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https://www.sciencedirect.com/science/article/pii/S0195670120304011	Nasal cannula prongs tested positive when cultured..
https://www.nature.com/articles/s41598-022-09218-5	Infectious virus on nasal cannula prongs attributable to indirect contact transmission was found by a team.
https://academic.oup.com/cid/article/63/3/363/2595016	Nasal cannula prongs tested positive for Middle East Respiratory Syndrome (MERS).
https://academic.oup.com/cid/article/63/3/363/2595016	In a MERS study, 16 fomites (ie, stethoscopes, bag valve masks, blood pressure cuffs, nasal prongs, pillows, and keyboards) were swabbed and 13 tested positive for MERS-CoV.
https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2894888/	**How disease is spread via respiratory droplets (skip to the results section).**
https://www.ncbi.nlm.nih.gov/pubmed/26597631	**Influenza and Coronavirus can be spread via shedding onto environmental surfaces and hands and cause people to self-innoculate noses. If hands can spread viruses into the nose, can nasal cannula prongs do so as well?** “Once contaminated from the environment, hands can then initiate self-inoculation of mucous membranes of the nose, eyes or mouth. Mathematical and animal models, and intervention studies suggest that contact transmission is the most important route in some scenarios.”
https://www.salterlabs.com/media/resources/SLML-130_Homecare_Nasal_Cannula_Technical%20Bulletin.pdf https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4659470/	**Coronavirus persists in an infectious state on common surface materials, including PVC, for several days. Influenza does also.** Most nasal cannulas are made from pvc material. “Surface contamination has recently been found to be more significant than originally thought in the spread of many diseases (12).

https://www.ncbi.nlm.nih.gov/pubmed/6282993/ https://mbio.asm.org/content/6/6/e01697-15	"Symptoms of respiratory disease often result in continuous recontamination of surfaces which are then touched, and infectious virus particles may be **transferred to facial mucosa**." **Chart shows coronavirus persisting for five days on PVC. Nasal cannulas are made from PVC.** **"There is scant information on minimum infectious doses, but for many respiratory viruses, the minimum infectious dose is believed to be low, i.e., just a few virus particles...The results from this study have shown that a relatively low concentration of enveloped respiratory viruses may retain infectivity on common hard surfaces for longer than previously thought and may present a real risk of infection to anyone who contacts a contaminated surface."**
abstract: https://www.ncbi.nlm.nih.gov/pubmed/26679623 Full text: https://academic.oup.com/cid/article/62/6/755/2462781	**MERS can be spread through surfaces such as bedsheets, bedrails, IV fluid hangers, and X-ray devices up to 5 days after the last positive detection in respiratory specimens aka after the patients are recovered.** "Many environmental surfaces of MERS patient rooms, including points frequently touched by patients or healthcare workers, were contaminated by MERS-CoV. Viral RNA was detected up to five days from environmental surfaces following the last positive PCR from patients' respiratory specimens… In addition, MERS-CoV was isolated from environmental objects such as bed sheets, bedrails, IV fluid hangers, and X-ray devices. During the late clinical phase of MERS, viable virus could be isolated in 3 of the 4 enrolled patients on day 18 to day 25 after symptom onset."
https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1828811/	**"There is now growing evidence that contaminated fomites or surfaces play a key role in the spread of viral infections"..."** "...viruses are shed in large numbers in body secretions, including blood, feces, urine, saliva, and nasal fluid (10, 33, 34, 39, 48, 58)...If viruses remain viable on surfaces long enough to come in contact with a host, the virus may only need to be present in small numbers to infect the host (10, 58, 66, 71). After contact with the host is achieved, viruses can gain entry into the host systems through portals of entry or contact with the mouth, nasopharynx, and eyes…current scientific evidence also suggests that fomites are an important vehicle in the spread of respiratory viruses…A majority of respiratory viruses are enveloped (parainfluenza virus, influenza virus, RSV, and coronavirus) and survive on surfaces from hours to days."
https://www.modernhealthcare.com/article/20150811/NEWS/150819999/the-dirty-truth-of-hospital-cleaning-thin-science	**You can't truly get a hospital room clean.** An estimated 722,000 patients get an infection while being treated in US acute care hospitals. 75,000 with those conditions die. The study looked at 20 studies published between 1998 and 2014. It found that, even after cleaning, the most common pathogens found in hospitals were MRSA, VRE and C. difficile on bed rails, tray tables, call buttons, and other hard surfaces.

