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PREGLEDNI ČLANAK / REVIEW ARTICLE

Bakterijska kontaminacija korištenih kirurških maski među djelatnicima odjela visokog rizika

Bacterial contamination of used surgical masks among high-risk ward staff

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Sažetak

Uvod: Zaštitne maske kontaminiraju se uporabom, mikrobiotom nosne i usne šupljine te kože lica. Izvješća o kontaminaciji i potencijalu za prijenos uzročnika bolničkih infekcija nedostaju ili su rijetka. Istraženo je može li maska postati izvor mikroorganizama i predstavljati rizik za prijenos infekcija povezanih sa zdravstvenom skrbi. Cilj rada bio je usporediti mikrobno opterećenje maski, vestibuluma nosa i ruku djelatnika kako bismo identificirali potencijalne rizike.

Metode: Provedena je studija prevalencije u jednom danu u studenom 2022. godine na hematološkom odjelu tercijarne bolnice. Kriterij uključivanja bila je činjenica da se djelatnik tog jutra nalazi u neposrednom radu sa stacionarnim bolesnicima. Uzeti su brisevi nosa, ruku i maski. Sudionici su podijeljeni u dvije skupine: oni koji su masku nosili do 30 minuta i oni koji su je nosili više od 1 sata. Brisevi su obrađeni standardnim mikrobiološkim postupcima.

Rezultati: Od 10 ispitanika, njih je 5 masku nosilo 30-ak minuta, a preostalih 5 više od 1 sata. U prvoj skupini nije bilo pozitivnih mikrobioloških nalaza. U skupini djelatnika koji su masku nosili dulje od 1 sata izolirani su koagulaza negativni stafilokoki, *Staphylococcus hominis* i *Staphylococcus warneri* u tri od pet ispitanika. Iz briseva vestibuluma nosa u jednom slučaju identificiran je meticilin osjetljiv *Staphylococcus aureus*. U dva slučaja identificirane su iste vrste, *S. hominis* i *S. warneri*, kao i na njihovim maskama. Brisevi ruku kod devetero djelatnika ostali su sterilni, dok su u jednom slučaju izolirani antrakoidi iz roda *Bacillus*.

Rasprava sa zaključkom: Unutar jednog sata na zaštitnim maskama mogu se naći bakterije koje se nalaze u nosu ili koži lica djelatnika. Produljenom uporabom može se očekivati povećanje broja, ali i kontaminacija raznolikim vrstama mikroorganizama što može predstavljati značajan rizik biološke sigurnosti. Osnaživanje prakse higijene ruku minimizira rizik od infekcija i povećava sigurnost pacijenata i osoblja.

Ključne riječi: kirurška maska, bris, vestibulum nosa, bakterijska kontaminacija

Kratak naslov: Kontaminacija kirurških maski

Abstract

Introduction: Protective masks become contaminated through use, with the microbiota of the nasal and oral cavities as well as facial skin. We have investigated whether masks could become a source of microorganisms and pose a risk for the transmission of healthcare-associated infections. This study aimed to compare the microbial burden on masks, vestibulum nasi, and hands of healthcare workers to identify potential risks.

Methods: A one-day prevalence study was conducted in November 2022 in the hematology department of a tertiary hospital. The inclusion criterion was the fact that the worker was directly involved in caring for inpatients that morning. Swabs were taken from the nose, hands, and masks. Participants were divided into two groups: those who wore the mask for up to 30 minutes and those who wore it for over 1 hour. Swabs were processed using standard microbiological methods.

Results: Out of 10 participants, 5 wore the mask for around 30 minutes, and the remaining 5 wore it for over 1 hour. The first group showed no positive microbiological findings. In the second group, coagulase-negative staphylococci, *Staphylococcus hominis*, and *Staphylococcus warneri* were isolated in three out of five participants. The nasal colonization by methicillin-sensitive *Staphylococcus aureus* was detected in one case. In two cases, the same species, *S. hominis* and *S. warneri*, as on their masks were identified. Hand swabs remained sterile in nine workers, while in one case, *Bacillus* species were isolated.

