

The Role of Banknotes in the Spread of COVID-19

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Banknotes have long been known to be reservoirs to a number of bacteria and viruses that cause human diseases [1]. It is important to understand whether banknotes could serve as a reservoir for SARS-COV-2, the virus which causes COVID-19. The disease has led to a global pandemic resulting in at least 2,804,796 confirmed cases and 193,710 deaths worldwide [2]. The sheer numbers of infections and deaths, along with the crippling effect on healthcare systems around the world [3], makes it very important to understand and curb all possible modes of transmission. According to the WHO, COVID-19 is spread mainly through direct contact with respiratory droplets generated by an infected person who is sneezing and coughing. COVID-19 can also be spread through self-inoculation after contact with surfaces contaminated with the virus and through airborne droplet nuclei in certain settings that promote aerosol generation like during endotracheal intubation [4]. The specific role of banknotes as fomites has still not been elaborated as the disease is still fairly new.

Transmission Determinants

Models from influenza transmission through contaminated surfaces can be used to predict COVID-19 surface contamination patterns since it has been shown that both viruses have similar shedding patterns [5]. According to one study done on influenza, surface contamination can occur through droplet contamination or hand contamination [6]. Droplet contamination, which involves the direct contamination of surfaces through droplet deposition, is the main mode of surface contamination for influenza [6]. Surfaces that are exposed to the environment like public tables, benches and door knobs are more prone to direct contamination compared to banknotes [6]. Considering how people normally handle money, banknotes are relatively shielded from exposure to direct contamination. According to a study on the circulation of banknotes in Australia, they spend majority of their life-cycle outside bank reservoirs in wallets or in hoards, [7] suggesting that hand contamination is more relevant for the contamination of banknotes. The role of direct contamination of banknotes is probably more significant in settings where the duration of exposure of the banknotes is increased. Such settings include places with frequent cash transactions including supermarkets, open-air markets and matatus (local public service vehicles in Kenya). These settings increase the chances of hand-contamination of banknotes.

Enveloped viruses are generally unstable on dry surfaces compared to bacteria [8]. However, SARS-COV-2 appears to be an exception. In a recent study on the stability of SARS-CoV-2 in different conditions, infectious virus was found on banknotes up to 2 days after it was infused with a 5µL droplet of SARS-COV-2 virus culture [9].

There is still no definitive information on how this would translate to transmission of COVID-19 through banknotes outside laboratory settings. Comparisons with the survival characteristics of influenza and other corona viruses on banknotes and dry surfaces may offer a clue. According to a paper published by the Journal of Applied and Environmental Microbiology, the stability of the influenza virus on banknotes increases drastically when the inoculum is introduced in the form of respiratory mucus [10]. According to the study, the survival of a high concentration inoculum (which was well within the normal concentration found in nasopharyngeal secretions during the peak of symptoms) increased from 3 days to 17 days when respiratory mucus was introduced. Even though no studies on the survival of previously known human corona viruses on banknotes could be found, there is evidence that strains of SARS-COV-1 could survive for periods between 24 hours to 96 hours on paper [11], 72 hours on press paper and 96 hours on cloth [12]. The difference in strains, viral titers and experimental conditions make it useless to compare the survival times of influenza and corona viruses directly. However, since SARS-COV-1 and MERS-COV have been shown to be more resistant on dry surfaces than influenza, [10] it is possible that the presence of respiratory mucus would increase the survival time of SARS-COV-1 and MERS-COV. This would indicate that SARS-COV-2 could also survive for extended periods on banknotes after shedding by infected persons.

Despite evidence showing that influenza viruses and corona viruses can survive for days on banknotes, there is still no evidence indicating that they are an important medium for transmission of these flu viruses. This is because a number of factors are at play for a new infection to arise from this mode of transmission. Evidence shows that the influenza virus may survive on the hands for only a few minutes [13]. This means hand-to-banknote contamination and self-inoculation by touching mucous membranes on the face can only occur within a limited timeframe. Even within the timeframe, touching banknotes with contaminated hands would not guarantee transfer of infectious viruses unless there was actual contact between the droplet site and the banknote. Likewise, contamination of hands after touching contaminated banknotes can only happen if there is contact between the hand and the contaminated part of the banknote. It is also not clear what concentration of virus titer would be required for transmission through contaminated banknotes. While it is clear that for SARS, MERS and influenza, the concentration in respiratory secretions is higher than the dose required to initiate infection, [10] there is no information on whether there are any concentration thresholds for hand-banknote transfer or hand-to-banknote-to-hand transfer to ensure the eventual inoculum is above the infectious dose.

Handling food and money simultaneously can increase the risks of self-inoculation after coming into contact with contaminated banknotes [13]. Behavioral variations may also play a role considering that money is handled by people with varying personal and environmental hygiene [13]. People with poor hand hygiene practices are therefore more likely to contaminate banknotes or self-inoculate. The role of behavioral variations in the spread of COVID-19 is complicated further by the fact that unlike in SARS, MERS or influenza, asymptomatic patients are also infectious [5,14]. This means that people infected with COVID-19 may not realize the need to make behavioral adjustments like self-isolation and wearing facemasks. Considering the fact that these changes are not compulsory in every part of the world during the current pandemic, asymptomatic people could potentially contaminate their hands, banknotes and other surfaces just by breathing or vocalization [15].

Conclusion

Information on the modes of transmission of COVID-19 is still very scarce. As a result, determining the role of contaminated banknotes in the transmission of COVID-19 can only be done by supplementing missing information with knowledge from research on influenza, SARS and MERS. While evidence shows that these viruses can survive on banknotes for days, transmission through banknotes is more complicated as there are many more factors involved.

The dynamics involved in the transfer of infectious viruses from an infected person to another through banknotes reduce the likelihood of banknotes being an important medium of transmission. On the other hand, practices like handling food and money simultaneously would increase the likelihood of infection through contaminated banknotes. Additionally, the fact that asymptomatic people can spread COVID-19 means not all infected people take the necessary precautions to ensure they do not contaminate banknotes. All factors considered the possibility of being infected with COVID-19 after contact with contaminated notes definitely exists but especially the media have overstated its significance. However, a great risk associated with contaminated banknotes still exists, though indirectly. A single person infected with COVID-19 through contaminated banknotes could potentially start a new chain of infections through other modes of transmission.

Recommendations

Since hands are an intermediate for transmission through contaminated banknotes, improved hand hygiene would be very effective in preventing infection. The WHO recommendations of cleaning with an alcohol-based rub or soap and running water would be effective when done after handling banknotes. Use of alcohol-based rubs is not only effective, but has been shown to increase compliance with hand hygiene recommendations [1].

The spread of COVID-19 via contaminated banknotes can

also be contained. Measures to contain or decontaminate would include disinfecting currency notes in banks as has been done in China using ultra-violet light. Alternatively, currency notes could be quarantined for periods between 14 days to a month before being reintroduced into circulation as has been done in China, Kuwait and South Korea [17]. However these measures would not be effective unless the contaminated banknotes are deposited in banks. Alternatively, cashless transactions can substitute for banknotes during this pandemic. However, debit or credit card use would not alleviate the risk, as these cards are also potential contaminated surfaces for the spread of COVID-19. Mobile wallets like M-Pesa that allow for contactless transactions would therefore be the most appropriate alternative to bank notes. Finally, coughing or sneezing into elbows instead of palms would reduce the likelihood of hand to banknote contamination [18].

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