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PROTECTION OF LIBRARY COLLECTIONS AND READERS DURING THE PANDEMIC PERIOD

Abstract. During the pandemic, the activities of the Collection Preservation Division (CPD, hereinafter also the Collection Preservation Division) of the National Library of the Czech Republic (NL CR) and its three departments focused on minimizing the risk of employees, readers, researchers getting infected with COVID-19. The standard task of the Collection Preservation Division staff is to take care of the good physical condition of library collections and to provide methodological assistance in this area for the entire extensive libraries network throughout the Czech Republic. The aim is to prevent damage to library collections and to provide conditions needed for their permanent preservation for future generations.
During the COVID-19 pandemic, the search for facility disinfection options, the provision of hand sanitizers for employees and the establishment of preventive measures against the spread of the disease inside and between buildings became a priority. An important part of the work of the Collection Preservation Division was specific consulting and planning of individual steps to support the decision-making of the crisis staff of the National Library of the Czech Republic.

Introduction

The coronavirus pandemic affected the activities of all libraries and other cultural institutions, museums, galleries, and monuments not only in the Czech Republic, but all over the world. Most public libraries were closed in the spring of 2020 (March to May) and then during the next wave in the fall and winter of 2020. This situation continued in 2021 with an ordered lockdown, and we anticipate further restrictions on physical public access to libraries at the beginning of winter 2021. The National Library of the Czech Republic (hereinafter NL CR) was closed to readers from 11 March to 2 May 2020 and then in the autumn of 2020 (from 18 December to the end of 2020). Cultural and educational events (exhibitions, workshops, conferences, seminars) were also closed and canceled, since there was a risk of gathering a greater number of people. For several weeks at the beginning of 2021, a window was opened for lending of books without letting public inside the building, but in the end, due to the deteriorating situation, the National Library of the Czech Republic closed again. This regime was also in the spring of 2021, when NL CR closed again on March 6, 2021. The gradual opening to the public took place from mid-April, when this was made possible by the improving pandemic situation and the gradual loosening of government measures.

When the NL CR was closed, the library collections were made available to the public in digital form within the project “National Digital Library for University Students”, which in this period made it possible to partially replace physical access to library collections. The National Library of the Czech Republic is used mainly by researchers, teachers and university students, so immediate availability of the collection was essential. The digital library was made available to these users as early as spring 2020, and the access was possible until the beginning of 2021. More than 216 000digitized documents contained in the National Digital Library were made available, including the latest works protected by copyright law. These were titles published in the Czech Republic. Users had to prove that they were students or researchers by registering through a school or research institution. Up to 103 institutions were involved. Digitized documents could not be downloaded or printed.This exceptional access, possible only during the state of emergency, was could be made thanks to a special license agreement between the NL CR and the collective copyright administrators DILIA and OOA-S. In the first weeks, up to 10,000 visitors per day were recorded, but gradually the number of visitors stabilized at around 5,000 visitors. More than 76% were accessed from a computer, over 20% from a mobile phone and only about 2% from a tablet. In the 2020 survey, 87% of services were rated positive, 10.6% were neutral and only 1.8% of respondents rated the service negatively.After the end of the state of emergency, this project was replaced by the unlimited “National Digital Library - DNNT” project, where registered library readers can gain access to works that are not available on the market (access is not limited by copyright), published in the Czech Republic until 1989. Full texts of documents (books, magazines, newspapers, etc.) published on the territory of the Czech Republic, as of 1 February 2021 book editions up to 2007 (periodicals - editions up to 2010). These are documents that are protected by copyright (ie 70 years after the author's death) and that are not available on the market, including other editions, possibly modified or electronic. In addition, the full texts of documents that are so-called free (no longer protected by copyright) are accessible from the NDK interface. The condition of the service is the registration of the user in the library, which has a contract for the provision of NDK-DNNT services with the National Library of the Czech Republic. It is a free service, supported by Ministry of Culture.The staff of the Collection Preservation Division considers the study of electronic resources to be a preventive measure in order to keep the originals in good physical condition and, during the pandemic, also an appropriate measure against the spread of contagious diseases. Improving and accelerating digitization leads to the rescue of physical originals in good physical condition, because the originals are stored in depositories, in stable climatic conditions and there is no manipulation with them.