Discussion with Conclusion: Within one hour of use, protective masks can harbor bacteria found in nose or facial skin of healthcare workers. Prolonged use may lead to an increase in bacterial counts and contamination with various types of microorganisms, representing a significant risk to biological safety. Strengthening hand hygiene practices minimizes the risk of infections and enhances patient and staff safety.

Keywords: protective surgical mask, swab, vestibulum nasi, bacterial contamination

Short title: Surgical Mask Contamination

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Uvod

U standardne mjere kontrole infekcija ubrajaju se pravilna higijena ruku za sve djelatnike, bolesnike i posjetitelje, uporaba osobne zaštitne opreme (OZO) te redovito čišće-

Introduction

Standard infection control measures include proper hand hygiene for all employees, patients and visitors, using personal protective equipment (PPE), and regular cleaning

nje i dezinfekcija okoline [1]. Korištenje OZO-a u zdravstvenim ustanovama, a posebno u bolničkom sustavu, ključni je dio standardnih postupaka koji se moraju provoditi u svrhu zaštite zdravstvenih i nezdravstvenih radnika, pacijenata i drugih osoba. Glavni elementi OZO-a u bolnicama uključuju: zaštitne maske koje prekrivaju nos i usta, rukavice, zaštitu za oči i zaštitnu odjeću (obuću). Zaštitne maske koriste se kako bi se spriječilo širenje manjih i većih kapljica, aerosola i čestica iz nosa i usta osoblja. Posebno se preporučuje njihova uporaba tijekom postupaka koji uključuju generiranje aerosolnih čestica, poput intubacije, aspiracije i slično. Također, štite medicinsko osoblje od inhalacije mikroorganizama prisutnih u zraku [2]. Tijekom pandemije COVID-19, maske za lice različitih kvaliteta i razine zaštite korištene su kao jedna od bitnih mjera kontrole javnog i osobnog zdravlja protiv širenja SARS-CoV-2 [3]. Praksa pokrivanja lica i nosa kao metoda prevencije infekcije ima dugu povijest [4]. Kirurške maske od papira i flisa, slične današnjima, dizajnirane su 1960-ih za jednokratnu upotrebu u bolničkom okruženju u uvjetima stroge asepse. Namijenjene su kirurzima i kirurškim medicinskim sestrama da ne bi kontaminirali operacijsko polje te mikroorganizmima iz svoje usne šupljine da ne bi zarazili pacijenta na operacijskom stolu. No, zaštitne kirurške maske ključan su dio zaštite pacijenata, posebno onih imunokompromitiranih, i na drugim odjelima visokog rizika. Zaštitna djelotvornost i duljina korištenja kirurških maski ovise o situaciji i aktivnosti koja se obavlja. Učinkovitost maski za lice, uključujući kirurških, protiv prijenosa virusa opsežno je proučavana tijekom COVID-19 pandemije [5]. Također, zbog nestašice maski u početku, a zatim masovne potrošnje kirurških maski u široj zajednici, pitanje njihove ponovne uporabe i recikliranja dobro je istraženo i potkrijepljeno u brojnim objavljenim radovima [6]. Ipak, kirurška maska kontaminira se i samom uporabom, mikrobiotom nosne i usne šupljine te kože lica osobe koja ju nosi. Može li kirurška maska postati izvor mikroorganizama i put njihova prijenosa u zdravstvenim ustanovama? Izvješća o bakterijskoj kontaminaciji maski u uporabi i eventualnom potencijalu za prijenos uzročnika bolničkih infekcija nedostaju ili su vrlo rijetka. Stoga smo u ovom radu istražili mikrobno opterećenje kirurških maski u uporabi i usporedili ga s mikrobiotom vestibuluma nosa i ruku djelatnika zatečenih u radu na odjelu visokog rizika s ciljem identificiranja potencijalnih rizika i donošenja preporuke za poboljšanje higijenskih praksi.