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4812669/	**Reservoirs of MRSA, VRE, Clostridium exist on porous and non-porous surfaces in hospital rooms.** Eighty studies were evaluated. HAIs are a leading cause of illness and death us US and worldwide. Porous (curtains) and non-porous hard surfaces (bed rails) were included in studies. "Contaminated surfaces are a reservoir for transmission of pathogens directly through patient contact with the environment or indirectly through contamination of healthcare workers' hands and gloves."
https://www.webmd.com/a-to-z-guides/news/20150810/whats-the-best-method-for-cleaning-hospital-rooms#1	**Hospital sheets still contaminated despite washing**
https://www.webmd.com/health-insurance/news/20181019/hospital-bed-sheets-still-germy-despite-wascarehing	**Germs on hospital beds.**
https://www.investors.com/politics/columnists/hospital-infections-dirty-beds/	**How dirty is your hospital bed?**
https://link.springer.com/article/10.1007/s40726-019-00123- 6	**Persistence of SARS on hospital surfaces.** Severe acute respiratory syndrome (SARS) coronavirus RNA was found on 30% of surface swab samples in hospitals, including in patient rooms, on computer mice at nurse stations, and on the handrail of a public elevator [67]. Weber and Stilianakis (2008) reviewed numerous studies that investigated the environmental inactivation of influenza A viruses, finding that daily inactivation rate constants differ by several orders of magnitude depending on the nature of surface characteristics and that influenza virus can survive in aerosols for several hours, but only for a few minutes on human hands [71]. As an example from this body of literature, Bean et al. (1982) tracked the survival of laboratory-grown influenza A and B viruses on various surfaces, **finding that both viruses survived up to 48 h on hard, non-porous surfaces, such as stainless steel and plastic and up to 12 h on porous surfaces, such as cloth, paper, and tissues [72]. Moreover, fomite transmission of influenza viruses was considered possible because influenza virus could be transferred from stainless**

	steel surfaces to hands for up to 24 h after deposition (and from tissues to hands for up to 15 min after deposition). The viruses then subsequently survived on hands for an additional 5 min after transfer from the tested fomites. **Influenza virus can survive (i.e., remain viable and/or potentially infectious) much longer on fomite surfaces,** While there is high variability among these studies in **influenza** inactivation rates and survival on fomite surfaces over time (influenced by a combination of material type, environmental conditions, virus strain, inoculation methods, and viral presence/abundance/viability detection methods), **there is general consistency in the literature that influenza viruses can survive for up to several days after being deposited on some surface types and in some conditions.** Human **adenoviruses** (HAdV) were detected from 63 of 141 (45%) fomite samples in an adult intensive care unit (ICU) in a hospital in Rio de Janeiro, Brazil, with viral loads ranging from 2.48 × 101 to 2.1 × 103 genomic copies per milliliter [69]. Middle East respiratory syndrome coronavirus (**MERS-CoV**) was detected on 2 of 51 (4%) high-touch surfaces in patient rooms with laboratory-confirmed MERS-CoV patients [70].
http://www.scielo.br/pdf/rbgg/v19n2/en_1809-9823-rbgg-19-02-00247.pdf	**Cannula non-usage at home.** Patient caregivers take nasal cannulas off 25% of the time. Most commonly to take a break, eat, or because of breathlessness
https://bjanaesthesia.org/article/S0007-0912(17)46102-2/pdf	**Not only do patients take off their oxygen devices, but so do nurses.** 30 postoperative patients in two groups were studied using masks and cannulas, and it was removed 9 times out of 15 patients overnight
https://www.ncbi.nlm.nih.gov/pmc/articles/PMC474298/pdf/thorax00309-0093.pdf	**Nasal cannulas get dislodged at night.** Of 99 patients, 49 of them were dislodged at least once overnight (that 99 is 50 using facemasks and 49 using cannulas though)
https://www.resmedjournal.com/article/S0954-6111(98)90035-X/pdf	**Why do patients with oxygen at home take off their nasal cannulas?** Netherlands study - LTOT compliance is poor. 20% of patients used oxygen less than prescribed. Of that 20%, only 31% used oxygen for walking indoors. 29% while eating. 21% while taking a bath or shower. 20% when going out.

https://www.homecaremag.com/february-2020/dont-let-oxygen-concentrator-lead-infection	**How infection via a nasal cannula prong can occur.** Mary McGoldrick, MS, RN, CRNI, has been a pioneer in the field of infection prevention and control in homecare and hospice for over 25 years, with seminal works published on infection prevention and control. She provides consulting services on infection prevention and control strategies, regulatory and accrediting body compliance, and serves as an infection preventionist for home health agencies and hospices. McGoldrick is the author of the Home Care Infection Prevention and Control Program manual, an evidenced-based compendium of infection prevention and control policies, checklists and forms. “For patients switching to portable oxygen or pro re nata home oxygen administration, nasal cannula storage can be problematic. The nasal cannula prongs often become contaminated when patients don’t properly protect the cannula between uses (i.e., leaving the nasal cannula on the floor, furniture, bed linens, etc.). Then the patient puts the contaminated nasal cannula back in their nostrils and directly transfers potentially pathogenic organisms from these surfaces onto the mucous membranes inside their nasal passages, putting them at risk of developing a respiratory infection. Educate the patient on how to store the nasal cannula between uses in a manner that does not allow it to have direct contact with potentially contaminated surfaces. Either keep the “in-use” nasal cannula somewhere that does not allow contact with a surface or place it on a cleaned surface, inside an open clean container, or in an open plastic bag.”