all possible forces and resources be directed towards protecting officers from danger.

This book is one of those measures. The information is a compilation of existing theoretical and practical knowledge about personal protective equipment, methods of disinfection and procedures for responding to the risks associated with SARS-CoV-2.

Professor, Michał Bijak, Ph.D., University of Lodz

The SARS-CoV-2 pandemic and the risks associated with it have in many cases caused fear and terror. Most of us fear the unknown, the new. There's a fear of losing control and not knowing how to act...

Often, the worst thing that can happen to us is that lack of knowledge will not allow us to make the best decisions.

The current epidemiological situation and the dynamic spread of the SARS-CoV-2 coronavirus require that knowledge of the risks posed by SARS-CoV-2 be continuously gained and updated.

What is called and realized increases the chance of having more control over it.

Among the many needs that have arisen, a prepared publication can satisfy at least one of them - the need for knowledge, knowledge – that will allow to find good solutions and to prepare for fighting a pathogenic opponent.

Małgorzata Wlaź
Police Emergency Medical Coordinator
Occupational Protection Section
National Police Headquarters

Every police officer is prepared to give first aid and has basic rescue skills. There are also officers within the Police structures who are ready to perform rescue operations in terms of qualified first aid (as rescuers), medical rescue operations (doctors, nurses and paramedics). Rescue has become one of the most dynamically developing areas related to our service. For several years now, there has also been a function of the Police Medical Rescue Coordinator within our structures. We can safely say that rescue has become an important element of training and functioning of our service.

And when we started to support the State Medical Rescue system at the level of qualified first aid and have already learnt the standards of emergency response in tactical emergencies, we faced an even greater challenge than before.

We started this fight from a quick preparation phase and to react to the threat. Nobody expected that within 2-3 weeks every police officer in Poland would have to gain elementary knowledge in the field of virology, preventing infections, using individual protection measures intended for use in a biological threat situation.

This publication does not replace the legal acts (regulations, guidelines, decisions) that police officers must observe and implement. Its purpose is to supplement the knowledge and show some practical solutions for police operations in the COVID-19 environment.

The events in Europe and in our country shows how dynamically threats can change and how we, as services, must react quickly to such situations. The threat of COVID-19 has also resulted in the fact that the scope and competences of individual services cannot be arbitrarily delineated with a red line. Regardless of the tasks assigned by our superiors, the denominator of our actions should be one word - COOPERATION.

And it is thanks to such cooperation that this book was created. The cost was two weeks of hard work - collecting and analyzing scientific materials, taking photos, phone consultations, sleepless nights, etc.

Another important added value of this publication, however invisible, is self-confidence. During the creation of this book I talked and met people I did not know before. All the people gave me a helping hand and shared their knowledge, experience and sometimes their passion.

And for all this I want to sincerely thank these people.

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- major Ryszard Kurzyński from the Police Prevention Department in Szczecin,
- first lieutenant Przemysław Szczepański from the Crisis Response Centre of the Provincial Police Headquarters in Łódź,
- Employees of the Procurement and Investment Department of the Provincial Police Headquarters in Szczecin.

I would like to give a special thanks to my **wife Karolina** and **my son Szymon**, as for the last two weeks they have allowed me to devote myself completely to the work on this publication.

first lieutenant, DHSc, Michał Kurdziel

CHAPTER 1

SARS-CoV-2 coronavirus –hazard characterization

For years, coronaviruses have been sidelined by mainstream research in virology and medicine, because they were believed to cause a mild cold that disappears within days without any intervention. The lack of diagnostic methods and effective therapy further deepened the view that these pathogens may be interesting for research, but *per se* (Latin) they are not a medical problem. The emergence of new, highly virulent coronavirus species and the understanding that for children, elderly and immune-compromised individuals these viruses in can lead to the development of a serious, life-threatening disease have led to an increased interest in these pathogens[1].

The image of human coronaviruses as relatively harmless pathogens has changed with the appearance of a new species of human coronavirus, SARS-CoV (*severe acute respiratory syndrome* coronavirus) in Guangdong Province in China in November 2002. [2–4]. The first person diagnosed with the infection was a 45-year-old man in the city of Foshan, who developed fever and respiratory symptoms on November 16, 2002.

The transmission of the virus between patients was fast and in some cases there were mass infections. An example of such infection is the case of a 44-year-old man, hospitalized in Guangzhou on 30 January 2003. During his illness, he infected 19 relatives and more than 50 people belonging to the medical staff.

Further transmission and crossing of the country's borders was only a matter of time - one of the infected doctors passed it to another 17 people during his trip to Hong Kong, causing the virus to be transmitted outside China.

During one season the virus spread to 37 countries, 8273 cases were found and 775 people died. Surprisingly, on 5 July 2003, less than 8 months after the first case of infection, the World Health Organization (WHO) announced the eradication of SARS-CoV. The sudden disappearance of the virus can be explained in two ways. Firstly, infections with human coronaviruses are seasonal in nature, with the highest frequency in winter and early spring. It can therefore be assumed that the end of the epidemic in early July was not accidental. Secondly, the symptoms of the infection are relatively clear and appear before the patient enters the most infectious phase of the disease (the amount of the virus in secretions increases gradually during the disease, reaching a maximum after the first week). This has enabled effective measures to prevent virus transmission and isolation of patients [1,5].

1.1. SARS-CoV-2

The coronavirus SARS-CoV-2 is a virus belonging to the coronaviridae family (Latin *Coronaviridae*), which includes a large group of RNA shields that can infect animals as well as humans, with many infections occurring asymptomatic. These viruses often mutate and have a high ability to break down the barrier and infect new species.

All coronaviruses known so far causing infections in humans are viruses that cause symptoms from the respiratory system, very rarely from other systems and organs. It is possible that they may cause disorders of the digestive system, including diarrhea. By 2019, 6 viruses causing infections in humans were known. Four of them (229E, OC43, NL63, HKU1) cause mild colds. Two others (SARS-CoV and MERS viruses) may lead to life-threatening acute respiratory failure. The coronavirus SARS-CoV-2 is the virus responsible for the current epidemic of respiratory infections, which started in Wuhan, China and was first identified there in December 2019 [6].

The following elements are important in the infectious process (including viruses):

- **Source of infection** - an element of the environment from which the pathogen (virus) has been transmitted to a susceptible person [7]. The exact source of infection for SARS-CoV-2 virus has been presented by the State Health Committee of the People's Republic of China. It is a 57-year-old woman who sold shrimps at the seafood market in Wuhan.
- **Germ reservoir** - natural biological environment (e.g. man) in which the germ is present for a long time, retaining its virulence. The organism can indicate that it is a reservoir of the germ in the form of symptoms. Sometimes confirmation of the carrier will only be possible after using specific diagnostic tests [7].

- **A carrier (vector)** - in this case a human being. COVID-19 is the clinical culmination of the carrier, manifesting itself as a disease. Carriers of asymptomatic or scarce symptoms, having contact with another person, unconsciously make this person another reservoir of the germ and consequently a carrier of the virus.
- **Germ carrier** - an object or biological material contaminated by the micro-organism, from which it is transferred to a susceptible person [7].

In the case of coronavirus infections, the patient is usually the most contagious at the time of symptoms, but during the current pandemic, the possibility of virus transmission has also been documented through contact with an infected person with no symptoms of the disease. It is not yet known how long infected people can infect other people, but patients with severe infection are likely to excrete the virus for a longer period of time. Therefore, patients with confirmed infections should remain in isolation until recovery and the results of control tests should help to decide about the end of isolation [8].

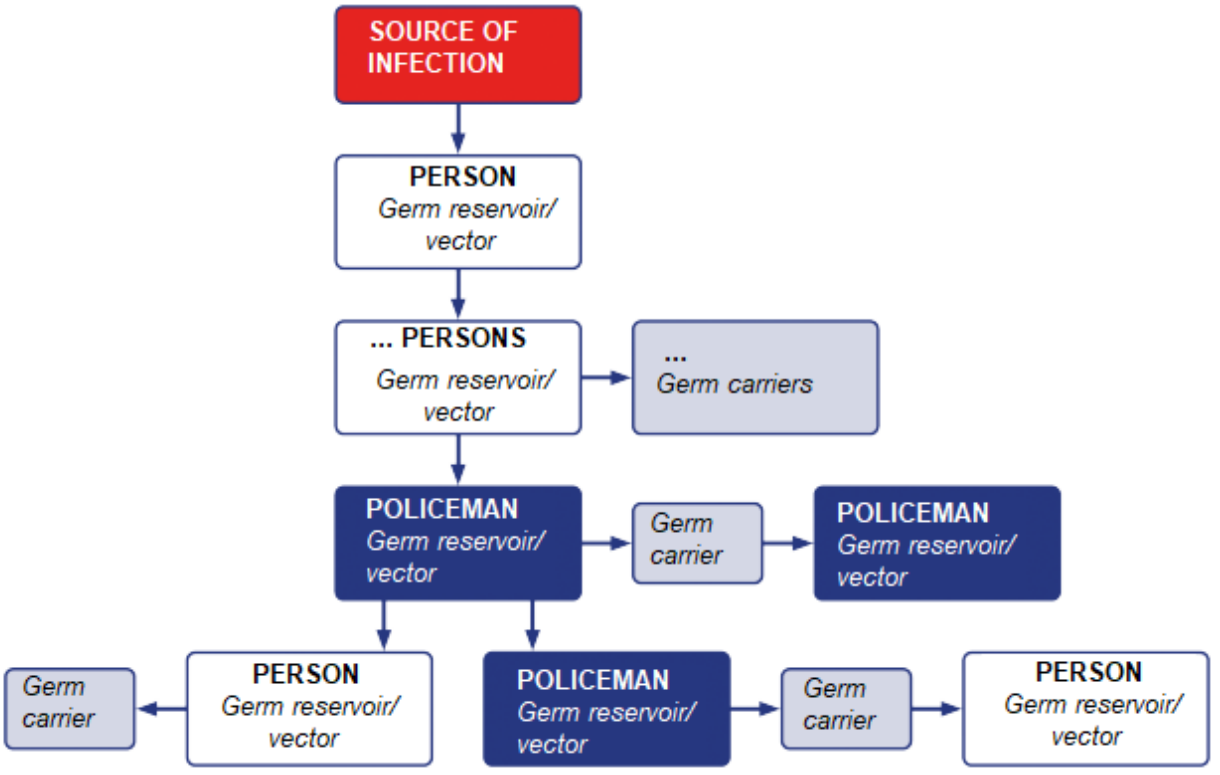
Coronaviruses are quite sensitive to outdoor conditions, especially to drying out. It is assumed that the SARS-CoV-2 coronavirus maintains its infective properties for about 72-96 hours, depending on the conditions. Its ability to infect decreases faster when the infectious material (e.g. the saliva of a sick person) was embedded on porous surfaces (paper, cotton). From a practical point of view, it should be assumed that it is possible to transfer the coronavirus by contact from surfaces and objects within a short time after their contamination. Dangerous objects on which the virus can be found, which has not yet lost its infectious properties, include those frequently touched: handles, buttons in the elevator, handles in the bus, etc., and those in the immediate vicinity of the sick person. Moreover, contaminated computer equipment (mouse, keyboard), used by various people in a short period of time, may have played a role in the spread of coronavirus infection among medical personnel [8] – Table 1.

Table 1: Examples of potential carriers of pathogens if they come into contact with infectious material (containing virus)

Potential carriers of infectious material in service premises	Potential carriers of infectious material in the course of business activities	Potential carriers of infectious material in private life
▪ Room keys, room entry cards ▪ Door handles/handles ▪ Interior fittings with which the person has direct contact (furniture) ▪ Stationary means of communication (radio stations, fixed and mobile phones) ▪ Dishes, cutlery ▪ Toilets	▪ Uniform ▪ Tactical equipment ▪ Direct coercive measures ▪ Firearms ▪ Means of communication ▪ Means of transport ▪ Documents ▪ Items belonging to persons for whom the police officer is carrying out his official duties	▪ Civilian clothing ▪ Public/private transport means ▪ Door handles/handles ▪ Interior fittings with which the person has direct contact (furniture) ▪ Stationary means of communication (fixed and mobile phone) ▪ Selected media used in the performance of business activities brought home ▪ Toilets

Source: own study

Potential route of virus transmission among officers



Source: Own study

The risk of infection of a police officer/employee will be affected by factors such as:

- a person's health (including the immune system);
- her age;
- the reaction of the defense mechanisms upon contact with the pathogen;
- the duration of exposure to the virus;
- the concentration of virus particles in the air;
- the number of exposures a police officer will be exposed to;
- compliance with the hygiene rules recommended for the prevention of COVID-19;
- Use personal protective *equipment* (PPE*)* appropriate to the time and intensity of the hazard.

This is why the application is so important in preventive and therapeutic measures:

- **quarantine**– isolation of a healthy person, who was exposed to the infection, to prevent the spread of particularly dangerous and highly contagious diseases [9];
- **isolation**–isolation of a person or group of people with a communicable disease or a person or group of people suspected of a communicable disease in order to prevent the transmission of the biological pathogen to other people [9].