Cilj

Cilj rada bio je utvrditi kvalitativno mikrobiološko opterećenje maski, vestibuluma nosa i ruku djelatnika, usporediti rezultate te detektirati potencijalne rizike.

Materijali i metode

Opis studije

Studija prevalencije (*point prevalence study*) provedena je u jednom danu u studenom 2022. godine među zatečenim zdravstvenim djelatnicima na hematološkom odjelu tercijarne bolnice. Istraživanje je odobrilo Etičko povjerenstvo Kliničkog bolničkog centra Rijeka (Klasa: 003-05/22-1/77, Ur.

and disinfecting of the environment [1]. The use of PPE in healthcare institutions, and especially in the hospital system, is a key part of the standard procedures that must be carried out to protect health and non-health workers, patients, and other persons. The main elements of PPE in hospitals include protective face masks that cover the wearer's nose and mouth, gloves, eye protection and protective clothing (including footwear). Protective masks are used to prevent the spread of smaller and larger droplets, aerosols and particles from the nose and mouth of staff or patients. They are especially recommended during aerosol-generating procedures, such as tracheal intubation, airway suctioning, etc. Also, masks protect healthcare personnel from inhalation of microorganisms present in the air [2]. During the COVID-19 pandemic, face masks of different quality and levels of protection were used as essential public and personal health control measures against the spread of SARS-CoV-2 [3]. Covering the face and nose as a method of preventing infection has a long history [4]. The use of disposable items made of paper and fleece was introduced in the 1960s. They were intended for surgeons and surgical nurses to catch microorganisms shed in liquid droplets and aerosols from the wearer's mouth and nose, protecting the patient from surgical wound infections. Also, protective facemasks are recommended when providing patient care, especially for immunocompromised and other high-risk and vulnerable patients. The protective capacity and length of use of surgical masks depend on the situation and activity performed. The effectiveness of face masks, including surgical ones, for reducing transmission of respiratory viruses has been extensively studied during the COVID-19 pandemic [5]. Also, due to the initial shortage and later mass consumption of surgical masks in the wider community, the issue of their reuse and recycling has been well researched and published [6]. However, the surgical mask can be contaminated by the use itself, by nasal, oral, or facial skin microbiota of the person wearing it. Is it possible that the surgical mask becomes a source of microorganisms and a route of their transmission in healthcare institutions? Reports on bacterial contamination of masks in use and their eventual potential for hospital infection transmission are missing or very rare. Therefore, we investigated the microbial load on surgical masks in use, in comparison to nasal and hand microbiota of healthcare staff caught during routine work shifts in the high-risk department, to identify potential risks and make recommendations for improving hygiene practices.

Objective

This study aimed to determine the qualitative microbiological load on face masks and compare it to the wearers' nasal and hand microbiota to detect potential risks.

Materials and Methods

Study design

The point prevalence study was conducted in one day in November 2022 among the healthcare workers in the haematology department of the tertiary hospital. The study

broj: 2170-29-02/1-22-2). Kriterij uključivanja u istraživanje bila je činjenica da se djelatnik tog jutra nalazi u neposrednom radu sa stacionarnim bolesnicima. Svi sudionici dali su svoj pristanak prije uzimanja briseva. U istraživanje nisu bili uključeni djelatnici iz ambulantnog djelokruga rada.

Prikupljanje uzoraka

Svakom djelatniku uzet je bris vestibuluma nosa (jednim brisnim štapićem iz obje nosnice), bris ruku (cijela površina dlana i nadlanice, između prstiju i oko noktiju) te bris zaštitne kirurške maske (unutarnje i vanjske površine) koju je djelatnik nosio tijekom jutarnjeg rada. Na temelju trajanja korištenja kirurških maski, sudionici su podijeljeni u dvije skupine: oni koji su masku upotrebljavali do 30 minuta i oni koji su je upotrebljavali više od 1 sata.