During the emergency state, the staff of the Collection Preservation Division of the NL CR worked from home to create searches, protocols and reports, publishing activities; however, some activities in the field of library collection protection were continued as long as possible (restoration, bookbinding and rebinding, manufacturing protective covers, experimental activities in laboratories, etc.). The Collection Preservation Division has a structured workplace where activities can be planned so that employees do not come into contact. During the lockdown, the staff took turns to work from home so that the basic activities of the individual Collection Preservation Division were maintained.

In the future, we anticipate that nationwide measures against the widespread development of infection will generally result in financial losses that will have an impact on culture and education.

Collection Preservation Division (CPD)

Working team of CPD is included in the organizational structure of NL CR in the Library Collection and Services section and includes three departments:

- Department of Development and Research Laboratories
- Restoration department
- Preventive Conservation department

The Collection Preservation Division of NL CR has 21 employees of various professions - conservators, restorers, microbiologists, scientists in the field of restoration technology, bookbinders, climatologists, and more than 70 people of a number of professions working on projects in the field of library collection protection.
The library collections of NL CR, more than 7.5 million documents, are located in three buildings with different age, location, building construction and type of masonry, etc. The Clementinum is a large Baroque complex of buildings in the center of Prague; the Central Depository in Hostivař presents several modern air-conditioned buildings on the outskirts of Prague in the industrial area and the Reserve Depository in Neratovice (30 km from Prague) is an air-conditioned building outside Prague.

CPD staff take care of the library collections and their good physical condition. Thus preventing damage to library collections. The Collection Preservation Division is also a methodological and advisory center in the field of protection of library collections for an extensive network of libraries in the Czech Republic. In a pandemic situation, however, it was necessary to concentrate all efforts on minimizing the risk of staff, readers and researchers getting infected, but also to continue in the care for library collections.

Activities of the NL CR and the CPD during the pandemic

Since the spring of 2020, specifically since 16 March 2020, the activities of the Collection Preservation Division focused on “first aid” in libraries during a pandemic.
The priority of all activities was the protection of staff and their health. The Crisis HQ of the NL CR followed the recommendations of the Ministry of Culture of the Czech Republic, the Ministry of Health of the Czech Republic, the State Health Institute of the Czech Republic and the Institute of Public Health of the City of Prague and other public health authorities.

All employees were advised to use the 3 rules for safety - frequent hand washing and using hand sanitizers, using of protective face masks (wearing respirators in the premises of the NL CR was later made obligatory), social distancing (two meters minimum) and restrictions on staff meetings (six people maximum).
Library staff sent a number of inquiries to the Collection Preservation Division, regarding the risks of handling books that were returned from readers or sent as part of out-of-library lending, hard copies, etc., as well as the activity of the new virus.There are more than 5,000 libraries in the Czech Republic, and dozens of inquiries were received. Inquiries were also made from abroad.

The most common questions were:

- How to perform disinfection? What disinfectants should be used? The questions were regarding methods of using alcohol, UV-A radiation, gamma radiation, ozone, etc.
- Are books from readers dangerous for staff? How to safely handle books after returning from readers?
- What should be the conditions and length of book quarantine?
- How long can the virus survive on books surface, or different book materials?

- How are the materials from which books are made affected by disinfection?

The first activity was to find answers to the questions of how to protect yourself, or rather librarians at the time of the coronavirus threat, when handling books. Aerosol transmission of SARS-CoV-2 isconsidered to be one of the most important ways of its spread, along with contact and droplet infection. Aerosols are tiny particles dispersed in the air. Human creates an aerosol not only when coughing or sneezing, but also during breathing. Some of these particles may carry a virus. On the basis of research and study of professional articles and publications, several principles were formulated, which became part of the manual on how to protect yourself, or librarians, during coronavirus pandemic when handling books. The following principles and steps have been defined:

- It is necessary to use protective equipment, especially gloves (plastic, latex, surgical), masks, respirators.
- It is necessary to wash your hands thoroughly with soap and warm water, for a long enough time and wash the whole hand.
- It is necessary not to touch the face, eyes, mouth, etc., where the virus can enter the body.
- It is necessary not to sneeze openly, but into a tissue and then to throw it away.
- Transporting books, for example from Asia or other risk areas, does not increase the risk of virus transmission: the transportation time is long enough, there is radiation and dry air, as well as radicals and lower temperature in the plane that act as a disinfectant, so the virus lifetime is short (an above all, the virus is not in a body, where it can survive for a longer period).
- Disinfectant gels act mainly on bacteria. Effective disinfectant against viruses is reported to be an industrial disinfectant such as https://www.schuelke.com/de-de/produkte/desderman-pure.php or a World Health Organization (WHO) disinfectant solution which was made for the employees of NL CR directly in its laboratories according to the WHO recipe.