COVID-19 is a disease caused by the Wuhan coronavirus (SARS-CoV-2). Previously, the disease had no name and was referred to as "coronavirus disease" or "Wuhan coronavirus infection". The name COVID-19 was announced by the WHO and is official. 'CO' stands for 'corona', 'VI'. - virus, 'D'–disease. The number 19 indicates the year of the virus's appearance - 2019 (*corona-virus-disease-2019*). The difference between SARS-CoV-2 coronavirus and COVID-19 is that the coronavirus is the factor causing the disease and COVID-19 is the disease, i.e. the syndrome of symptoms caused by this factor [6].

About 80% of people who suffer from COVID-19 do not require treatment and the disease disappears on its own. One in 6 people has a more severe course of the disease, breathing problems and requires intensive treatment.

According to data from the Chinese Centre for Disease Control and Prevention, covering more than 70,000 COVID-19 cases reported by 11 February 2020, 87% of COVID-19 patients in China were in the 30-79 age group, and 8% of the cases were in the 20-29 age group. People over 70 years of age constituted 3% of all COVID-19 cases.

In 81% of patients, pneumonia did not develop or was mild; in 14%, it was severe [6].

1.1.1. Symptoms and diagnosis

The disease is usually manifested by **fever, coughing, dyspnea, muscle aches, fatigue** [6].

Symptoms are objective, noticeable changes observed by another person (e.g. paramedic, police officer) or by auxiliary methods (e.g. body temperature measurement) performed by another person or by the patient himself [10].

Fever is a state of abnormally elevated body temperature above the upper limit of the norm of daily variations of its value (e.g. > 37.8°C [100°F]), measured in the mouth or rectum. One of the methods of temperature measurement is to measure its value at the skin level within the hairless part of the head using a non-contact thermometer [10].

Cough is a reflex that can be triggered by a number of stimuli, including viral inflammation of the airways; it should be mentioned here that the main symptom of COVID-19 is a dry cough, with no "detachable" features.

Dyspnea, often referred to as shortness of breath, is a subjective feeling of difficulty in breathing. Patients describe it as difficult to breathe or simply "breathlessness", often patients also have trouble pronouncing whole sentences without stopping to catch deep breathing [10].

The feeling of fatigue is often given by patients**.** It is a natural physiological response to significant effort or other chronic physical and mental activity. From the physiological point of view, it can be most easily detected in muscles that do not shrink properly in the state of fatigue or have a progressively slowed down reaction to a stimulus until a lack of reaction is observed [10].

In March 2020, the results of a meta-analysis of eight scientific studies related to COVID-19 were published. The studies included 46,248 people infected with the new coronavirus and were included in scientific databases (PubMed, EMBASE, Web of Science).

The results confirmed that the most common clinical symptoms in COVID-19 patients were:

- Fever (91 ± 3, 95% CI 86-97%);
- Cough (67 ± 7, 95% CI 59-76%);
- Fatigue (51 ± 0, 95% CI 34-68%);
- Dyspnea (30 ± 4, 95% CI 21-40%) [11].

The course of infection with the new coronavirus varies from asymptomatic to mild respiratory disease (similar to a cold), to severe pneumonia with *acute respiratory distress syndrome* (ARDS) and/or multi-organ failure.

It should be remembered that similar symptoms can occur in many other diseases, especially respiratory infections, which are quite common in the autumn-winter season.

In order to fall ill because of the SARS-CoV-2 coronavirus, an infection is necessary through:

- direct contact with the sick person (e.g. when providing medical assistance, at work, staying in the same room, travelling together or living together);
- travelling to the region where the outbreak occurred within 14 days before the symptoms appeared;
- working at the place of medical aid, where COVID-19 patients were and were treated [6].

On 11.03.2020 the Chief Sanitary Inspector of the Ministry of Interior and Administration introduced a case definition for the surveillance (of human infections with the new coronavirus SARS-CoV-2) for services (Table 2).

Table 2 Case classification based on criteria (clinical, laboratory, epidemiological)

Criteria		
Clinical criteria	**Laboratory criteria**	**Epidemiological criteria**
Group A Criteria **REQUIRING** additionally to meet the epidemiological criterion. Any person with one or more of these symptoms of an acute respiratory infection: ■ Fever, ■ Coughing, ■ Shortness of breath. **Group B** Criteria **NOT REQUIRING** to meet an epidemiological criterion: ■ a person hospitalized with symptoms of a severe respiratory infection without any other etiology fully explaining the clinical picture.	***Laboratory criteria for a confirmed case:*** ■ detection of SARS-CoV-2 nucleic acid from clinical material, confirmed by a molecular test targeted at another area of the virus genome. ***Laboratory criteria for a likely case*** At least one of the following criteria: ■ a positive result of the molecular coronavirus test (test *pan-coronavirus* by RT-PCR)[1], ■ An inconclusive result of the SARS-CoV-2 nucleic acid detection test.	Any person who, in the 14 days prior to the onset of the symptoms, met at least one of the following criteria: 1) was or has returned from the area, where a local or low-population COVID-19 transmission occurs, 2) had close contact with a person who was diagnosed with COVID-19 infection (contact with a confirmed or probable case). Close contact is to be understood as: ■ living with a person infected with COVID-19, ■ direct physical contact with a person infected with COVID-19 (e.g. shaking hands), ■ direct contact without protection with the secretions of a person with COVID-19 (e.g. touching a used handkerchief, exposure to coughing by a sick person), ■ being in the immediate vicinity (face to face) of the sick person - for any time, ■ staying within 2 meters of a person infected with COVID-19 for more than 15 minutes in any other exposure not listed above, ■ medical personnel or other person directly caring for a COVID-19 patient, or a person working in a laboratory without intermediate protection, or where personal protective equipment has been damaged, ■ contact on board the aircraft and other collective means of transport including persons occupying two seats (in each direction) from the COVID-19 patient, persons accompanying or caring for the patient, crew members operating the section where the patient is present (in case of severe symptoms of the COVID-19 patient or his movements all passengers in the section or on board the means of transport shall be considered as close contact), ■ to obtain information from the relevant services that there has been contact with a confirmed case.

[1] RT-PCR (*real-time polymerase chain reaction*)

Case classification
A. Suspected case Anyone fulfilling: ■ Group A clinical criterion without any other etiology fully explaining the clinical picture and epidemiological criterion 1 **OR** ■ Group A clinical criterion and epidemiological criterion 2 **OR** ■ Group B clinical criterion.
B. A probable case Any person who meets the criteria for a suspected case and the laboratory criteria for a probable case.
C. Confirmed case Any person meeting the laboratory criteria of a confirmed case.
Note: compliance with the suspicion criteria is an indication for laboratory diagnosis (tests in the NIZP-PZH and the laboratories of the State Sanitary Inspectorate shall be performed only in consultation with the competent State Sanitary Inspector).

Source: Study based on the guidelines of the Chief Sanitary Inspector of the Ministry of Internal Affairs and Administration of 11.03.2020. and the guidelines of the Main Sanitary Inspector of the Ministry of the Interior for the Police, the Border Guard, the State Fire Service, the Internal Security Agency, the Intelligence Agency, the Central Bureau of Investigation, to the Central Anti-Corruption Bureau and to the Office of the MINISTER OF INTERNAL MISCELLANEOUS, ORGANISATIONAL UNITS SUBJECT TO THE MINISTER or SUPERVISORY OF 28 February 2020 on actions of officers and employees who come into contact with persons suspected of being infected/infected with the new type of SARS-CoV-2 coronavirus

CHAPTER 2

Basic principles of protection against COVID-19

One of the building blocks of the SARS-CoV-2 virus is a lipid coating, which makes it resistant to detergents and chemicals that cause "degreasing". Therefore, the basic principles of hygiene are the foundation of the fight against COVID-19. They are also the basis for other safety procedures, such as using personal protective equipment (PPE). At the present time, we must absolutely comply with these principles regardless of where we are. Adhering to the basic principles of hygiene has a key impact on limiting the transmission of pathogens from human to human, as well as from elements of the environment to human.

According to the guidelines of the Chief Sanitary Inspector of the Ministry of Internal Affairs and Administration, to prevent respiratory infections of viral etiology, the basic hygiene rules should be observed [9], i.e.:

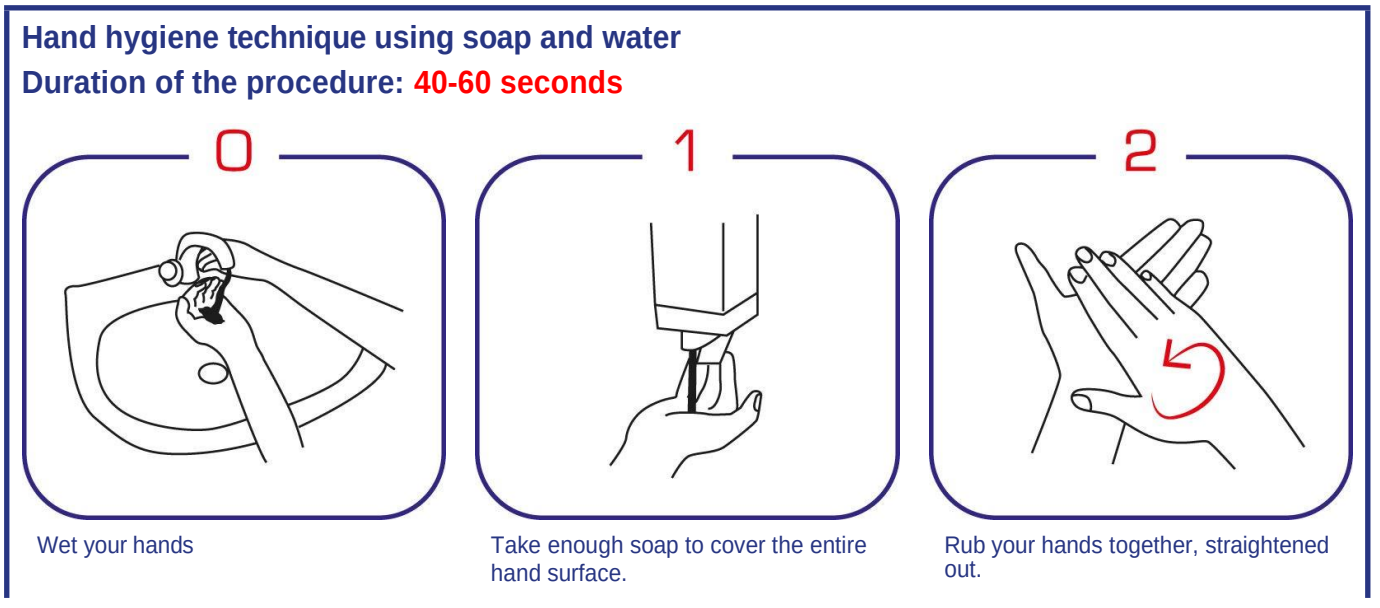
1. Wash your hands frequently with water and soap [9]

WHO guidelines recommend:

- When washing your hands with soap and water, wet your hands and apply a sufficient amount of soap to cover the entire hand surface.
- Then rinse hands with water and dry thoroughly with a disposable towel. Use clean, running water whenever possible.
- Hot water must be avoided, as repeated contact with hot water can increase the risk of dermatitis.
- Turn the tap off with a towel.
- Dry hands thoroughly using a method that will not re-contaminate the hands.
- Make sure that the towels are not used several times or by several people.
- Liquid soap, cubes, flakes or powder can be used. When cube-based soap is used, small cubes placed on openwork soap dishes should be used to facilitate water drainage so that the soap can dry [12].

The hand washing technique is also extremely important, as is the time spent on this activity.

The WHO's proposed hygienic hand washing scheme



Source: WHO guidelines on hand hygiene in healthcare - summary. The First Global Patient Safety Initiative "Hand Hygiene is Safe Care". World Health Organization, 2009

The WHO proposed the method "5 steps of hand washing hygiene", according to which the technique of hygienic hand washing should be applied:

- before contacting the patient;
- before a clean/aseptic procedure;
- after exposure to bodily fluids;
- after contacting a patient;
- after contact with the patient's environment [12].

The described indications on hygienic hand washing can be adapted to the daily activities carried out by officers/employees of police units, e.g.:

- before contacting another person (e.g. a petitioner who came to take care of the case in the police unit);
- before a clean procedure, e.g. application of a protective mask or other means to protect the airways, eyes or skin;
- after direct exposure to body fluids (saliva, nasal discharge);
- after direct contact with another person (petitioner, legit person, etc.);
- after contact with the person's environment or other things, e.g. his or her identity card, protocol, clothes, door handle, etc.

2. Disinfect hands with an alcohol-based agent [9]

The studies carried out on another type of coronavirus, HCoV-229E, showed high efficacy of 70% solution of ethyl alcohol, which completely inactivated the virus after 1 minute [13]. The studies on SARS-CoV demonstrated the efficacy of many chemical substances, including ethyl alcohol and isopropyl alcohol [14]. The results are presented in Table 3.

