



DeLaRue

COVID-19 and Banknote Report

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Abstract

The World Health Organization (WHO) has declared the COVID-19 outbreak to be a pandemic and has issued general advice on dealing with the coronavirus on their website¹. This advice includes regularly washing your hands, keeping a good distance away from anybody who is coughing or sneezing, avoiding touching your face (specifically your eyes, nose and mouth where the virus can enter your body) and practicing good respiratory hygiene (for instance coughing or sneezing into a tissue that you immediately dispose of). If you have a fever, cough and difficulty breathing the WHO advises that you seek WHO medical care early, ideally calling in advance then following the directions of your local health authority.

This report summarises news reports, scientific studies (including De La Rue research) and expert advice to answer the most commonly asked questions about the current coronavirus pandemic and banknotes.

¹ <https://www.who.int/emergencies/diseases/novel-coronavirus-2019/advice-for-public> [Accessed 10th May2020]

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COVID-19 and Banknotes

This whitepaper provides a summary of the expert perspectives on COVID-19, sharing the central bank and industry responses about banknotes that are in the public domain. It finishes with a review of the scientific literature in this area.

Are Banknotes Spreading COVID-19?

Official responses and expert opinions

Handling banknotes doesn't pose a particular risk of contracting coronavirus, the head of Germany's Robert Koch Institute (RKI) for infectious diseases said on 11th March.² The main way that the coronavirus spreads is by airborne particulates that are generated by people coughing or sneezing and not by touching objects.^{3,4} The U.S. Centers for Disease Control and Prevention experts state that COVID-19 spreads primarily from person to person, between people who are within around six feet of each other and through droplets produced by a sick person's cough or sneeze.⁵

It may be possible for a person can get COVID-19 by touching a surface or object that has the virus on it and then touching their own mouth, nose, or possibly their eyes, but this is not thought to be the main way the virus spreads.⁵ "The risk of banknotes spreading the coronavirus is small "unless someone is using a bank note to sneeze in" said Dr Christine Tait-Burkard, an expert in infection and immunity at the Roslin Institute at the University of Edinburgh.⁶ Others have been a bit more cautious; "We don't know if you can pick up COVID-19 from contaminated surfaces or inanimate objects at this point. That's the bottom line," says Marilyn Roberts, a microbiologist at the University of Washington School of Public Health.⁷ However the Head of the Health Department in Frankfurt, Germany pointed out that "To date, there is no evidence of the coronavirus having been spread via euro banknotes – and, if it had, the numbers of infection would be way higher."⁸

The general consensus among experts is that there is a small risk associated with touching any frequently handled objects such as door handles, furniture, seats on public transport, seats on airplanes, kettles, coffee machines, mobile phones, point of sale terminals, petrol pump handles, banknotes, self-service checkout screens, elevator buttons, the take-away left outside your door,

2 <https://thetop10news.com/2020/03/11/banknotes-carry-no-particular-coronavirus-risk-german-disease-expert/> [Accessed 15th March 2020]

3 J. Bauomy & L. Chadwick, Euronews, 6th March 2020

4 <https://www.canada.ca/en/public-health/services/diseases/2019-novel-coronavirus-infection/prevention-risks.html> [Accessed 13th May 2020]

5 Centers for Disease Control and Prevention Website. https://www.cdc.gov/coronavirus/2019-ncov/prepare/transmission.html?CDC_AA_refVal=https%3A%2F%2Fwww.cdc.gov%2Fcoronavirus%2F2019-ncov%2Fabout%2Ftransmission.html [Accessed 15th March 2020]

6 Speaking to the Guardian, 3rd March 2020

7 A. Regalado, MIT Technology Review, 11th March 2020

8 <https://www.cashmatters.org/blog/why-medical-experts-are-speaking-up-for-cash-in-times-of-covid-19/> [accessed 12th May 2020]

shopping trolleys, handrails, water taps, ATMs, light switches and many other day-to-day objects. Regular handwashing as well as not touching your face helps to further minimise the risk of the virus spreading by physical objects.

Banknotes are often less exposed to the virus than other physical objects because they are protected by being in a wallet, pocket or another closed container. They are also typically touched less frequently than other physical objects. Sizun Jiang, a virology expert and postdoctoral research fellow at Stanford University agrees and described the risk associated with banknotes as being low, stating that “more importantly, there are countless other surfaces that we interact with more frequently than conventional banknotes.”³ Compared to a door handle, which is frequently touched and always exposed if somebody sneezes nearby, banknotes are handled less often and more likely to be protected in a wallet, pocket or other closed container at the point of somebody sneezing or coughing. Overall though there are more experts and reports citing that the risk associated with banknotes are low compared to person-to-person contact and comparable to touching other objects, including other payment methods and mobile phones.