Furthermore, on the basis of research and study of professional articles and publications, it was defined how to manipulate books at the time of coronavirus threat:

- According to an expert article by Kampf et al. 2020, coronaviruses found on a surface can be infectious for up to 9 days. on a paper, persistence (resistance) is a maximum of 4-5 days at room temperature.
- Recommended procedure for returning books potentially affected by coronaviruses: Library staff who handle delivered books always wear protective latex gloves (surgical). New gloves should be worn whenever old gloves have been removed.
- Surfaces that come in contact with potentially virulent books should be disinfected with a 70% ethanol spray (about once an hour).
- The openings in the waste bins where the gloves are stored should also be sprayed with 70% ethanol, especially before the cleaning staff removes the waste - and inform the cleaning company that the waste is potentially virulent so that they know they are to be protected.
- A decision should be made on where the returned books will be quarantined, then the books should be kept there for a period of min. 4-5 days.
- The book cover should also be wiped with a cloth soaked in min. 70% ethanol, but this could be harmful to books and the material, including the prints - beware of “bleeding” (dissolving colored parts of books). The next step in handling

books returned from readers may be to spray the surface of the books with ethyl alcohol (min. 70%). Here it is necessary to pay attention to the presence of colored book parts or various plastics, or softened plastics. It is necessary to leave the treated books air-dry for a few minutes to allow the ethyl alcohol to evaporate.

- The implementation of these measures depends on the local conditions in the libraries, e.g., if there is a room the books can be quarantined or even treated in some way (portable UV light, higher temperature). However, beware of direct exposure to UV radiation or higher temperatures on library collections.
- The study by Lai et al. [Lai, 2005], however, found that "the risk of infection from contact with paper contaminated with droplets is small".

Other disinfection options - verification of the effect on library collections

The activities of CPD staff were also focused on studying the literature on the effects of ozone, gamma radiation and UV radiation on library materials. These researches have already been carried out by colleagues from the laboratories of the National Archives or the University of Chemistry and Technology in Prague; the results of similar researches have been published in foreign publications. The detrimental influence of these factors on the stability of library collections materials has been demonstrated: reduced mechanical properties, disintegration, color change, etc. The question is, why use these dangerous methods when there is a very easy and cheap method - book quarantine. The use of these disinfection methods is not suitable for books that we want to preserve for future generations.

According to a study by Duan et al. [Duan, 2003] it is stated that UV radiation and heat can be effective measures against the stability of the virus on surfaces. Thus, one way to handle potentially infected books could be to expose them to UV radiation for 30-60 minutes - unfortunately, UV radiation has a negative effect on paper, textiles, leather, or books.

The report of the National Archives (NA) entitled "Influence of light and ultraviolet radiation on archival documents" [Ďurovič, 2009] shows:

- The photodegradation process is further supported by the action of oxygen (photooxidation), water, ozone and other gases (NO_x) (p. 113).
- Mechanical damage expressed by a decrease in strength properties depends on the proportion of UV radiation component, especially wavelengths below 340 nm. This is evident from the aging results of cotton yarn (representing "pure" cellulose) in direct daylight and under glass, which filters out radiation with a wavelength shorter than 320 nm40. The glass-protected yarn is 30 to 50% less damaged. However, air cleanliness also plays an important role, especially the content of sulfur and nitrogen oxides, or ozone and free radicals (p. 161).
- Photochemical degradation processes of textile materials take place mostly in the presence of atmospheric oxygen and under the influence of the surrounding atmosphere (presence of ozone, influence of temperature and humidity). The sensitivity of polymers to oxidation is basically determined by the nature of the carbon chain. Saturated straight-chain polymers are the most resistant to oxidation. The most sensitive are diene polymers, i.e. those that contain double bonds in the chain (p. 171).

Even in the case of other materials, especially plastics, ozone is said to be a strong oxidizing agent accelerating photochemical degradation processes. The

procedure reported in the NA report is adapted to prevent damage, but is less effective in terms of disinfection.