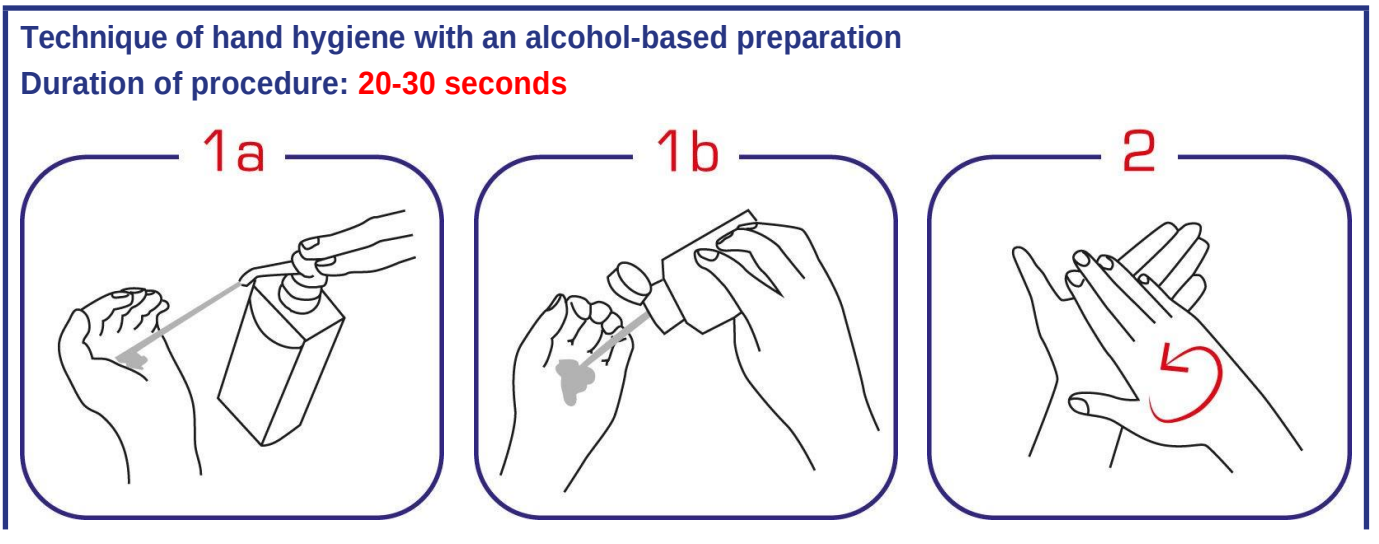
Table 3: Virological activity of various disinfectants against SARS-CoV

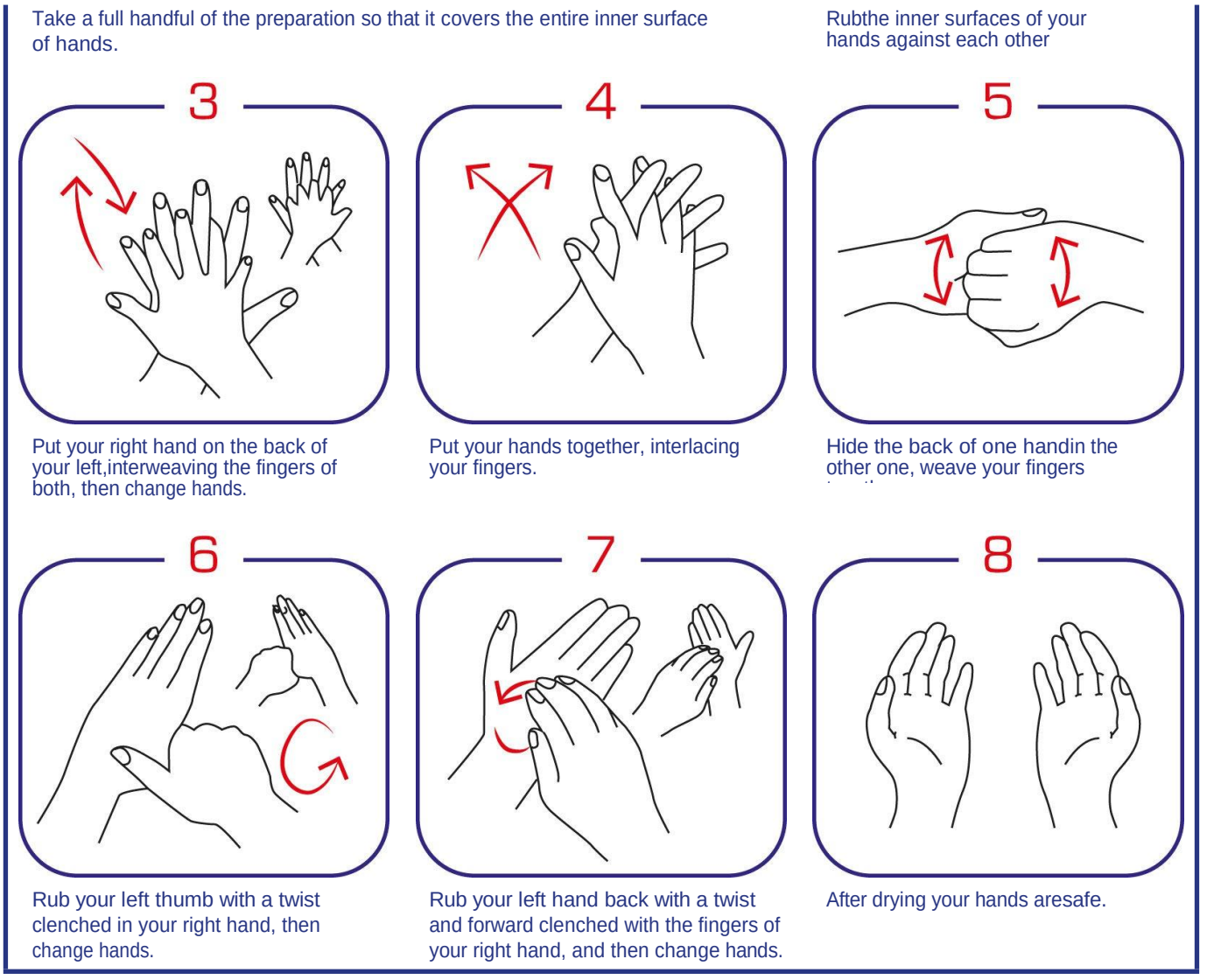
Disinfectant	Infectious titer expressed in log10 TCID50/ml (*50% tissue culture infectious dose*) (after contact time ins)	Minimum reduction coefficient (log10)
Isopropanol (100%)	< 1.8 ± 0 (30 s)	> 3.31
Isopropanol (70%)	< 1.8 ± 0 (30 s)	> 3.31
Desderman (78% ethanol)	< 1.8 ± 0 (30 s)	> 5.01
Sterillium (45% isopropanol, 30% propanol)	< 3.8 ± 0 (30 s)	> 2.78
Wine vinegar	< 2.80 ± 0 (60 s)	> 3.,0
Formaldehyde (0.7%)	< 3.8 ± 0 (120 s)	> 3.01
Formaldehyde (1.0%)	< 3.8 ± 0 (120 s)	> 3.01
Glutar dioxide (0.5%)	< 2.8 ± 0 (120 s)	> 4.01
Incidin plus (2%) (26% glucoprotamine)	< 4.8 ± 0 (120 s)	> 1.68

Source: Rabenau H.F., Cinatl J., Morgenstern B. iwsp.: Stability and inactivation of SARS coronavirus. Med Microbiol Immunol 2005, 194(1–2): 1–6

It has been demonstrated that ethyl alcohol, even in the concentration of 35%, inactivates SARS-CoV; however, it requires as much as 120 seconds [13]. For this purpose, in order to properly disinfect hands, it is necessary to take the full hand of the alcoholic disinfectant and spread it over the whole surface of hands and then rub them until the preparation dries [12].

Hand washing technique with disinfectant





Source: WHO guidelines on hand hygiene in healthcare - summary. The First Global Patient Safety Initiative "Hand Hygiene is Safe Care". World Health Organization, 2009

There are other important elements related to hand disinfection, such as:

- If an alcoholic hand disinfectant is available in a given facility (police station), the use of antibacterial soaps is not recommended.
- Some people may be allergic to disinfectants, or if used for a long time, severe damage to the epidermis may occur. In such cases, hygienic washing of hands with soap, putting on protective gloves and disinfecting the gloves according to the previously described indications is a good solution [12].
- You should also think about using lotions or hand creams to minimize the occurrence of contact dermatitis associated with antiseptic or hand washing. Aloe vera gel may be a good factor protecting hands [12].

The results of Polish research on the failure of medical personnel to wear protective gloves indicate that the main reasons for this are: emergency situations, allergies and skin irritations, too few washbasins equipped with antiseptic dispensers and lack of time. Quite often the respondents raised the problem of lack of knowledge of hygienic procedures [15]. These observations confirmed the results of earlier studies by Bielski and Kosiński - according to the respondents, the main reasons for non-application of hand washing and disinfection procedures were: irritating properties of washing agents, lack of soap and disinfectants, and lack of time [16].

3. Avoid touching the face (mouth, nose, eyes) with an unwashed hand [9]

In 2015, the University of Sydney observed medical students during classes. The recording showed how many times they touched their faces with their hands. Each of the 26 observed future doctors did it on average 23 times per hour. Almost in half (44%) of the cases, fingers landed on the eyes, nose or mouth. Contact of nasal mucous membranes, oral cavity and lips with hands full of dangerous pathogens are one of the most common routes of transmission of infectious diseases [17].

It should be noted that the results of scientific works indicate that the lack of time, which should be combined with too little staff (high workload, poor work organization), is a significant factor preventing precise observance of hygienic procedures at work [18].

4. When sneezing and coughing, cover your mouth/nose with a bent elbow or a disposable tissue [10], which should be discarded each time and then wash hands [9]

Covering the mouth and nose during coughing and sneezing prevents the spread of germs and viruses. A person who sneezes or coughs in the hands can contaminate objects or by touching other people [19].

5. If possible, keep a safe distance from the other person (about 2 m) [9].

6. Especially avoid face-to-face contact with a suspected or infected person [9].

When someone is infected with a virus causing a respiratory disease such as COVID-19, coughs or sneezes, they excrete small drops of saliva and mucus containing the virus under pressure. If the other person is too close, there is a high risk that he or she may aspirate the virus particles to the airway [19].

7. Officers and workers with symptoms of respiratory tract infections should not be at work [9].

As mentioned earlier, in the case of SARS-CoV-2 infection, the carrier of the virus is the most contagious at the time when symptoms occur. However, during the current epidemic, the possibility of virus transmission has also been documented through contact with an infected person who did not show signs of disease.

CHAPTER 3

Basic personal protective equipment

On 27 February 2020 the WHO published a document entitled "Rational use of personal protective equipment". [20]. These seven-page guidelines summarize the WHO recommendations concerning the rational use of personal protective equipment. The document emphasizes that the current global stock of personal protective equipment is insufficient, especially when it comes to access to medical masks. Soon, the stocks of aprons and protective goggles will also prove insufficient. Growing global demand - driven not only by the number of COVID-19 cases but also **by disinformation, panic-driven purchases and stockpile accumulation - will cause further shortages of personal protective equipment worldwide [21].**

The rational use of personal protective equipment is therefore a matter of:

- the officer using the protection (must use it adequately to the danger!);
- persons responsible for distributing equipment to individual units of police organizational units (equipment of the highest protection class must be distributed to persons who are most at risk of infection);
- persons responsible for supervision to observe the correct use and enjoyment of these means.

At the present time it is unacceptable that a person on duty in a room where the basic principles of hygiene are observed and there is no direct contact with people suffering from COVID-19 is equipped with a mask type FFP2/FFP3, glasses, protective gloves. It is also extremely irresponsible to act when a police officer is sent to act on a body fatal accident without full protection (i.e. protective suit, shoe protectors, FFP2/FFP3 masks, goggles/glasses, protective gloves).

Equipping police officers in preventive and criminal services with personal protective equipment (PPE) can currently be divided into three categories - I, II, III (Table 4).

Table 4. Equipment of police officers during the COVID-19 pandemic in March 2020 in Poland

Level of protection	Personal protective equipment (PPE)						
	Protective gloves	FFP2/FF P3 mask	Surgical mask	Goggles/Glasses	Protective suit category III	Shoe protectors	Alcohol-based disinfectants
I	X		X				X
II	X	X	X	X			X
III	X	X	X	X	X	X	X

Source: Own study

Various scientific centers propose solutions for the rational use of protective equipment depending on the risk of exposure to new coronaviruses (Table 5) [22].