Mikrobiološka obrada uzoraka

Odmah po uzorkovanju, brisevi su dostavljeni u Klinički zavod za kliničku mikrobiologiju gdje su obrađeni standardnim mikrobiološkim postupcima. Brisevi su nasađeni na krvni agar i inkubirani na 37 °C tijekom 24 sata. Identifikacija poraslih kolonija provedena je konvencionalnim bakteriološkim metodama i/ili koristeći Vitek2 analizator (Biomerieux, Francuska). Brisevi su prilikom prikupljanja kodirani brojevima i pripadajućim slovima te laboratorijski djelatnici nisu mogli utvrditi identitet osoblja kojemu je zajamčena anonimnost.

Rezultati

Istraživanje mikrobnog opterećenja nošenih kirurških maski provedeno je u jednom danu na hematološkom odjelu tercijarne bolnice. Na radu, tijekom jutarnje smjene, zatečeno je 10 zdravstvenih djelatnika koji su pristali sudjelovati u studiji. Svakom djelatniku uzet je bris vestibuluma nosa, ruku te unutarnje i vanjske površine maske koju su nosili u tom trenutku. Od 10 ispitanika, njih 5 masku je nosilo svega 30-ak minuta, a preostalih 5 više od 1 sata. Dok u prvoj skupini nije bilo pozitivnih mikrobioloških nalaza, u skupini djelatnika koji su maske nosili dulje izolirane su isključivo gram pozitivne bakterije i to koagulaza negativni stafilokoki, *Staphylococcus hominis* i *Staphylococcus warneri* u 3 od 5 ispitanika.

Iz briseva vestibuluma nosa, ni u jednog člana medicinskog osoblja nije dokazano kliconoštvo na meticilin rezistentnog *Staphylococcus aureus* (MRSA), ali u jednom je slučaju identificiran na meticilin osjetljiv zlatni stafilokok (MSSA), a u drugom su izolirani difteroidi iz roda *Corynebacterium*. U dva slučaja identificirane su iste vrste kao i na njihovim maskama (*S. hominis* i *S. warneri*).

Brisevi ruku kod devetero su djelatnika ostali sterilni, dok su u jednom slučaju izolirani antrakoidi iz roda *Bacillus*.

Rasprava

Tijekom COVID-19 pandemije brojne studije usredotočile su se na važnost maski za lice u prijenosu respiratornih virusa. Međutim, mogući podcijenjeni problem biološke sigurnosti predstavlja bakterijska kontaminacija maski tijekom

was approved by the Ethics Committee of the Clinical Hospital Centre Rijeka (Class: 003-05/22-1/77, ed. Number: 2170-29-02/1-22-2). All healthcare workers caught at the department during their work shift were eligible to participate. The only inclusion criterion was that they were in direct contact providing healthcare to hospitalized patients. Those who worked with outpatients at the polyclinic were excluded from the study. All participants gave their consent before taking swabs.

Sample collection

Sampling involved bacterial swabs taken from anterior nares (one swab from both nostrils), hands (the entire surface of the palm and back of the dominant hand, between the fingers and around the nails), and protective surgical mask (inner and outer surfaces) worn by the employee during the work shift. Based on the duration of surgical mask usage, participants were divided into two groups: those who used the mask for up to 30 minutes and those who used it for more than 1 hour.

Microbiological specimens processing

Immediately after sampling, the swabs were processed using standard microbiological procedures at the Department of Clinical Microbiology. Briefly, the swab samples were spread onto blood agar plates, and incubated at 37 °C for 24 hours. The bacterial identification was performed by conventional bacteriological methods and/or using the Vitek2 analyser (bioMérieux, France). When collected, the swabs were coded with numbers and corresponding letters, therefore, the laboratory staff could not identify whose sample it was, and the participants were guaranteed anonymity.

Results

At the haematology department of a tertiary hospital, we investigated the microbial load on the face masks in use. At work, during the morning shift, 10 healthcare workers participated in the study. A swab of the nose, hands, and the inner and outer surfaces of the masks they were wearing was taken from each of the participants. Of the 10 respondents, 5 wore a mask for only 30 minutes, and 5 for more than 1 hour. While in the first group there were no positive microbiological findings, in the second group that wore masks for longer, gram-positive bacteria, coagulase-negative staphylococci (CoNS) were isolated. In three out of 5 subjects *Staphylococcus hominis* (*S. hominis*) and *Staphylococcus warneri (S. warneri)* were identified.