From the NL CR report entitled "Influence of atmosphere with reduced oxygen content on the rate of paper degradation" by Ing. Marie Benešová [Benešová, 2010] follows:

- Another factor that significantly affects the rate and course of degradation reactions is the presence of air pollutants in the atmosphere. Sulfur and nitrogen oxides, known as acid-forming oxides, react with the moisture present in the material to form sulfuric acid, nitrous acid and nitric acid. For this reason, based on the results of "The museum environment" project, recommendations were developed for maximum limits of sulfur and nitrogen content below 10 $\mu m/m^3$ and ozone below 0-2 $\mu g/m^3$ (p. 4).
- The use of a UV lamp is not recommended, the so-called bank lamp doesn't act as a disinfectant, it "only" causes damage to paper and changes the colors. Germicidal lamp with hard UV radiation damages colors (makes them disappear), prints, illustrations. It is necessary to apply the radiation to all surfaces (pages) to eliminate all germs and it damages the paper, nevertheless.
- Ozone has strong oxidizing effects on paper, textiles, leather and plastics. The application to books is the problem here. The gas must get to the inner book. Book pages should be fanned out, otherwise germs, including viruses, can survive the treatment and the paper is damaged unnecessarily. Ozone is a poisonous gas (comparable to hydrogen cyanide), so its presence in the inhaled air is very undesirable. It is irritating even in very low concentrations and, when exposed for a longer period, it causes a significant stress on the body because it induces so-called oxidative stress at the cellular level (it generates a higher concentration of free radicals, which can kill the cell). [Kotek, 2018]
- Putting the returned books in quarantine for 4 to 5 days is the simplest and least expensive solution (equipment acquisition cost, electricity, purchasing new books when the treated ones fall apart)[1].

Preparation of disinfectant solution according to WHO

At the beginning of the pandemic, it was impossible to obtain protective equipment or disinfectants. Therefore, after consulting with the General Director of the NL CR, the capacities of the NL CR laboratories were used to produce a disinfectant solution (according to the World Health Organization - WHO) to protect employees (Figure 1) that had to come to work to maintain the necessary activities.

According to the recommendations from the research activities of the NL CR, essential oils (pure substances - Citronellal) were added to the recipe as an antibacterial substance and also for a more pleasant scent of disinfection. After situation with disinfectant production on the Czech market stabilized, the disinfectants were purchased and distributed in the buildings of the NL CR (Figure 2).

Making disinfectant solution from ethanol or propanol, respectively:

- 833.3 ml of 96% ethanol, or 751.5 ml isopropyl alcohol
- 41.7 ml hydrogen peroxide
- 14.5 ml of 98% glycerol
- 110.5 ml of distilled water, or 192.3 ml (if using isopropyl alcohol) of distilled water

[1] The information leaflet is publicly available at https://ipk.nkp.cz/images/manipulace-s-knihami-v-dobe-covid-19

Figure 1. Hand disinfection for employees prepared according to the WHO recipe

Figure 2. Disinfectant preparation according to WHO in the NL CR, in CPD laboratories

Instructions on how to receive books back from readers

Thanks to the study of expert literature and consultations with colleagues in the Czech Republic and abroad, a number of necessary information was obtained about the possibilities of protecting employees and readers from coronavirus infection. From the available information, a procedure was compiled and an illustrative leaflet was prepared, which simply summarizes the necessary measures when returning books at the counter or to the library box. The poster leaflet sets out the steps that should be taken, how to proceed step by step and how to work in libraries risk-free, how to handle returned books during a COVID-19 pandemic.