Table 5: COVID-19 personal protection levels recommended by The First Affiliated Hospital, Zhejiang University School of Medicine (FAHZU)

Management level	Protective equipment	Scope of application
Level I protection	■ Disposable surgical cap ■ Disposable surgical mask ■ Uniform workwear ■ Disposable latex gloves and/or disposable insulation clothing (if necessary)	■ *Triage* before examination, general clinic

Management level	Protective equipment	Scope of application
Level II protection	■ Disposable surgical cap ■ Medical face mask (including FFP2/N95) ■ Working clothes ■ Disposable insulating clothing ■ Disposable latex gloves ■ Goggles (eye protection)	■ Outpatient Fever Unit ■ Isolation ward area (including an isolated intensive care unit) ■ Examination of samples from suspected or confirmed patients (other than those taken from the airways) ■ Imaging of suspected or confirmed patients ■ Cleaning surgical instruments used in suspected or confirmed patients
Level III protection	■ Disposable surgical cap ■ Medical face mask (including FFP2/N95) ■ Working clothes ■ Disposable insulating clothing ■ Disposable latex gloves ■ Full face protection with respiratory protective equipment with inhaled air purifying device	■ Staff during procedures such as tracheal intubation, tracheotomy, bronchofiberoscopy, gastroscopy, etc., during which suspected or confirmed patients may spray respiratory secretion or there is exposure to body fluids or blood ■ Staff during surgery or autopsy in suspected or confirmed patients ■ Personnel transferring samples for screening for COVID-19 (virus RNA tests)

Source: Liang T. (ed.): COVID-19. Prevention and treatment. The First Affiliated Hospital, Zhejiang University School of Medicine (FAHZU). Publication consistent with clinical experience. α-medica press, Bielsko-Biała 2020

Proposal to apply a level of protection depending on the duration and risk of exposure to coronavirus

Security level I (Fig. 1):

- When carrying out work tasks in contact with persons when a distance of 2 meters (and more) is kept, taking into account the recommended hygiene rules;
- When there are insufficient personal protective equipment required for level II protection.

Fig. 1

Security level II (Fig. 2):

- When the distance from the potentially infected person is less than 2 meters;
- When the distance from the infected person is less than 2 meters (short time in the person's environment);
- During short-term contact with objects of the potentially infected person and the infected person.

Fig. 2

Security level III (Fig. 3):

- When the distance from the infected person is less than 2 meters (long time spent in that person's environment);
- During prolonged contact with objects of potentially infected and contaminated person;
- During prolonged contact with objects of the potentially infected and infected person on which their excretions/secretions are visible;
- During contact with the body of a person (potentially infected person/infected person).

Fig. 3

Before using personal protective equipment it is recommended to:

- Pin up your long hair so that it does not get into the edge of the facial part of the respirator and does not protrude beyond the contour of the suit;
- Shave facial hair (any leakage at the edges of the mask increases the risk of the virus entering the airways);
- Take off the jewelry (especially rings and rings);
- Wear short cut nails;
- Do not wear artificial or gel nails;
- Take the wrist watch off your wrist.

3.1. Protective gloves

The disposable diagnostic gloves available on the market are made of various materials that differ not only in color but also in properties such as: flexibility, strength, hand adhesion, microbial penetration (protection against infection), penetration of various chemicals, resistance to punctures.

The most popular are latex, nitrile, vinyl and synthetic polymer gloves. Latex gloves are the most flexible, most puncture-resistant and well protected against infectious biological agents. Similar properties to latex have gloves made of synthetic polymers, which can be an alternative for latex allergic people. Nitrile gloves also provide good protection against infectious agents, but are less flexible and more resistant to various chemicals.

On the other hand, vinyl gloves should not be used when working with infectious material as they do not provide protection against infectious biological agents [23,24].

Whatever the material of the glove, it shall comply with EN 374:2003 and – when working with potentially infectious material, belong to category III and have a microbial protection mark.

Principles of correct use of protective gloves

- Apply hygienic hand washing/disinfection before wearing gloves **(Fig. 4).**


Fig. 4

- Select the correct size of protective gloves.
- After removing the gloves from the pack, try to touch them only within their cuffs to minimize contact with your hands or any other surface (uniform, equipment) **(Fig. 5).**


Fig. 5

- Do not touch the outside of the gloves when putting them on **(Fig. 6-8).**


Ryc. 6


Ryc. 7


Ryc. 8

- Don't touch your face, hair, uniform with gloves.
- Take off your gloves after performing the actions to which they were applied or, if damaged - when torn - immediately!
- When taking the gloves off, do not touch the inner ("clean") part of the glove and roll them inwards to minimize the risk of splashes of substances that may be on their surface **(Fig. 9-11).**


Fig. 9


Fig. 10


Fig. 11

- Throw used gloves into a red bag (for disposal).
- Then apply hygienic hand washing/disinfection.

3.2. Respiratory protective equipment

Cleaning elements (filters and canisters or filter absorbers) are not respiratory protective equipment themselves. Only when combined with a suitable facepiece in the form of: mouthpiece, quarter mask, half mask, mask, hood or helmet, do they constitute equipment with a suitable degree of effectiveness. The exception are filtering respirators or filtering and absorbing respirators, which do not need to be combined with other equipment, as they are a type of equipment functioning independently. Any type of cleaning equipment (filters, absorbers and filters) may be part of assisted or forced airflow cleaning equipment.

The facial parts used in the cleansing equipment are divided into two groups, taking into account how they fit. In the cleaning equipment without airflow support, only the face parts, referred to by the term - tight fit, are used. This group includes mouthpieces, quarter masks, half masks or masks whose small percentage of internal leakage guarantees the effectiveness of protection (in particular, this refers to leakage through leaks in the places where they stick to the user's face skin and through valves). Of this group, the most effective protection for facepieces is provided by masks which provide a maximum leakage of 0.05% through the edge of the mask body and 0.01% through the valves. Additionally, they protect the user's eyes and face, which makes them recommended for use in cases of pollution requiring simultaneous protection of the respiratory system, eyes and face [25].

Division of gas absorbers

- **Class 1** - absorbers with low sorption capacity, designed for protection against gases or vapors with a volumetric concentration in air not exceeding 0.1% (1,000 ppm).

- **Class 2** - absorbers of medium sorption capacity, designed for protection against gases or vapors with a volumetric concentration in air not exceeding 0.5% (5,000 ppm).
- **Class 3** - absorbers with a high sorption capacity, designed for protection against gases or vapors up to 1% (10,000 ppm) in air.

Classification of filters

Sodium chloride and paraffin oil mist determine the appropriate filtration efficiency, so we can distinguish three classes of filters:

- **Class 1 - (P1)** - 80% filtration efficiency - used for protection against low toxicity solids for which the WEL ≥ 2 mg/m3;
- **Class 2 - (P2)** - Filtration efficiency 94% - used to protect against low and medium toxicity solid and liquid particles for which the WEL ≥ 0.05 mg/m3;
- **Class 3 - (P3)** - filtration efficiency 99.95% - used for protection against highly toxic solid and liquid particles, for which the WEL < 0.05 mg/m3.

Table 6 Designation of filters and absorbers

Symbol	Color	Purpose
A	Brown	Gases and organic vapors with a boiling point above 65°C
AX	Brown	Gases and organic fumes with a boiling point below 65°C
B	Grey	Inorganic gases and vapors, excluding carbon monoxide, including but not limited to chlorine or hydrogen sulphide
E	Yellow	Acid gases and vapors, including but not limited to sulphur dioxide
Hg	Red	Mercury vapour
K	Green	Ammonia and organic ammonia derivatives
NO	Blue	Nitrogen oxides
P	White	Dust and liquid aerosols
SX	Violet	Substances indicated by the manufacturer, so-called special absorbers

Source: https://www.glovex.com.pl/pl/i/Drogi-oddechowe/38 (accessed 24.03.2020)

Figure 12: Full face mask with Dräger filter

Fig. 12

Filtering equipment

Filtering equipment is selected depending on the concentration of aerosol at the workplace, using a multiple of the maximum permitted concentration (MEL) of the substance. In order to make a proper selection of the protective class of a half-mask filtering respirator, it is necessary, first of all, to precisely identify hazards that occur at workstations. This is connected with determination of the type of contamination and measurement of its concentrations and determination of maximum values occurring during the working day in a given work environment. These measurements should be referred to the WEL values, because the protective class of the equipment depends on the multiple of the WEL excess. The higher the WEL exceeds the value, the higher the protection index should be characterized by the filtering respirator [26].

The effectiveness of filtering equipment is measured by its protective class:

- **Class P1** - equipment of low protective effectiveness - protects the respiratory system against aerosols whose concentration of the dispersed phase does not exceed four times the maximum permissible concentration (4 × WEL) [26].
- **Class P2** - equipment of medium protective effectiveness - protects the respiratory system against aerosols whose concentration of dispersed phase does not exceed 10 times the maximum permitted concentration (10 × WEL) [26].
- **Class P3** - equipment of high protective effectiveness - protects the respiratory system against aerosols whose concentration of the dispersed phase does not exceed twenty times the maximum permissible concentration (20 × WEL) [26].

In many cases, in their instructions for use, the manufacturers often state that the respirator additionally protects against vapors and gases below the WEL, yet they do not provide its absorbing capacity, expressed as the minimum time of protective action against harmful substances [26].

The marking of filtering respirators consists of the following symbols:

1. FFP1, FFP2, FFP3 - means the first, second and third protective class [26]:

- **Class 1** - (designation **FFP1**) - **80%** filtration efficiency - used for protection against low toxicity solid and liquid particles, for which **WEL ≥ 2 mg/m^3**, as long as the maximum concentration is up to **4 × WEL** [27];
- **Class 2** - (designation **FFP2**) - filtration efficiency **94%** - used for protection against low and medium toxicity solid and liquid particles, for which the **WEL ≥ 0.05 mg/m^3** if the maximum concentration is up to **10 × WEL** [27];
- **Class 3** - (designation **FFP3**) - filtration efficiency **99%** - used for protection against highly toxic solid and liquid particles, for which **WEL < 0.05 mg/m^3** if the maximum concentration is up to 20 **× WEL [27**].

2. Classification according to U.S. standards designated as N:

- **N95 -** filtration efficiency at least 95%;
- **N99 -** at least 99% filtration efficiency;
- **N100 -** filtration efficiency of at least 99.97%.

There is also the Chinese standard KN95, which corresponds to N95.

Attention!

- **NR** - means that the product is designed for single use.
- **R** - the product is intended for repeated use.
- **D** - the product meets the clogging requirements. The letter D is placed only in the marking of the respirator if it has passed the tests for dolomite dust clogging. This test is not obligatory and does not depend on the protection class of the filtering respirator [25].

Additionally, filtering respirators contain information on

- the dated number of the European standard;
- identification of the manufacturer, supplier or importer by name, trademark or other means of identification;
- manufacturer's model designations [26].

Fig. 13. FFP3 type semi-filtering masks ready for use in sealed packaging

Figure 14. 3M half mask packaging. The description on the package indicates that: the mask meets the European standard EN 149:2001+A1:2009; it has the highest protection class - FFP3; it is a disposable mask

The rules of proper wearing of the FFP2/FFP3 type filtering respirator

- Prepare the respirator for use: choose the correct type, size, check the tightness of the package.
- Washing/disinfecting hands hygienically before putting on the FFP2/FFP3 type half mask.
- Wear protective gloves.

- Remove the half mask from the package and apply it to the face **(Fig. 15).**
- Attach the occipital tape without moving the facepiece **(Fig. 16).**
- Then attach the neck tape without moving the facepiece **(Fig. 17).**


Fig.15


Fig.16


Fig.17

- Choose the slack in the straps securing the half mask to the face so that it fits tightly to the mask **(Figures 18, 19).**

- Press the half mask bar against the nose and check the adhesion of the half mask by inhaling and exhaling **(Fig. 20-22)**.


Fig.18


Fig.19


Fig. 20


Fig. 21


Fig. 22

- Leakage (mismatch) of the half-mask at its edges results in loss of filtration efficiency and penetration of undesirable particles into the user's airways. Apart from the face fit, the mask should not cause any problems when put on or off [28].

- Put on goggles/glasses.
- Put on a headgear (if uniformed regulations require it).
- Disinfect the gloves **(Fig. 23).**

Fig. 23

- Put another pair of gloves on your hands **(Fig. 24).**


Fig.24

- When using the half-mask, do not touch it with your hands, do not remove it, and do not touch other objects, which could transfer the pathogen onto the mask or come into contact with the uncovered parts of the face **(Figures 25-27).**


Fig. 25


Fig. 26


Fig. 27

Principles of proper removal of the filtering half-mask type FFP2/FFP3

- Disinfect your gloves.
- Take off your headgear, if you have one **(Fig. 28).**


Fig. 28

- Take off the first pair of protective gloves **(Fig. 29).**


Fig. 29

- Remove the goggles/glasses by holding the front of the goggles and put them in a safe place (for disinfection) **(Fig. 30).**


Fig.30

- Remove the half-mask by pulling the body away from the face and then pull it off in an upward motion **(Fig. 31, 32).**


Fig.31


Fig. 32

- Throw the respirator into the red bag (for disposal).
- Take off your gloves and discard them in the red bag (for disposal).
- Secure the red sack.
- Disinfect your hands.

The user of respiratory protection must take into account the recommendations for wearing the respirator type in question, as they may differ from the method described - the instructions for use of the FM 0/14-P2 NR D filter respirator (FFP2 protection type) are given below:

- Select the correct size for your respirator.
- Put the headgear on the neck, put the half-mask on the face and the headgear on the occiput with the upper headband**(Figures 33-35)**.