So whilst it may be possible that a person can get the COVID-19 virus by touching a banknote it is not the main way that the virus is thought to spread. The WHO, after being initially misquoted, have specifically stated that “We did NOT say that banknotes are transmitting the coronavirus.”⁹

How long does the COVID-19 virus live on banknotes?

COVID-19 is currently classified as a hazard and so it not available for commercial or general testing. This means that there is no data available specifically evidencing how long COVID-19 lasts for on banknotes but conclusions are extrapolated from the behavior of similar viruses, such as the feline coronavirus, tested by De La Rue.

Some experts believe the question ‘how long does the virus last for’ misses the point. They say that it doesn’t matter how long the COVID-19 virus lasts on a banknote and they emphasize that what matters is whether banknotes are able to pass on the virus the virus or not. “In principle, it is entirely irrelevant how long pathogens can survive on surfaces. What is decisive is whether it is an infection channel” says, Dr. René Gottschalk,¹⁰ who does not consider there to be any risk of transmitting coronavirus via banknotes. The head of Robert Koch Institute agrees and says “(Virus) transmission through banknotes has no particular significance.”

However, attempts have still been made to answer this question, with articles providing a range of results that depend on the temperature, humidity, type of virus, concentration of virus, methodology

⁹ World Health Organization spokesman, speaking to MarketWatch on 9th March 2020

¹⁰ <https://www.bundesbank.de/en/tasks/topics/cash-poses-no-particular-risk-of-infection-for-public-828762> [Accessed 13th May 2020]

and substrates selected. The examples that follow suggests coronavirus variants typically last less than a week. A 2014 review of scientific articles on viruses and bacteria on banknotes couldn't find any evidence of viruses on previously circulated banknotes.¹¹

Stephanie Brickman from the WHO says that "We do not know [how long the virus lasts on banknotes,] but we estimate not longer than two hours. The virus will not survive for very long on surfaces, particularly on a dry surface like a banknote."³

De La Rue research during the H5N1 flu in 2006 suggested that as little as 10 % of coronaviruses (with feline coronaviruses being specifically tested) were still present after four hours. This research concluded that overnight storage was likely to be adequate to ensure that variant of the coronavirus virus was no longer present.

Other coronavirus varieties can live on inanimate surfaces including metal, paper, and plastic for between hours to days, depending on initial concentration and conditions such as temperature and humidity, with viruses lasting longer at lower temperatures. In April 2020 the Lancet reported a study on a coronavirus variant where it lasted for four days on banknotes.¹² In the Journal of Hospital Infection review, where the virus, strain/isolate, inoculum (viral titer) and temperature were the same, a coronavirus variant lasted four to five days and up to approximately 25% longer on non-banknote paper than non-banknote polymer.¹³ Another report suggests 3 days on plastic according to Vincent Munster and a team at the National Institutes of Health virology laboratory in Hamilton, Montana.¹⁴

Is there any difference between paper and polymer banknotes?

One of the biggest differentiators between paper and polymer banknotes is how easily that the virus can attach to the surface and transfer from the surface. In this area payment mechanisms are divided into those that are porous, like paper banknotes, or non-porous, like polymer banknotes, debit cards, credit cards, pin pads and mobile phones. Microbiologists from the University of Arizona and Michigan State University measured the "transfer efficiency" of various bacteria and viruses and found it was lower for porous surfaces¹⁵ This means that generally viruses and bacteria can be transferred from and wiped clean from less-porous surfaces more easily. It is worth noting, despite the focus of this report on viruses similar to COVID-19 that polymer banknotes have been found to harbor less bacteria than paper banknotes, possibly because of the ease with which they can be wiped clean.¹⁶ Changing from paper to polymer banknotes (or vice-versa) is unlikely to have any significant impact on the spread of COVID-19.