The carriage of Methicillin-resistant *Staphylococcus aureus* (MRSA) was not proven in any of the tested healthcare workers. However, Methicillin-sensitive *Staphylococcus aureus* (MSSA) was identified in one case, and in the other diphtheroids, *Corynebacterium* spp. In two participants, the same species of coagulase-negative staphylococci, *S. hominis* and *S. warneri*, were confirmed in the nasal swabs and masks they wore.

Hand swabs remained sterile in nine employees, while in one case, anthracoid bacilli (*Bacillus* spp.*)* were isolated.

uporabe. Za optimalan rast, bakterije trebaju površinu na kojoj će rasti, toplinu, vlagu i hranjive tvari, a to je okruženje koje se stvara na maski za lice zbog izdahnutog zraka. Mikroorganizmi prisutni na koži i u gornjim dišnim putovima mogu se prenijeti na masku za lice tijekom nošenja, zatim na ruke zbog dodirivanja vanjske površine maske te mogu predstavljati izvor, odnosno put prijenosa uzročnika infekcija povezanih sa zdravstvenom skrbi. Iako sve smjernice ističu izbjegavanje dodirivanja maske, kao i dodirivanje lica, doticanje maske može biti spontano ljudsko ponašanje zbog čega je primjena ovih preporuka izazovna [7]. Osim toga, potencijalna nelagoda tijekom uporabe maske također može utjecati na suradljivost.

U ovoj studiji, u jednom danu u studenom 2022. godine tijekom jutarnje smjene, prikupljeno je ukupno 10 briseva nošenih maski od zdravstvenog osoblja hematološkog odjela. Analizirali smo bakterijsko opterećenje na kirurškim maskama koje su korištene do 30 minuta, odnosno više od jednog sata. Istovremeno, od svake osobe uzeti su brisevi vestibuluma nosa te brisevi ruku kako bismo usporedili i povezali izolate. Budući da je vrijeme korištenja maski bilo kratko, pretpostavili smo da bakterijsko opterećenje neće biti značajno. Doista, na kirurškim maskama nošenima do 30 minuta nije detektirano prisustvo bakterija, dok su na onima korištenim nešto više od 1 sata identificirani isključivo koagulaza negativni stafilokoki za koje se zna da čine normalnu mikrobiotu kože i gornjih dišnih putova. Vrste *S. hominis i S. warneri* identificirane su na 3 maske i u brisu vestibuluma nosa dvoje djelatnika koji su te maske nosili. *S. hominis* drugi je najčešće izolirani koagulaza negativni stafilokok iz zdrave ljudske kože, dok je *S. warneri* kao dio normalne mikrobiote kože prisutan u otprilike 50 % zdravih odraslih osoba [8]. Zanimljivo je da među koagulaza negativnim stafilokokima ni u jednog ispitanika nije identificiran *Staphylococcus epidermidis* koji se smatra jednom od najzastupljenijih komenzalnih bakterija na ljudskoj koži i sluznicama. Iako je *S. epidermidis* najprisutnija vrsta i u mikrobioti ljudske nosne šupljine, njezina se brojnost u nosu mijenja tijekom života čovjeka. Zastupljenija je kod adolescenata nego kod djece i odraslih kao što su i naši ispitanici [9].