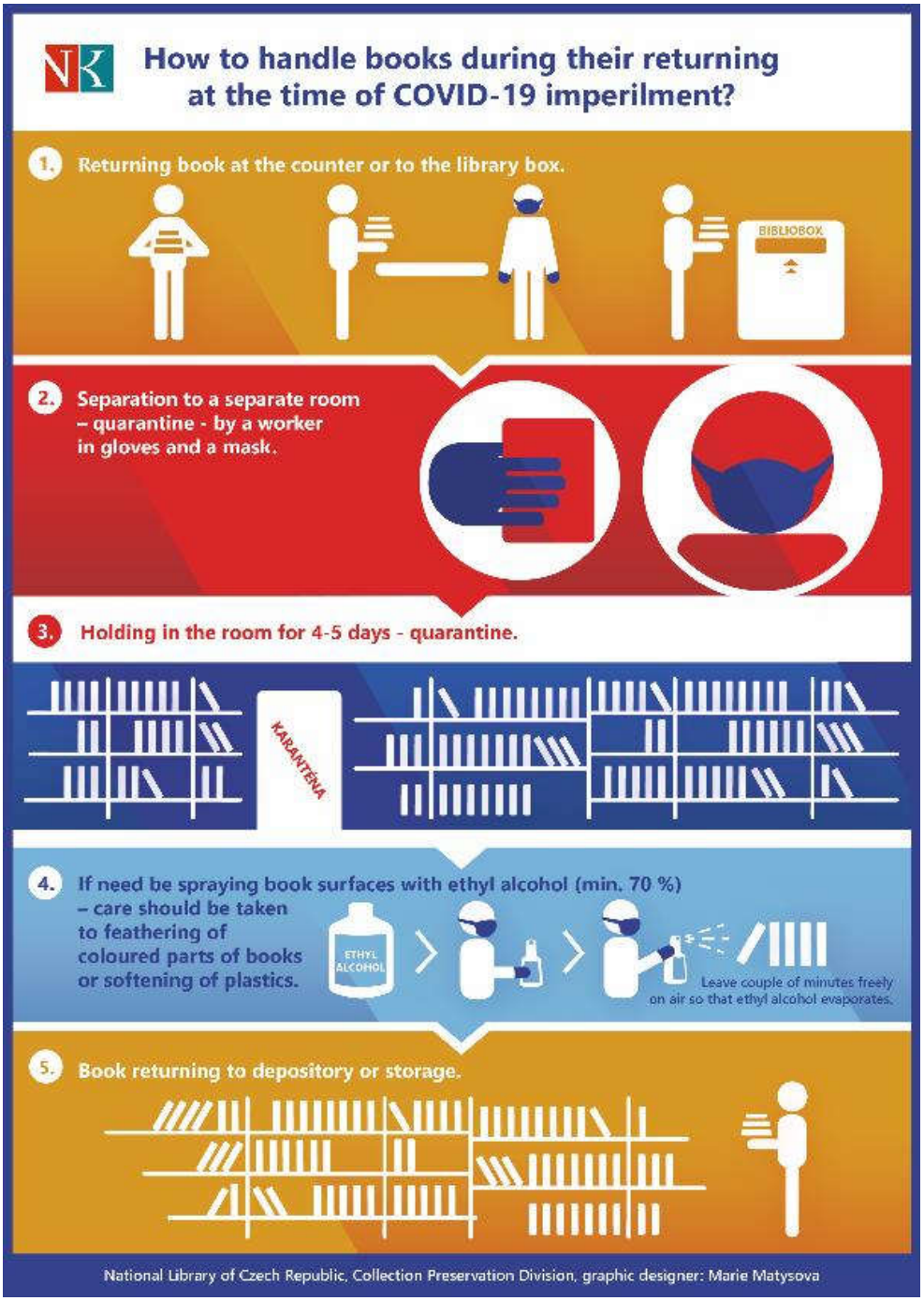

Figure 3. Poster “How to handle books during COVID-19 pandemic”

Figure 3 shows the poster in English. Graphic design was created by graphic artist Bc. Marie Matysová. Questions regarding procedures and access to books as a possible source of infection also came from abroad, from colleagues from other countries and their libraries. Therefore, this poster was translated from Czech into several languages in cooperation with colleagues from Slovakia, Poland and other countries; in addition to English, for example Polish or Slovak variations were prepared.

Colleagues were advised to place the returned books in a separate room in the so-called quarantine and the staff should use gloves and protective masks. The available literature indicates that the effective quarantine period for books is 4-5 days. The quarantine has been introduced for books that were returned by readers due to the results of testing virus survival and stability on various types of surfaces. The length of book quarantine ensuring the virus disappearance was established based on published tests regarding the stability of SARS-CoV-2 virus, resp. SARS-CoV-1 on steel surface, copper and cardboard. [Kampf 2020] The testing was performed on 10 samples in three iterations. SARS-CoV-2 has been shown to be more stable on plastic (laminated covers, book covers, book wrappers, etc.) and steel than on copper or cardboard. On a plastic surface, vital virus was detected 72 hours after application, followed by a rapid reduction (from $10^{3.7}$ to $10^{0.6}$ $TCID_{50}$[2] per milliliter - initial concentration $10^{5.25}$ $TCID_{50}$ per milliliter). On a cardboard, vital virus SARS-CoV-2 was not detected after 24 hours and SARS-CoV-1 after eight hours. However, this is a measurement on the surface, accessible for air that is slowly drying. The article reports a sharp decline in detected vital viruses, but the virus did not disappear completely in some cases. In the case of books, the virus may be present in the inner book, on the inside of the cover, where there is less to no airflow and a more stable temperature and humidity. The detected limit for the virus decline or disappearance is 72 hours, but for prevention reasons, taking into account the specifics of bookbinding, the quarantine period should be at least doubled to increase the security and ensure that the virus is not preserved in the book under certain conditions.