11 https://www.researchgate.net/publication/260398093_Paper_money_and_coins_as_potential_vectors_of_transmissible_disease [Accessed 13th May 2020]

12 [https://www.thelancet.com/journals/lanmic/article/PIIS2666-5247\(20\)30003-3/fulltext](https://www.thelancet.com/journals/lanmic/article/PIIS2666-5247(20)30003-3/fulltext) [Accessed 13th May 2020]

13 G. Kampf, D. Todt, S. Pfaender, E. Steinmann, Journal of Hospital Infection, 104, (2020), 246-251

14 <https://www.medrxiv.org/content/10.1101/2020.03.09.20033217v1.full.pdf> [Accessed 15th March 2020]

15 <http://www.sciencedirect.com/BB/abstract/2973> [Accessed 13th May 2020]

16 <https://edepot.wur.nl/159237> [Accessed 13th May 2020]

Central Bank and Industry Position on Cash during COVID-19

Reassuring the Public and Putting Risks into Perspective

Multiple central banks have now publicly stated that banknotes pose no particular risk in spreading COVID-19. Many have cited the same message as experts: the risk of spreading COVID-19 by banknotes is lower than person-to-person contact and comparable to other the risk associated with touching any physical object.

- A Bank of England source, speaking to the Telegraph in March said there were no plans to quarantine or disinfect banknotes in the UK and that “the risk posed by handling a polymer note is no greater than touching any other common surface, such as handrails, doorknobs or credit cards.”¹⁷
- Johannes Beermann, Executive Board Member of the Bundesbank stated that “So far there is no evidence of the coronavirus having been spread via euro banknotes. The probability of contagion with a virus via a banknote is very low in comparison with other surfaces.”¹⁸
- The European Central Bank has said that Euro banknotes are safe to touch. “Overall, banknotes do not represent a particularly significant risk of infection compared with other kinds of surface that people come into contact with in daily life,” said ECB executive board member Fabio Panetta.¹⁹
- The South African Reserve Bank has stated “there is currently no evidence that the coronavirus is transmitted through the use of banknotes and coins.”²⁰
- The Reserve Bank of New Zealand put the risk into perspective compared to other objects and payment methods: “Cash is just one of a number of frequently touched surfaces we encounter. The same is true for any other payment device whether it’s a card, phone or watch. This reinforces the need for good hand hygiene regardless of the way you pay or accept payment.”²¹
- The Bank of Canada asked retailers to continue accepting cash: “The risks posed from handling Canadian bank notes are no greater than those posed by touching other common surfaces such as doorknobs, kitchen counters and handrails. Canadians handling cash should follow the public health guidelines on COVID-19 and wash their hands as they would do for other activities.”²²

17 https://www.telegraph.co.uk/news/2020/03/02/exclusive-dirty-banknotes-may-spreading-coronavirus-world-health/?mod=article_inline [Accessed 16th March 2020]

18 <https://www.bloomberg.com/news/articles/2020-02-28/bundesbank-says-euro-banknotes-have-low-risk-of-virus-contagion> [Accessed 16th March 2020]

19 https://www.rte.ie/news/business/2020/0428/1135340-euro-bank-notes/?utm_content=128904444&utm_medium=social&utm_source=twitter&hss_channel=tw-743477599800786944 [Accessed 29th April 2020]

20 <https://www.iol.co.za/business-report/economy/we-are-not-recalling-cash-because-of-covid-19-says-sa-reserve-bank-45047774> [Accessed 20th March 2020]

21 <https://mailchi.mp/rbnz.govt.nz/media-statement-cash-and-other-payments-systems-ready-for-covid-12266442?e=b8d1687ce5> [Accessed 20th March 2020]

22 <https://www.bankofcanada.ca/2020/03/bank-canada-asks-retailers-continue-accepting-cash/> [Accessed 20th March 2020]

- The commentary from the Sveriges Riksbank aligned with that of the experts: “There is nothing to indicate that there is a risk of being infected by the coronavirus via banknotes and coins. The corona virus that causes COVID-19 is primarily spread from coughing and sneezing or via close contact with someone already infected” said Sveriges Riksbank going on to add that there was “no evidence that the coronavirus spreads via banknotes.”²³
- The Central Bank of Luxembourg was also consistent with the commentary of other experts and central banks. “As with normal seasonal influenza respiratory droplets of a person infected with a virus could survive for a limited period on a banknote, like on any other object. The probability of contagion with a virus via a banknote is, however, very low in comparison with other surfaces (e.g. door handles, handrails, light switches, shopping baskets, payment terminals). The basic protective measures against the new coronavirus should be applied as recommended by the World Health Organisation including washing your hands frequently.”²⁴
- The Austrian National Bank has published the statement with the title ‘No heightened risk of infection from Cash’ and highlighted that the probability of infection from cash is even lower than from other objects.²⁵
- The People’s Bank of China stepped up its efforts to reassure people that cash is safe to use, after observing a ‘surge’ in online searches about safety of banknotes and coins.²⁶
- Banxico’s Alejandro Alegre told the newspaper El Universal that proper hygiene, rather than payment method, is what will help curb the spread of the virus when shopping.”²⁷
- The Bank for International Settlements has published a paper saying that the probability of COVID-19 transmission via banknotes is low when compared with other frequently-touched objects such as credit card terminals or PIN pads.²⁸