Nightingale i sur. [10] analizirali su kirurške maske zdravstvenog i nezdravstvenog osoblja ustanove za postakutnu skrb i rehabilitaciju te ustanovili značajno mikrobno opterećenje uključujući *Staphylococcus aureus* u 15,9 % i gramnegativne bakterije u 31,9 % slučajeva bez obzira na to je li maska nošena kraće ili dulje od 6 sati. Razlike u rezultatima tumačimo razlikom u vremenu korištenja maski, ali i razlikama u vrsti pacijenata i zdravstvene skrbi koja im je pružana. U ustanovama za dugotrajnu njegu mikroorganizmi se lako mogu prenositi jer se većina štićenika koristi zajedničkim prostorijama, žive u neposrednoj blizini i imaju bliske odnose s drugim štićenicima i zdravstvenim osobljem. Suprotno navedenom, hematološki odjeli su odjeli visokog rizika u kojima se zdravstvena skrb pruža imunokompromitiranim bolesnicima koji su osobno, kao i zdravstveni djelatnici na tim odjelima, svjesni rizika od infekcije te su visoko suradljivi u higijeni ruku, nošenju kirurških maski i ostalim standardnim i specifičnim mjerama prevencije. U našem istraživanju, brisevi ruku svih ispitanika ostali su sterilni, što je ipak, najvjerojatnije, posljedica utrljavanja alkoholnih pripravaka

Discussion

During the COVID-19 pandemic, numerous studies have focused on the importance of face masks against respiratory virus transmission. However, the potential biosafety problem posed by bacterial contamination of masks during use may have been underestimated. Namely, for optimal growth, bacteria need a surface, heat, moisture, and nutrients, and all of this is present on masks because of the breathed air. Microorganisms from the skin of the face and the upper respiratory tract can be transferred to the face mask in use and then contaminate the hands that touch the outer surface of the mask. In this way, face masks can become a source and a route of transmission of healthcare-associated infections. Although all guidelines emphasize that touching the mask in use, as well as the face, should be avoided, this recommendation is challenging to implement, because touching the mask/face is a spontaneous human behaviour, [7] further enhanced by discomfort due to the presence of the mask.

In this study, during the morning shift one day in November 2022, a total of 10 swabs of face masks worn for up to 30 minutes, or more than one hour, were collected from the healthcare workers of the haematology department, to analyse the bacterial load. At the same time, nasal swabs and swabs of the dominant hands were taken from each participant. Since the time of the mask usage was short, we assumed that bacterial load would not be significant. Indeed, no bacteria were detected on surgical masks worn for up to 30 minutes, while those used for over 1 hour identified exclusively CoNS that form part of the normal microbiota of the skin and upper respiratory tract. *S. hominis and S. warneri* were identified on 3 masks as well as in the nasal swabs of two subjects who wore these masks. *S. hominis* is known as the second most isolated CoNS from healthy human skin, while *S. warneri* is part of the normal skin microbiota present in approximately 50% of healthy adults [8]. Interestingly, *Staphylococcus epidermidis*, which is known as the most common inhabitant of human skin and mucous membranes, was not identified in any of the isolated CoNS cases. Perhaps the reason is that the nasal abundance of *S. epidermidis* changes over the lifetime, being more prevalent in adolescents than in children and adults, as are our participants [9].

Nightingale *et al*. [10] analysed surgical masks of health and non-healthcare staff at rehabilitation facilities and, in contrast to our results, found significant microbial load, including *Staphylococcus aureus* in 15.9% and gram-negative bacteria in 31.9% of cases regardless of whether the mask has been worn for 6 or more hours. These differences can be explained by the different times of wearing the masks, but also by the different patient populations and the health care provided to them. In long-term care facilities, microorganisms can be easily transmitted because most residents use common rooms, live nearby, and have close relationships with other wards and health personnel. On the contrary, haematology departments are high-risk departments in which health care is provided to immunocompromised patients who are personally, as well as healthcare workers, aware of the infection risks and are highly cooperative in

neposredno nakon što su saznali za provođenje istraživanja, a ne apsolutne suradljivosti u higijeni ruku.

Zaključak

Unatoč nedostacima ovog istraživanja (kratko vrijeme nošenja maski i mali broj uzoraka), možemo zaključiti da se u unutar 1 sata na kirurškim maskama mogu naći bakterije koje se nalaze u nosu, na licu ili u usnoj šupljini zdravstvenih djelatnika. Produljenom uporabom kirurških maski može se očekivati povećanje broja bakterija, ali i kontaminacija raznolikim vrstama mikroorganizama što može predstavljati značajan problem biološke sigurnosti. Razumijevanje ovih aspekata omogućuje daljnje poboljšanje prakse higijene ruku i nošenja maski u kliničkom okruženju s ciljem minimiziranja rizika od infekcija te osiguranja zaštite pacijenata i zdravstvenog osoblja.