The recommendation of the US Library of Congress shows that time is the best disinfection - and the staff of the NL CR adds that it is also the cheapest. The director of conservation and preventive care at the George A. Smathers Libraries at the University of Florida, Fletcher Durant, recommends quarantine as a sufficiently safe disinfectant for up to 14 days.

These issues were also discussed during several meetings of the working group of the heads of restoration workplaces of European libraries led by Ms. Christy Hoffmann from the Austrian National Library. The discussion shows that library staff in the area of care for the physical condition of the collections were not affected by the COVID-19 disease to a large extent, even though they were still working during the pandemic. This is probably due to the use of protective equipment and adherence to the rules to which they are accustomed from the very essence of their work: they commonly use protective equipment (masks, respirators), often wash and disinfect their hands, work at their stations in the studios and thus stay far away from other employees.

At the group's online meeting on February 4, 2021, colleagues from the Library of Congress in Washington presented the REALM (REopening Archives, Libraries, and Museums) research project, which is dedicated to the virus survival on library collections. This is a project carried out by the OCLC (Online Computer Library Center), the Institute of Museum and Library Services and company Battelle to obtain scientifically based information on how materials can be used to alleviate the COVID-19 disease for employees and visitors of archives, libraries and museums.

[2]The dose of the virus required to induce infection in 50% of inoculated cell cultures.

The project has three phases, each of which is focused on partial activities. Phase 1 (May 2020 - August 2020) included preparations for library reopening, research on materials and high-priority workflows. At this stage, information and best practices for the handling of physical collections and facilities were collected and promoted, pending the gradual introduction or complete reopening of public library buildings and services from May 2020.

In Phase 2 (June 2020 - October 2020), further research was carried out to support the operation of libraries, archives and museums. In this phase, analyses of sets of materials (covering library materials from newspapers through leather bookbinding, DVDs/CDs to plastic book covers) and working procedures of libraries, archives, special collections and museums were processed. Research activities will provide the results of laboratory testing, review of the scientific literature, toolkits and related resources that will provide updated or new information that may have emerged since Phase 1. A better website was launched during this phase. Test results and other information for each library collection material, virus survival time on selected material, testing procedure can be found on the website.

At the time of preparation of this paper, work is underway on the third phase of the project (October 2020 - September 2021). It is opened for other institutions to be involved. Monitoring is carried out, information is updated, results are communicated, and emerging research is evaluated, which may require updates and additions to what was created during the first two phases. In addition, as the rate of virus transmission changes over time and communities continue to adapt to these changes, the change may also require an update of library and museum policies and procedures.
Disinfection methods and the effects of disinfectants on library collections are also summarized.

Conclusion

The Covid-19 pandemic affected the functioning of society as a whole and, of course, the activities of libraries, which were and still are going through a turbulent period. The pandemic has brought many changes to the activities of libraries; we have learned a lot of new things, we have moved on and we hope to see the end of the pandemic soon with the libraries being reopened to readers and researchers without restriction.

In the NL CR, there has been no community spread of COVID-19 throughout the pandemic and individual waves. Employees take precautionary measures, use protective equipment (hand disinfectants, masks, respirators, distancing) and it is thus possible to ensure safe operation and anumber of necessary activities of the NL CR. Many thanks to the employees for this responsible behavior. In addition to the above, other measures were taken in the National Library: plexiglass partitions were installed on the counters in the study rooms and in the Service Hall; during the first openings, service personnel wore plastic shields and gloves in addition to protective masks/respirators; it was prohibited to use rest benches in the corridors, but also reference libraries in study rooms and card catalogs (these were closed using a red and white tape. The operation schedule was modified to create a lunch break, during which the areas of counters, tables, computer keyboards, PC mice, etc. were disinfected. The equipment disinfection was also performed after the end of the shift.

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