Fig. 33


Fig. 34


Fig.35

- Correct the position of the half-mask by securing it so that the spherical cap covers both the nose and chin **(Fig. 36).**


Fig. 36

- Adjust the length of the head band to ensure that the spherical cap fits tightly around the edge without deformation **(Fig. 37).**

Fig. 37

- Shape the nose clamp to fit the shape of your nose in such a way as to ensure that it is tight without causing excessive pressure **(Fig. 38).**


Fig.38

- Take off the half-mask, grasp it by the spherical cap, pull it away from your face and pull it upwards **(Fig. 39, 40).**


Fig.39


Fig.40

There is no mention of washing/disinfection of hands, use of protective gloves and wear of goggles/protective goggles, however, in use the points contained in the *Principles for proper use of the FFP2/FFP3 type filter respirator* (see above) must be followed.

The possession of a respiratory protective device by a person does not guarantee that it will be used correctly.

One American study conducted in 2006 among 538 residents of New Orleans on the ability to wear an N95 type filtering respirator confirms this hypothesis. After hurricanes "Katrina" and "Rita" passed through the territory of the United States in 2005, the N95 type respirators were recommended for use by people renovating and cleaning houses from mold. Only 129 participants (24%) showed the ability to wear the mask correctly. The most important errors included the lack of proper nose clip formation (71%) and incorrect placement of fastening straps (52%). It turned out that 22% of respondents wore upside-down semi-filtering masks [29].

Another study based on the observation of 62 healthcare workers in three hospitals in California found that 40 (65%)

misused N95 type filtering respirators before entering the Tuberculosis patient isolation room. The errors in the use of respiratory protection included the use of only one belt for fastening the half mask, improper placement of fastening belts and presence of beards of mask users [30].

The American Centers for Disease Control and Prevention (CDC) recommend the N95 filter mask standard as an essential part of the recommended protective equipment against biological hazards.

Considering that the protective equipment that we will be using on duty may be from outside the European Union, Table 7 presents the classifications of individual respiratory protective equipment recommended in case of contact with a COVID-19 patient [31].

Table 7: Overview of respiratory protective equipment used in selected countries

Country	Standard	Approved product classes	Standards/guidelines	WEL protection factor ≥ 10
Australia	AS/NZS 1716:2012	P3 P2	AS/NZS 1715:2009	Yes
Brazil	ABNT/NBR 13694:1996 and 13697:2010	P3 P2	Fundacentro CDU 614,894	Yes
China	GB 2626-2006	KN100, KP100 KN95, KP95	GB/T 18664-2002	Yes
Europe	EN 149:2001	FFP3 FFP2	EN 529:2005	Yes
Japan	JMHLW-2000	DS/DL3 DS/DL2	JIS T8150:2006	Yes
South Korea	KMOEL-2017-64	Special 1st	KOSHA GUIDE H-82-2015	Yes
Mexico	NOM-116-2009	N100, P100, R100 N99, P99, R99 N95, P95, R95	NOM-116	Yes
USA (Guidelines of the National Institute for Occupational Safety and Health [NIOSH])	**42 CFR 84 (by NOISH)**	**N100, P100, R100 N99, P99, R99 N95, P95, R95**	**OSHA 29CFR1910.134**	**Yes**

Source: https://www.cdc.gov/coronavirus/2019-ncov/hcp/respirators-strategy/crisis-alternate-strategies. html (accessed: 20.03.2020)

Figure 41:P95 type filtering half mask packaging

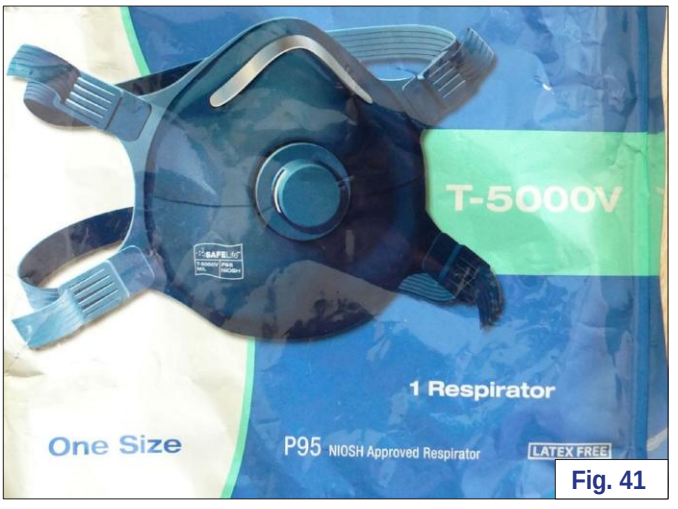


Fig. 41

Surgical masks

To begin with, it is worth noting that surgical masks are designed to protect against droplets or particles larger than 100µm in diameter, while SARS-CoV-2 virus is essentially spherical, although slightly pleomorphic in shape, with a diameter of 60-140 nm - thus 100 times smaller than pore diameter.

The standards for the filtration rate of surgical masks (BFE (*bacterial filtration efficiency*) are defined in the European standard EN 14683. It divides surgical masks into: Type I, Type IR, Type II, Type IIR. In the operating room, disposable type II surgical masks made of three layers of polypropylene non-woven fabric are most commonly used. Their bacterial filtration rate (BFE) is at least 98%. They provide effective protection for both the doctor and the patient and enable free breathing. Surgical IIR masks are additionally resistant to permeation, which guarantee safety of medical personnel against exposure to blood and other potentially infectious liquids [21].

A properly fitted surgical mask is designed to block the escape of droplets (aerosol), which may contain germs (viruses and bacteria), from the person using it towards the outside. Surgical masks also to some extent protect against the ingress of particles from the outside into the respiratory system of the person, but this is a negligible protection, which is due to the structure of the mask material and the fact that it does not adhere closely to the user's face.

Surgical masks are mostly two-colored. Note that the white side is the inside (applied to the face), while the colored side is the outside (from the face to the outside) **(Figures 42, 43)**.

Fig.42

Fig. 43

How to put on and take off the surgical mask (ribbon attachment)

- Apply hygienic hand washing/disinfection.
- Wear protective gloves.

- Apply the mask to the face and form a strip on the nose at the top of the mask (to prevent the mask from moving) **(Fig. 44)**.


Fig.44

Tie the upper pair of ribbons on the occipital part of the head **(Fig. 45)**.


Fig.45

- Pull the lower part of the mask over the chin and tie the lower pair of ribbons around the neck **(Fig. 46, 47).**


Fig. 46


Fig.47

- Disinfect your gloves before removing the surgical mask.
- Take off the goggles/safety goggles, holding the front of the goggles, and put them in a safe place (for disinfection).
- Grasp all the masking tapes with your fingers and tear the binding with a slight movement **(Fig. 48, 49).**


Fig.48


Fig.49

- Throw the worn out surgical mask into a red bag (for disposal).
- Take off your gloves and discard them in the red bag (for disposal).
- Secure the red sack.
- Disinfect your hands.

How to put on and take off the surgical mask (rubber mounting)

- Apply hygienic hand washing/disinfection.
- Put on your gloves.

- Put the mask on your face and put the elastics behind your ears **(Fig. 50, 51).**

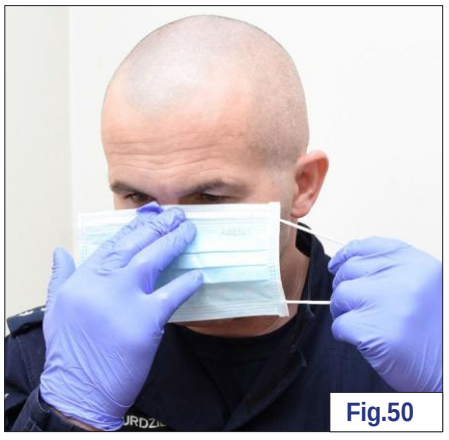


Fig.50


Fig. 51

- Form a strip on the nose at the top of the mask to prevent movement of the mask **(Fig. 52).**


Fig. 52

- Pull the lower part of the mask over the chin **(Fig. 53, 54).**


Fig.53


Fig.54

- Disinfect your gloves before removing the surgical mask.
- Take off the goggles/safety goggles, holding the front of the goggles, and put them in a safe place (for disinfection).

- Remove one ribbon from one ear and, holding it with your fingers, carefully pull the mask off your face so that it does not come into contact with your skin and clothing **(Fig. 55, 56).**

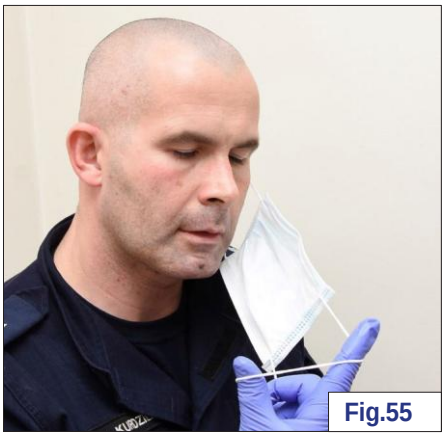


Fig.55

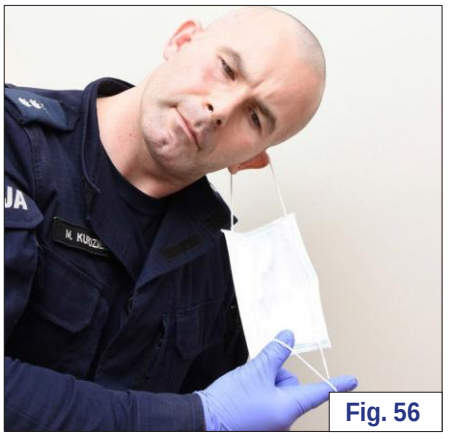


Fig. 56

- Throw the worn out surgical mask into a red bag (for disposal).
- Take off your gloves and discard them in the red bag (for disposal).
- Secure the red bag.
- Disinfect your hands.

When equipped with surgical masks and half masks type FFP2/FFP3, officers should e.g. use a surgical mask (or other means of protection against the emission of infected air from the person's respiratory tract) for the time of transport (delivery) and use a filtering half-mask for their safety.

Taking into account the limited number of masks and the need for full control of the person being brought in/remained, the officer should:

- Put the mask on this person himself, controlling his head and neck (the person can tear the mask apart) **(Fig. 57);**
- Put on the mask by applying it from the front towards the chin, taking proper precautions **(Fig. 58)**;
- When leading a person, keep the rules of full control of the person and point his face outwards **(Fig. 59).**

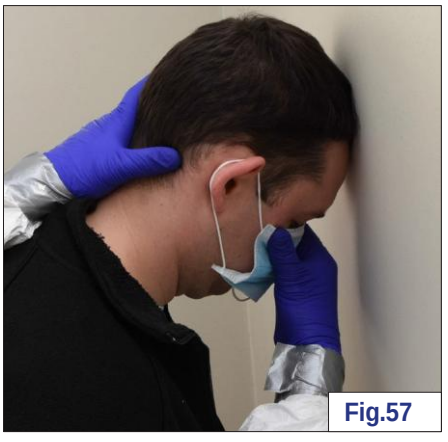


Fig.57

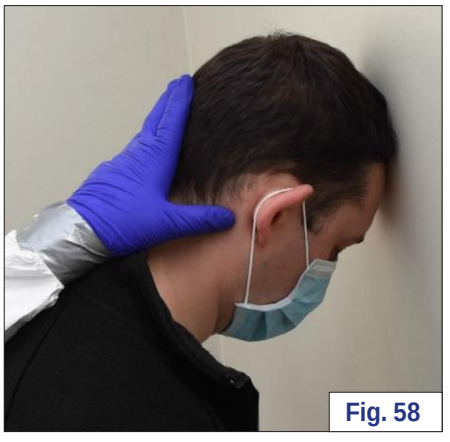


Fig. 58


Fig. 59

Surgical masks are not designed to filter or block very small particles in the air that can be carried by the droplets due to coughing. They also do not provide full protection against germs and other contaminants due to the loose fit between the mask surface and face.

Furthermore, these masks are not reusable. If the mask is damaged or dirty, or if it becomes difficult to breathe in it, the mask must be replaced, following the safety precautions described above.

Effectiveness of masks against different pathogens

Ultimately, the effectiveness of both surgical masks and N95 half-masks may be associated with their consistent and correct use [32]. Although the arguments may suggest that it is justified to wear N95 half masks, which should provide better protection than surgical masks against influenza infection, there are only two studies from recent years, which verify this

assumption. None of them showed the advantage of N95 respirators over surgical masks. Loeb et al. looked at the prevalence of influenza infections in nurses in Ontario, Canada, which were randomly assigned to wear N95 respirators or surgical masks during the 2008-2009 influenza season [33]. There was no significant difference in the frequency of influenza infections between the two groups - both were close to 23%. Similarly, MacIntyre et al. compared the N95 half-masks with surgical masks and the possibility to protect nurses in Beijing (China) against respiratory viral infections [34].

In contrast to the Loeb study, participants in the MacIntyre et al. study were required to attempt to wear respiratory protection by medical personnel on duty for four weeks. The results of this study suggested that the N95 respirators provided protection against respiratory viral infections (respiratory diseases), but showed no significant protection against influenza infection.