Nema sukoba interesa.

hand hygiene, wearing surgical masks and other standard and specific prevention measures. In our study, the hand swabs of all subjects remained sterile, which is nevertheless, most likely, a consequence of rubbing alcohol preparations immediately after being informed about the study and not absolute compliance in hand hygiene.

Conclusion

Despite limitations of this study (short time of masks usage and a small number of participants/specimens), it can be observed that within 1 hour, the same bacterial species that live in the nasal or oral cavity of the wearer can be found on their surgical mask. It can be expected that the prolonged use of face masks leads to an increase in the number as well as the types of microorganisms, which can become a significant biosafety problem. Understanding these aspects allows for further improvement of hand hygiene and mask-wearing practices in the clinical setting to minimize the risk of infections and ensure the safety of patients and healthcare staff.

Authors declare no conflict of interest.

Literatura / References

[1] Allegranzi B, Sax H, Pittet D. Hand hygiene and healthcare system change within multi-modal promotion: a narrative review. J Hosp Infect. 2013 Feb;8 3 Suppl 1: S3-10. doi: 10.1016/S0195-6701(13)60003-1.

[2] Tellier R, Li Y, Cowling BJ, Tang JW. Recognition of aerosol transmission of infectious agents: a commentary. BMC Infect Dis. 2019 Jan 31; 19 (1):101. doi: 10.1186/s12879-019-3707-y.

[3] Eke UA, Eke AC. Personal protective equipment in the siege of respiratory viral pandemics: strides made and next steps. Expert Rev Respir Med. 2021 Apr; 15 (4): 441–452. doi: 10.1080/17476348.2021.1865812.

[4] Schlich T, Strasser BJ. Making the medical mask: surgery, bacteriology, and the control of infection (1870s–1920s). Med Hist. 2022; 66 (2).

[5] Ju JTJ, Boisvert LN, Zuo YY. Face masks against COVID-19: Standards, efficacy, testing and decontamination methods. Adv Colloid Interface Sci. 2021 Jun; 292: 102435. doi: 10.1016/j.cis.2021.102435.

[6] Zorko DJ, Gertsman S, O'Hearn K, Timmerman N, Ambu-Ali N, Dinh T, Sampson M, Sikora L, McNally JD, Choong K. Decontamination interventions for the reuse of surgical mask personal protective equipment: a systematic review. J Hosp Infect. 2020 Oct; 106 (2): 283–294. doi: 10.1016/j.jhin.2020.07.007.

[7] Guellich A, Tella E, Ariane M, Grodner C, Nguyen-Chi HN, Mahé E. The face mask-touching behavior during the COVID-19 pandemic: Observational study of public transportation users in the greater Paris region: The French-mask-touch study. J Transp Health. 2021 Jun; 21: 101078. doi: 10.1016/j.jth.2021.101078.

[8] Becker K, Heilmann C, Peters G. Coagulase-negative staphylococci. Clin Microbiol Rev. 2014 Oct; 27 (4): 870–926. doi: 10.1128/CMR.00109-13.

[9] Liu Q, Liu Q, Meng H, Lv H, Liu Y, Liu J, Wang H, He L, Qin J, Wang Y, Dai Y, Otto M, Li M. Staphylococcus epidermidis Contributes to Healthy Maturation of the Nasal Microbiome by Stimulating Antimicrobial Peptide Production. Cell Host Microbe. 2020 Jan 8; 27 (1): 68–78. e5. doi: 10.1016/j.chom.2019.11.003.

[10] Nightingale M, Mody M, Rickard AH, Cassone M. Bacterial contamination on used face masks among nursing home healthcare personnel. Antimicrob Steward Healthc Epidemiol. 2023 Mar 15; 3 (1): e54. doi: 10.1017/ash.2023.130.