However no study included the formal group 'without masks' (for ethical reasons, of course), it was MacIntyre et al. who compared their subjects with a group of nurses working in hospitals where the use of masks was not routine. They concluded that the percentage of respiratory infections was higher in the group that did not use masks compared to those using surgical masks or N95 half masks. The Loeb et al. report contained a number of comments and remarks, including questions about the differences in filtering efficiencies of different brands of surgical and N95 respirators, quality of training on the use of N95 respirators, nonconformity in the use of N95 respirators, problems with ensuring their proper fit, and flu infections in off-site conditions [35,36].

It should be noted that the studies described concerned an influenza virus and not coronaviruses.

Having a mask and being able to use it properly is one thing. However, it is important to remember that they are not a comfortable solution for the user. Many health care workers find N95 respirators uncomfortable, hot and interfere with breathing and communication [37]. It has been found that women working in health care more often complain about complications related to their use than men [38]. Physiological measurements during the simulation of clinical workload in N95 respirators wearers have observed some deviation from normal values in percutaneous carbon dioxide levels. This was probably related to the measured increases and decreases in dead space of the N95 respirator and carbon dioxide and oxygen levels, respectively [39]. The possible consequences of these changes are unknown and probably not clinically significant [40].

The lack of a clear advantage of N95 filter respirators over surgical masks in the studies by Loeb et al. and MacIntyre et al may result from:

- a wrong face seal in N95 half masks;
- poor quality of use due to discomfort of use;
- lack of diagnosis of infectious patients and, consequently, improper use of N95 respirators (no use);
- infections resulting from infection by co-workers;
- conjunctival infection, despite the proper use of masks, but without eye protection;
- infections from sources outside health care [32,41].

Whatever the cause, the high percentage of infections in both groups in the Loeba syndrome study is impressive and reinforces the need to consider how to strengthen the personal protection of medical personnel and others using this type of protection [42].

The view that the number of cross-infections can be reduced by applying masks to potentially infectious patients, supported by laboratory and clinical studies, opens an additional doorway to an appropriate approach to protection. Demonstration of conjunctival infection by aerosols requires further investigation and suggests that eye protection may be required as an additional element of respiratory and facial protection, not only to reduce the risk of direct splash contamination, but also to prevent exposure to aerosols. Srinivasan and Perl and the US Department of Health's scientific review state that the use of masks and half-masks should be considered the last line of defense in the hierarchy of infection prevention measures [32,43]. The main measures used against infections are: preventive vaccination (if available), hand hygiene (always), environmental protection measures, including environmental ventilation (ventilation), provision of rooms for individuals and administrative practices that emphasize early diagnosis of infectious (symptomatic) patients and their isolation from healthy individuals [40].

The wearing of protective masks must be supported by the reasonableness of their use and not their pointlessness (**Fig. 60**).

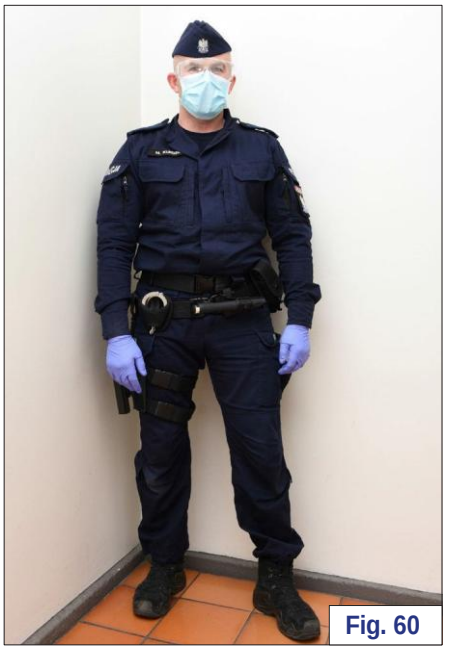


Fig. 60

Persons at moderate risk of infection: working in densely populated areas (e.g. hospitals, railway stations), staying with a quarantined person and administrative staff, police officers, security staff and couriers whose work is related to COVID-19 should wear disposable medical masks [44].

There is little evidence that face masks can provide effective protection against respiratory infections in the society, which is confirmed by the recommendations of the UK and Germany [45].

Recently a lot of social actions related to sewing masks for health care and other services have appeared. However, this type of masks should not be treated as an I-standard of protection without the support of other protection measures.

According to MacIntyre et al., in hospital conditions, material masks (made of cotton) increase the probability of viral infection 13-times compared to wearing surgical masks (made of nonwoven fabric) [46]. In exceptional cases, when N95-type half masks or surgical masks are not available, health care workers may use home-made improvised masks (e.g. buffet, handkerchief, scarf) to care for COVID-19 patients; however, such masks are not considered personal protective equipment, as their ability to protect medical workers is not known. Special care should be taken when considering this option. Homemade masks should be used in combination with a face shield (visor/shield) that covers the entire front (reaching up to the chin or below) and covers the sides of the face [47].

If a person suspected/confirmed to be infected with SARS-CoV-2 is taken on duty when the FFP2/FFP3 type half mask cannot be used, the police officer should use a surgical mask or other protective measures to minimize the risk of infection.

Since April 16, 2020 (until further notice) there is an obligation on the territory of Poland for persons to cover their mouths and noses (while staying outside the address of residence or permanent residence) with a part of clothing, mask or mask [48].

3.3. Eye protection

Due to the design we distinguish eye protection products such as:

- safety glasses;
- protective goggles;
- face shields [49].

The face and especially the eyes may be exposed to biological agents in the form of: liquids, aerosols or vapors. There are no requirements in the available literature for eye and face protection equipment to protect against these agents. Since protection against biological agents classified under groups 2 and 3 consists in preventing or minimizing their contact with skin or eyes, eye and face protection equipment in the form of face shields or goggles may be used to protect against liquids, aerosols or vapors containing hazardous biological agents.

The equipment shall have the same design as that used for protection against chemical agents and shall meet the requirements for protection against these agents in the form of droplets or splashes of liquids, dust and gases. Additionally, goggles and face shields should meet the requirements for resistance to disinfectants and their design must be free of elements enabling the accumulation of biological aerosols [49].

Among police officers, the most common means of eye protection are safety glasses **(Fig. 61).**

Goggles intended for protection against biological agents should be characterized by the lack of ventilation holes made directly in the frame and tight adhesion to the face. They may be equipped with special vents, preventing the aerosol penetration into their interior [49] **(Fig. 62).**

Fig. 61

Fig. 62

Face shields should be equipped with a large panoramic glass pane, which is an effective barrier preventing contact between the liquid and the employee's face. Additionally, they may be equipped with the so called "headgear", which provides protection also from above [49] **(Fig. 63)**.

Fig. 63

3.4. Protective clothing (protective suits)

Protective clothing against biological agents should meet the requirements of EN 14126, which states that the material of protective clothing against biological agents should be a barrier to all or part of the body against direct contact with infectious agents. Due to the diversity of microorganisms, the standard does not define evaluation criteria based on the type of microorganism or risk groups, but focuses on test methods in which the resistance of the material is assessed depending on the medium containing the microorganisms, e.g. liquid, aerosol or particulate matter (dust). Therefore, the clothing material for protection against infectious agents should have a barrier to the infectious agent during:

- activity of the contaminated liquid under hydrostatic pressure;
- mechanical contact with contaminated liquids;
- activity of contaminated liquid aerosols;
- activity of contaminated particles [49].

In addition to its barrier properties against infectious agents, the clothing material for protection against biological agents should exhibit adequate mechanical resistance in terms of abrasion, tear and bending, among other things. All material properties are presented in PN EN 14126 as classes, as in most European standards [49].

Full protection against contact with infectious agents is only provided by barrier materials, i.e. films and materials coated with plastic or laminated with film. These can be long- or short-lived materials that meet the requirements of EN 14126 for protective properties and differ in their mechanical resistance and, therefore, in their application time. Many types of barrier materials used in clothing protecting against biological factors are characterized by unfavorable tightness to water vapor, preventing evaporation of sweat secreted during work [49].

In recent years, a new generation of textile barrier materials has been introduced to the world markets, which combine protective features with good functional properties, significantly improving the feeling of physiological comfort [49]. They are multilayer products, disposable or reusable, coated with polyurethane vapor-permeable layers, laminated with microporous films or vapor-permeable membranes [49].

Clothing that protects against infectious agents should meet certain design requirements depending on the type and intensity of the medium containing the micro-organisms to which the worker is exposed and the parts of the body that should be protected. The construction of the garment should meet the requirements of EN 340 and the requirements of relevant standards for chemical protective clothing [49].

There are the following types of protective clothing construction against biological agents:

- **type 1 and 2** - protective clothing against vapors, liquids, gases and fine particles, provides the highest level of protection, PN-EN 943-1;
- **type 3** - clothing protecting from the liquid stream;
- **type 4** - clothing protecting against spraying;
- **type 5** - dust-protective clothing, PN-EN ISO 13982-1;
- **type 6** - protective clothing against liquid spraying, PN-EN 13034 - partial body protection [49].

Most often 3 and 4 types of clothing are used for protection against biological agents.

In situations of extreme risks, where complete isolation of the worker's body from the environment is necessary (e.g. Ebola virus risk), gas-tight clothing should be used: type 1 or 2, according to the classification for chemical protective clothing.

The analysis of risk and exposure of a worker may also show that only partial body protection is sufficient for his protection [49].

At present, various protective suits are being delivered to police units **(Fig. 64).**

Fig.64

Clothing protecting against infectious agents should be labelled in accordance with the requirements of the relevant standard for chemical protective clothing. In addition, protective clothing against infectious agents should be labelled with the following information **(Fig. 65):**

- Standard number PN EN 14126;
- Type of protective clothing, with the suffix '-B', e.g. Type 3 - B; or the graphic symbol *biohazard* - "protection against biological agents" [49].

Fig.65

Before putting on a protective suit, you should know how to dress it properly. Therefore, the instructions for use **(Fig. 66)** should be read before applying the suit.

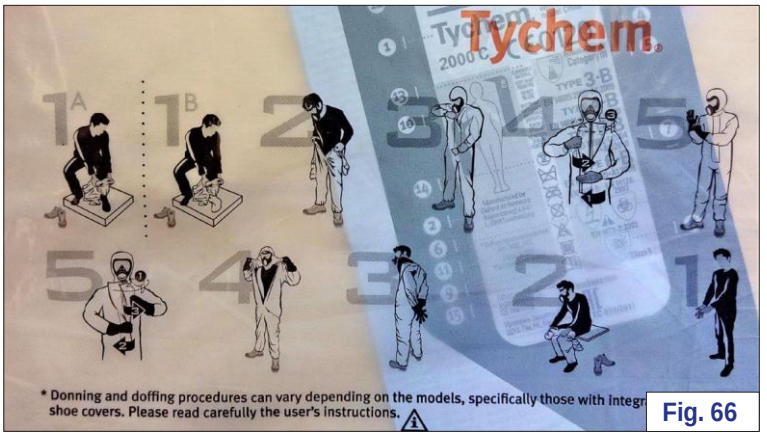


Fig. 66

Procedure for wearing a protective suit

1. **Get ready to wear the suit:**

- Put your sweatshirt inside, pull your socks on the legs of your uniform **(Fig. 67, 68)**;
- Take off your jewelry and watch;
- Wear your hair up;
- If possible, wear ballistic protection underneath your uniform's sweatshirt/uniform to minimize the number of items on the uniform;
- Unlace your shoes (this will make it easier to take off and put on the shoes quickly).

Fig. 67


Fig.68

2. **Select the appropriate size of the suit (preferably one size larger than recommended by the manufacturer, so that it does not hinder movement during the intervention, thus reducing the risk of damage).**

3. **Check the packaging of the suit for damage.**

4. **Apply hygienic hand washing/disinfection.**

5. **Put the first pair of gloves on your hands.**

6. **Start putting on your protective suit beginning with legs. Take off and put on your shoes alternately (Fig. 69). Try to dress the suit in a sitting position (to avoid touching other surfaces, e.g. building walls).**


Fig.69

7. **Put on the suit (without stretching the hood over your head) (Fig. 70).**


Fig.70

8. **Tie your shoes, and put your shoelaces in the shoe top. The legs of the suit should cover the upper of the shoe (Fig. 71).**


Fig.71

9. **Put on your shoe protectors and secure them. By tying the straps on the boot protectors, do not tie them too tightly so as not to disturb the blood circulation in the limbs (Fig. 72).**


Fig.72

10. **Put on the FFP2/ FFP3 filter respirator (Fig. 73).**

Fig.73

11. **Wear goggles/glasses (Fig. 74).**

Fig. 74

12. **Pull the hood on your head.**

13. **If the suit is equipped with additional adhesive tapes to increase tightness, break off the adhesive tape and fit the adhesive tapes to the suit. Check the whole suit (Figures 75, 76).**

Fig.75

Fig.76

14. **Put on your belt and your service equipment (Fig. 77).**


Fig.77

15. **If the suit has additional loops in its sleeves, put them on with your thumbs (Fig. 78).**


Fig.78

16. **Disinfect hands (with the gloves on) (Fig. 79).**


Fig. 79

17. **Put on another pair of gloves by pulling the gloves over the sleeve cuffs (Fig. 80).**

Fig.80

18. **You're ready to go (Fig. 81).**

Fig. 81

19. **If you have such possibility, reinforce with a wide adhesive tape, preferably SCAPA type, the cuff and glove joints. Do this with a second police officer or alone. Leave the ends of the tape attached in such a way so that they can be torn off with one hand (Figures 82-84).**
After securing your wrists with tape, disinfect your hands again!


Fig. 82


Fig. 83


Fig.84

20. **In case of long-term common action wearing protective suits of members of different formations/services, it is proposed to write with a marker on the suit or to stick the words "Police" in a visible place on adhesive tape (to identify the service).**

Procedure for taking off the protective suit

1. **Take off the suit in a place safe for the environment and for you.**

2. **If possible, spray the suit with an alcohol-based disinfectant (in order to reduce the risk of virus infection when removing it).**

3. **Pull down the belt and the service equipment and put it in a safe place.**

4. **Unlock the shoe protector and gently tear the wrist straps (if used) (Figures 85, 86).**


Fig.85


Fig. 86

5. **Peel off the reinforcement tapes placed on the suit. Gently unzip the suit all the way down. Grasp the tip of the hood with your fingers and pull it off from the head (Figures 87-89). Roll the hood out carefully.**

Fig. 87

Fig.88

Fig. 89

6. **Pull the shoulders all the way back. Grab with your fingers the back of the suit. Pull the suit off by pulling it from the inside out (Fig. 90-92).**

Fig.90

Fig. 91

Fig. 92

7. **Get out of the suit, leaving the outer part wrapped up inside (Figures 93, 94).**


Fig.93


Fig.94

8. **Take off the first layer of gloves, leaving them inside the sleeves of the suit (Fig. 95).**


Fig.95

9. **Check the gloves for damage (Fig. 96).**


Fig. 96

10. **With care, place the suit in the red bag (for disposal) (Fig. 97).**


Fig. 97

11. **Disinfect the gloves (Fig. 98).**

Fig.98

12. **Take off your goggles/glasses and put them in a safe place (Fig. 99).**

Fig. 99

13. **Remove the respirator and throw it in the red bag (for disposal) (Figures 100, 101).**

Fig.100


Fig.101

14. **Tie the red bag tightly (Fig. 102).**


Fig.102

15. **Disinfect the gloves again, take them off and place the previously tied bag with the gloves in a second bag (Fig. 103, 104). Then tie the bag tightly (Fig. 105).**

Fig. 103


Fig.104


Fig. 105

16. **Disinfect hands (Fig. 106).**


Fig. 106

Attention!

If, after removing the first layer of (primary) gloves, you detect that they are damaged, you must remove them immediately and disinfect your hands (Fig. 107-109).
Then follow the steps described in points 11-16.


Fig.107


Fig.108


Fig.109

Attention!

1. Personal protective equipment when accompanying the body of a deceased person

The recommendations of Chinese experts on the procedure for dealing with the bodies of deceased suspects or confirmed COVID-19 patients are extremely important. They stress that staff must ensure that they are fully protected by wearing: work clothes, disposable surgical caps, disposable gloves and thick rubber long-sleeved gloves, disposable medical protective clothing, medical respirators or respiratory air purifying devices, protective face shields, work shoes or rubber boots, waterproof shoe covers, waterproof insulation aprons, etc. [22].

CHAPTER 4

Inactivation methods for SARS-CoV-2

Since SARS-CoV-2 is the new pathogen that humanity is facing for the first time, most of the information on its susceptibility must be based on research conducted on very similar coronaviruses - SARS-CoV and MERS-CoV.

The range of persistence of SARS-CoV and MERS-CoV viruses on various surfaces based on a number of tests was described in detail in the work of Otter's team in 2016 [50]. In the case of protective clothing, SARS-CoV was able to survive in standard conditions for up to 48 hours, similarly for paper materials. The same survival time of MERS-CoV was observed on plastic and steel materials. Humidity is an important element in the survival of the virus. In extreme cases, when the SARS-CoV virus occurs in samples with high humidity, its survival time is up to 96 hours [51]. However, Rabenau et al. presents the SARS-CoV survival capacity under dry conditions for even 9 days [14].

To sum up, MERS-CoV and SARS-CoV have the ability to survive for a long time even on a dry surface, which is dangerous and requires effective disinfection methods.

Disinfection is one of the most frequently used methods to effectively prevent the transmission of microorganisms. The mechanism of their destruction in the process of physical disinfection is based on protein denaturation (temperature) and nucleic acid destruction (UV radiation). Chemical disinfectants destroy pathogens as a result of the disintegration of the envelope, inactivation of proteins and/or damage to nucleic acids. The majority of preparations present at least two target sites, which leads to inactivation of the pathogen and reduces the risk of increasing resistance [7].

4.1. Chemical disinfection

For the COVID-19 isolation area, Chinese specialists recommend disinfection procedures:

1. Floors and walls [22]

- Remove visible contaminants completely before disinfection and follow procedures to remove spilled blood and body fluids.
- Disinfect the floor and walls with a disinfectant containing 1000 mg/l chlorine by washing the floor, spraying or wiping.
- Make sure that disinfection is carried out for at least 30 minutes.
- Disinfect 3 times a day and repeat the procedure when contamination occurs [22].

2 Object surfaces [22]

- Remove visible contaminants completely before disinfection and follow procedures to remove spilled blood and body fluids.
- Wipe the surfaces of objects with disinfectant containing 1000 mg/l chlorine or wipe with active chlorine; wait 30 minutes and then rinse with clean water. Disinfect 3 times a day and repeat the procedure when contamination occurs.
- First wipe the less polluted areas and then the more polluted ones: first wipe the surfaces of objects that are not frequently touched, then the surfaces of frequently touched objects. After cleaning the surfaces of objects, replace the used cloth with a new one [22].

In turn, procedures of removing spilled blood or fluids from COVID-19 patients recommended in cases as follows [22]:

- **spillage of small volume (< 10 ml) of blood or body fluids**

(1) Option 1: Cover the spill with chlorine-containing disinfectant wipes (active chlorine 5000 mg/l) and carefully remove, then wipe the surface of the object twice with chlorine-containing disinfectant wipes (active chlorine 500 mg/l).

(2) Option 2: Carefully remove spills with disposable absorbent materials such as gauze, cloths, etc., soaked in a disinfectant solution containing 5000 mg/l chlorine [22].

- **large volume (> 10 ml) of blood or body fluids [22]**

(1) First, place the signs indicating the spill site.

(2) Perform disposal procedures according to option 1 or 2:

- Option 1: Absorb spilled liquids for 30 minutes with a clean absorbent towel (containing peracetic acid, which can absorb up to 1 l of liquid/ manual) and then clean the contaminated area.
- Option 2: completely cover the leak with disinfectant powder or whitening powder containing water-absorbing components, or completely cover with disposable water-absorbing materials; then pour a sufficient amount of chlorinated disinfectant containing 10000 mg/l on the absorbent material (or cover with a dry towel to be subjected to high level disinfection). Leave for at least 30 minutes before carefully removing the leak.

(3) Faeces, secretions, vomiting, etc. from patients should be collected in special containers and disinfected for 2 hours with a disinfectant containing 20 000 mg/l chlorine (secretion/disinfectant ratio 1 : 2).

(4) After the spills have been removed, disinfect the surface of the contaminated environment or objects.

(5) Contamination containers can be soaked and disinfected with an active disinfectant containing 5000 mg/l chlorine for 30 minutes and then cleaned.

(6) Remove collected contaminants as medical waste.

(7) Place used objects in two-layered medical waste bags and dispose of as medical waste [22].

4.1.1. Disinfection of coercive means and firearms

Disinfection of coercive means, firearms and all equipment that was exposed to SARS-CoV-2 should be carried out:

- in a place designated for that purpose, duly marked;
- agents based on ethyl or isopropyl alcohol (according to their intended use and the rules of use described by the manufacturer), or using UVC-radiated bactericidal lamps;
- When disinfecting the above mentioned equipment, a police officer should use personal protective equipment (PPE) adequate to the risk of infection **(Fig. 110);**
- After disinfecting coercive means and firearms, the police officer must ensure that the equipment is properly maintained in accordance with the manufacturer's recommendations, so that it is ready for use.

Fig.110

Also goggles/glasses should be disinfected for further use.

After disinfecting the equipment, the officer should disinfect hands, apply hygienic hand washing and then disinfect them again [52].

For proper disinfection of coercive means, service weapons and other hand-held equipment, a plastic box can be used to prevent the disinfectant from floating on other surfaces **(Fig. 111).**

Fig. 111

4.2. Application of UVC radiation

Ultraviolet is an electromagnetic wavelength from 10 to 400 nm, which corresponds to an energy range of 30 eV to 3 eV. They occur outside the visible range of the spectrum, which is between visible light and X-rays. Depending on the wavelength, three basic types of UV radiation are distinguished [53]:

- UVA, with a wavelength of 320-400 nm, which accounts for 95% of all ultraviolet radiation reaching the Earth's surface; it causes many chemical reactions of exposed substances, e.g. luminescence, and influences pigmentation and photo ageing of the skin;
- UVB, with a wavelength of 280-320 nm, representing 5% of all ultraviolet radiation reaching the Earth's surface; its proven beneficial effect on the skin is to enable the synthesis of vitamin D3, essential in the process of assimilating calcium and phosphorus, which is used in medicine and animal husbandry;
- UVC, with a wavelength of 200-280 nm, is naturally almost non-existent on the Earth's surface because it is completely absorbed by the atmosphere, as is vacuum and long-range UV radiation; it destroys, among other things, the structure of nucleic acids, which prevents the multiplication of viruses, and the most effective radiation wavelength is 265 nm.

The effectiveness of the method of disinfection by UVC radiation depends on many factors which determine the size of the dose acting on the pathogen. The most important ones include: irradiation time, intensity of UV radiation, distance from the radiation source, type and area of the surface [53].

In 2004 Darnell et al. applied different ultraviolet wavelengths to SARS-CoV viruses, only UVC light of 254 nm, with a power of 4016 µW/cm^2, at a distance of 3 cm from the contaminated surface was effective. Full inactivation of the virus was observed after only 15 minutes of exposure. This is related to the damage to the virus RNA. The same studies have shown that in the samples treated with γ radiation from the cobalt-60 source, there was no destruction of the virus, which undermines the possibility of using γ ionizing radiation as a means to inactivate this type of viruses [54].

It should be remembered, however, that the radiation of bactericidal lamps (UVC), which falls on biological tissue (human skin and eyes), can lead to harmful effects on health. Therefore, exposure limits have been established, the so-called maximum permissible exposure (MDE) to UV radiation (contained in the Regulation of the Minister of Family, Labor and Social Policy of 12 June 2018 on the maximum permissible concentrations and intensities of factors harmful to health in the working environment - Journal of Laws 2018 item 1286). During a working shift (regardless of its duration) UV radiation (dose) may not exceed 30 J/m^2. In the currently available materials, as administered by the Chinese National Health Commission, rooms should be disinfected with direct ultraviolet radiation at irradiance of more than 1.5 W/m^2 for at least 30 minutes. This means that the necessary dose to eliminate coronaviruses is at least 2700 J/m^2 (equivalent to 90 times the MDE value of 30 J/m^2). Therefore, a person must stay in a room disinfected with direct UVC radiation. Instead of directly exposing the surface, a safer solution involving the use of germicidal luminaires with a forced airflow function is possible. In these luminaires, air disinfection takes place in a closed casing - a chamber preventing penetration of UVC radiation outside the luminaire, thanks

to which during the disinfection process there is no exposure of people in the room to the influence of UVC radiation emitted by the luminaire [55].

The idea that can now be implemented is to create so-called dryers, i.e. rooms:

- separated in police organizational units, in which after service police officers would hang their clothes, lay out coercive means and service weapons;
- where, after the above equipment has been properly arranged, UVC lamps would be switched on to illuminate the unfolded equipment and uniforms;
- meeting the relevant ventilation and cleaning standards **(Fig. 112-114).**

Fig.112


Fig.113

Fig.114

Equipping police units with this type of lamp would result in any police officer fearing that he might have a dangerous pathogen on his clothes/equipment, being able to effectively deactivate it within a dozen or so minutes without having to touch and take the equipment outside the unit.

The virus can also be carried by documents, a person's personal belongings and many other items that a police officer/police employee may have contact with.

Mobile UVC lamps enable deactivation of pathogens in different rooms, without the need to move objects only to a designated place.

Another possible idea is to place lamps in police carts as an alternative to ozone. However, this would require the consultation and opinion of the manufacturers of individual car brands being used by the police on UVC resistance of the interior materials of official vehicles (power/lighting time).

Equipping the units with anti-microbial lamps (UVC) would not only be an ad hoc action to combat COVID-19, but would also protect police units in the event of other potential biological risks at a later stage.

4.3. Ozone exposure

The efficacy of ozonation against a wide range of viruses, including those composed of single-stranded RNA, was demonstrated at the concentration of 25 ppm during 15-minute exposure [56]. During the current epidemic in China, room ozonation started to be highly effective - according to some data appearing on the Internet, including governmental websites of the People's Republic of China, ozonation inactivates the virus in over 99% and was successfully used in the fight against the SARS-CoV-2 epidemic. This seems highly probable, as ozone as a strong oxidant will cause damage to the lipid layer and disintegration of the virus structure.

Many manufacturers of ozone equipment claim that the effectiveness of the SARS-CoV virus has been confirmed by as many as 17 scientific studies. Unfortunately, these studies cannot be found in any databases, hence the assumption that this is a marketing trick. Nevertheless, it seems that high doses of ozone should be effective.

The high ozone efficiency, which is non-invasive for many materials, can be a solution for decontamination of rooms and materials sensitive to chemicals.

Portable ozonators may be one of the means of eliminating coronavirus particles from the interior of company vehicles.

Ozone generator produces ozone, called active oxygen, with the symbol O_3, which differs from ordinary oxygen in that the oxygen has a permanent O_2 form. The half-life of ozone is 40 to 30 minutes in air and 30 to several minutes in water. In this way, after 2 hours, the ozone produced almost completely returns to natural oxygen, fulfilling at that time the function of a powerful sterilizer and oxidant [56, 57].

Many studies have shown that ozone has a bactericidal effect, removes or reduces viruses, fungi, molds, mites, dust and pollen allergic to air and water, and as a gas it reaches both food products and any object in the ozone room. As one of the strongest oxidants, it removes all odors of organic and inorganic origin, including tobacco, from animals and birds, fire, flood and others [56].

4.4. High temperature exposure

Although the virus surface proteins performing the main function infecting cells and should be inactivated (protein denaturation) already at temperatures above 40°C, its lipid envelope makes a higher temperature necessary to inactivate the virus. The research conducted on SARS-CoV shows that full inactivation takes place only after 45 minutes at 75°C, which makes the virus extremely resistant to thermal conditions. This of course depends on the environment in which it occurs, but the most optimal scenario for virus survival should always be taken [54]. Kariwa et al. performed the analyses of 56°C temperature effects - already after 5 minutes, the virus's ability to infect was decreased; however, full inactivation was observed only after 60 minutes [58].

Therefore, the deactivation of the coronavirus by ironing is rather missed, given that the graphic sign on the iron:

- one dot - means that the maximum ironing temperature is 100°C; fabrics ironed at a temperature not higher than 100°C: polyamide, polypropylene, acetate fiber, flexible opamide;
- two dots - maximum ironing temperature up to 150°C; at this temperature we iron: silk, wool, viscose, polyester, trio acetate;
- three dots - maximum ironing temperature up to 200°C; cotton and linen are ironed at this temperature [59].

The temperature ranges described basically exclude thermal methods for deactivating the virus on certain materials.

Taking into account the markings on the exercise uniform (new formula), ironing in a more undefined state may deactivate SARS-CoV-2, but there are no studies indicating the effectiveness of this method **(Fig. 115).**

Fig.115

High temperature action (ironing) will be the best home-made way to deactivate pathogens on cotton masks, which are distributed among different environments as a substitute for personal respiratory protection. Of course, ironing should be preceded by high temperature laundering. An additional element that can increase the effectiveness of thermal destruction of the virus is to increase the steam output when ironing clothes.

4.5. Hydrogen peroxide gas

Hydrogen peroxide, due to its oxidizing properties in relation to organic molecules, seems to be an ideal compound for virus inactivation. The studies carried out on the TGEV pig coronavirus have shown that the applied gaseous hydrogen peroxide is a very effective method of coronavirus inactivation. However, due to the very basic nature of studies, it is difficult to determine the treatment parameters [60]. This method is recommended by the Korean sanitary inspection for the MERS-CoV disinfection procedure [61].

CHAPTER 5

Basic COVID-19 resuscitation procedures for a COVID suspect

Rescue operations are an important part of police work. The quick and correct reaction of witnesses to the incident has an impact on the survival of the injured person, especially in case of sudden cardiac arrest (SCA). US and European studies indicate that well-trained police officers in first aid and *automated external defibrillators* (AEDs) are effective in supporting civilian emergency teams [62-64]. Different countries use the mobile capabilities and availability of officers for medical tasks. Their prompt and professional action is reflected in increasing the survival of SCA survivors, especially in public places.

At the beginning of March 2020, the British Resuscitation Council proposed to modify the algorithm of basic resuscitation procedures, taking into account the victim who may have a suspected or confirmed diagnosis of COVID-19 [65].

Taking into account recommendations for basic adult resuscitation, the officer should implement the following scheme:

1. Assess safety: disinfect hands, use personal protective equipment (PPE) - wear gloves, FFP2/FFP3 respirator, goggles/protective goggles.
2. Assess the person's consciousness.
3. Clear the airway.
4. Evaluate the breathing of the injured person from a distance (observe for 10 seconds chest movements, coughing reflexes).
   Keep away from the victim's nose and mouth **(Fig. 116).**

Fig. 116

5. Call an emergency medical team to the scene.
   - If a police officer has obtained information that a person is sick with COVID-19 or is highly likely to be a carrier of SARS-Cov-2, he should immediately pass this information on to a medical dispatcher.
   - Put the AED in place.

6. Before starting basic resuscitation, the police officer should put a surgical mask or other element/material on the victim's face to prevent splashing of secretions from the victim's mouth and nose **(Fig. 117).**


Fig. 117

7. Connect the AED and follow its instructions **(Fig. 118).**


Fig.118

8. Start CPR by applying continuous chest compressions to the injured person (2 hands, rate 100-120/min, compression depth 5-6 cm) **(Fig. 119).**

Fig. 119

Attention!

- If there are any residual excretions/secretions of the affected person after the rescue operation, they must be disinfected according to valid rules.
- A police officer should take off his clothes with personal protective equipment according to safety rules.
- Disinfect rescue equipment with alcohol-based agents.
- After completing the activities, the officer should disinfect hands.
- Contact a sanitary and epidemiological station to determine the risk of infection and to further prevent possible infection.

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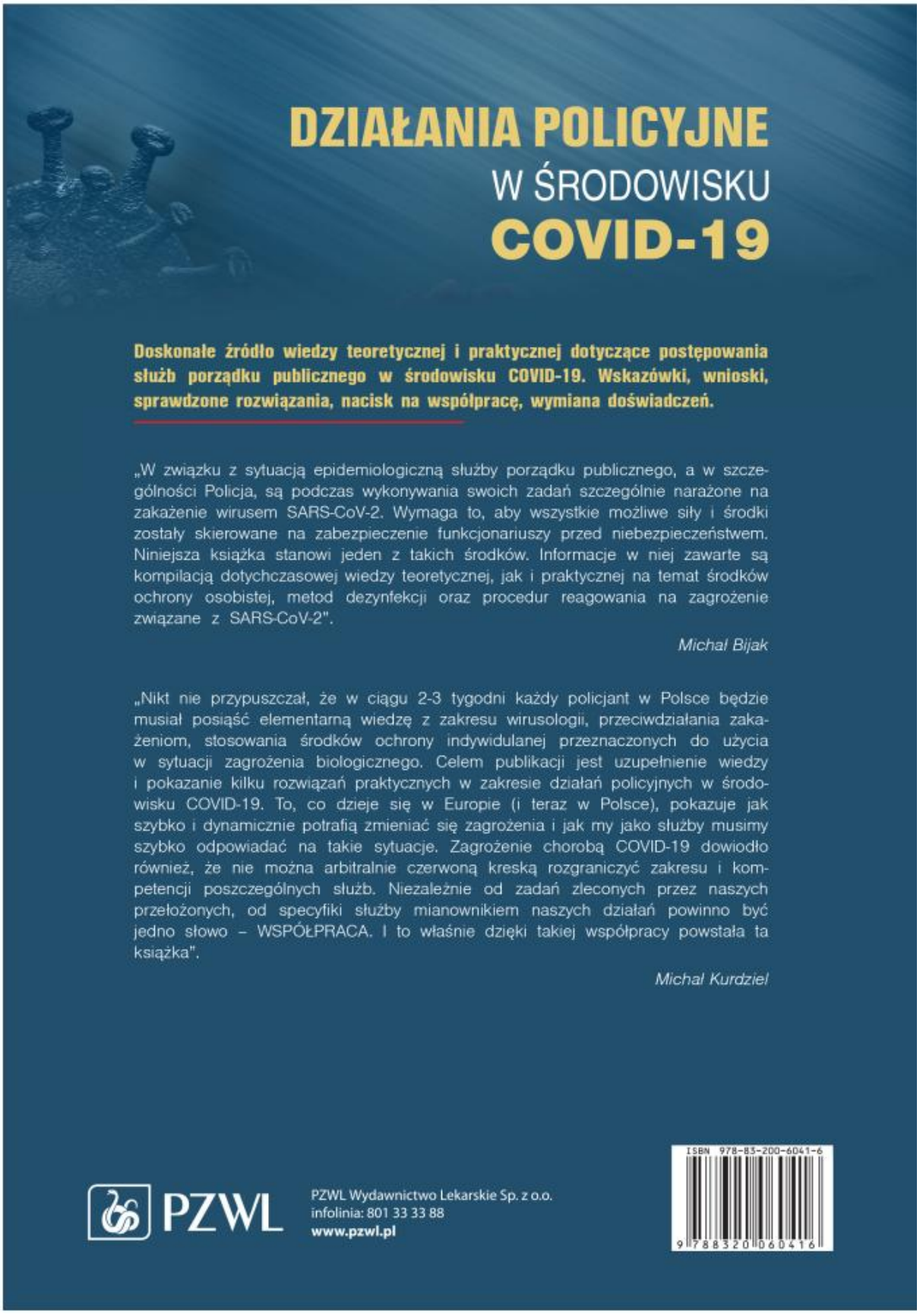
DZIAŁANIA POLICYJNE
W ŚRODOWISKU
COVID-19
Doskonałe źródło wiedzy teoretycznej i praktycznej dotyczące postępowania służb porządku publicznego w środowisku COVID-19. Wskazówki, wnioski, sprawdzone rozwiązania, nacisk na współpracę, wymiana doświadczeń.
„W związku z sytuacją epidemiologiczną służby porządku publicznego, a w szczególności Policja, są podczas wykonywania swoich zadań szczególnie narażone na zakażenie wirusem SARS-CoV-2. Wymaga to, aby wszystkie możliwe siły i środki zostały skierowane na zabezpieczenie funkcjonariuszy przed niebezpieczeństwem. Niniejsza książka stanowi jeden z takich środków. Informacje w niej zawarte są kompilacją dotychczasowej wiedzy teoretycznej, jak i praktycznej na temat środków ochrony osobistej, metod dezynfekcji oraz procedur reagowania na zagrożenie związane z SARS-CoV-2".
Michał Bijak
„Nikt nie przypuszczał, że w ciągu 2-3 tygodni każdy policjant w Polsce będzie musiał posiąść elementarną wiedzę z zakresu wirusologii, przeciwdziałania zakażeniom, stosowania środków ochrony indywidulanej przeznaczonych do użycia w sytuacji zagrożenia biologicznego. Celem publikacji jest uzupełnienie wiedzy i pokazanie kilku rozwiązań praktycznych w zakresie działań policyjnych w środowisku COVID-19. To, co dzieje się w Europie (i teraz w Polsce), pokazuje jak szybko i dynamicznie potrafią zmieniać się zagrożenia i jak my jako służby musimy szybko odpowiadać na takie sytuacje. Zagrożenie chorobą COVID-19 dowiodło również, że nie można arbitralnie czerwoną kreską rozgraniczyć zakresu i kompetencji poszczególnych służb. Niezależnie od zadań zleconych przez naszych przełożonych, od specyfiki służby mianownikiem naszych działań powinno być jedno słowo – WSPÓŁPRACA. I to właśnie dzięki takiej współpracy powstała ta książka".
Michał Kurdziel
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[Translation of back cover]

Police actions in COVID-19 environment

An excellent source of theoretical and practical knowledge on the conduct of law enforcement services in the COVID-19 environment. Tips, conclusions, best practices, emphasis on cooperation, exchange of experience.

Due to the epidemiological situation, law enforcement services, and in particular the Police are particularly vulnerable to SARS-CoV-2 infection during their activities. This requires that all possible forces and resources be directed towards protecting officers from hazards. This book is one such measure. The information contained herein is a compilation of existing theoretical and practical knowledge about personal protective equipment, methods of disinfection and procedures for responding to the risks associated with SARS-CoV-2.

Michał Bijak

No one expected that within 2-3 weeks every police officer in Poland would have to acquire elementary knowledge of virology, prevention of infections, use of personal protective equipment intended for use in a biological emergency. The aim of the publication is to supplement the knowledge and show several practical solutions for police actions in COVID-19 environment. What is happening in Europe (and now in Poland) shows how quickly and dynamically hazards can change and how we, as services, must respond quickly to such situations. The threat of COVID-19 has also proved that it is impossible to arbitrarily delineate the scope and competences of individual services with a red line. Regardless of the tasks assigned by our superiors, the denominator of our actions should be one word - COOPERATION. And it is thanks to such cooperation that this book was created.

Michał Kurdziel