This sentiment has been echoed across the cash industry. Groups representing the currency ATM, transportation and security sectors issued a paper “calling on governments, central banks, media, business and society to stand up for cash to protect the resilience of existing payment ecosystem and ensure vulnerable groups are not deprived of the only means of payment that is available.” It concludes with a call to action: “cash is safe: we should stop stigmatizing its users.”²⁹

Other activities from central banks have included encouragement of mobile ATM facilities to minimize travel and removal of fees associated with all types of payments. Many recognize that it is the face-to-face contact associated with any physical transaction and not a specific payment mechanism that represents the greatest risk, leading to an increased encouragement to stay home and shop online

23 <https://www.riksbank.se/en-gb/press-and-published/notices-and-press-releases/notices/2020/the-coronavirus-is-not-spread-via-banknotes-and-coins/> [Accessed 26th March 2020]
24 <http://www.bcl.lu/en/Media-and-News/Press-releases/2020/03/coronavirus/index.html> [Accessed 17th March 2020]
25 <https://www.oenb.at/Bargeld/kein-infektionsrisiko-durch-bargeld.html> [Accessed 10th May 2020]
26 <https://www.scmp.com/economy/china-economy/article/3079818/coronavirus-china-tries-bolster-confidence-banknotes-fears> [Accessed 16th April 2020]
27 <https://mexiconewsdaily.com/news/new-100-peso-banknote-will-be-released-later-this-year/> [Accessed 20th April 2020]
28 <https://www.bis.org/publ/bisbull03.pdf> [Accessed 12th May 2020]
29 <https://www.esta-cash.eu/wp-content/uploads/2020/04/ad2db86a1232d5b296dc3c4fd1c3360607d63934-5e9f2c4a809ec-20200421-Cash-coalition-press-release.pdf> [Accessed 12th May 2020]

where possible whilst lockdown continues. Others recognize that some necessary activities require some element of physical interaction with multiple surfaces and simply highlight social distancing and the WHO advice on regular handwashing.

Clean Note Policy, Cash Quarantines and Disinfection

Some central banks have sought to reassure the public and/or taken steps that may reduce the already low risk of banknotes spreading COVID-19 by introducing disinfection procedures, quarantine procedures or general steps to raise the quality of their circulating banknotes. Other central banks, some of whom have stated that banknotes pose no particular risk compared to other surfaces frequently encountered, have continued without quarantines or disinfection. This list that follows is not exhaustive but demonstrates full the range of responses observed.

- Fan Yifei, a deputy governor at the People's Bank of China, said efforts had been made to improve "the level of cleanliness" of cash in circulation,²⁶ with reports of new notes being printed, notes from badly impacted areas being destroyed, quarantine periods of seven to 14 days and disinfection techniques being used.
- The Bank of Thailand has suggested on Twitter that people could wash their banknotes with water and mild detergent if they were concerned.³⁰
- A Bank of England source, speaking to the Telegraph in March said there were no plans to quarantine or disinfect banknotes in the UK and that "the risk posed by handling a polymer note is no greater than touching any other common surface, such as handrails, doorknobs or credit cards."³¹
- The Bank of Korea is reported to be superheating previously circulating banknotes to 150°C for two to three seconds before they re-enter the economy.³²
- The Central Bank of Hungary is quarantining banknotes for 14 days prior to sending them through a tunnel heated up to 170°C.³²
- In Hong Kong the focus is on maintaining their clean note policy as opposed to specific treatments or quarantine procedures. "All banknotes returned to the vaults of the note-issuing banks will be sorted by machines automatically under a stringent standard, with filthy or unfit notes destroyed immediately" said a spokesperson from the Hong Kong Monetary Authority.³²
- Some central banks are reported to be printing additional new banknotes to raise the quality of notes in circulation. The Currency Research Europe Cash Cycle Seminar Webinar cited the Bank of Armenia and the Federal Reserve as going down this route.³³

30 <https://www.centralbanking.com/central-banks/currency/banknotes/7522076/bank-of-thailand-advocates-washing-banknotes> [accessed 10th April 2020]

31 https://www.telegraph.co.uk/news/2020/03/02/exclusive-dirty-banknotes-may-spreading-coronavirus-world-health/?mod=article_inline [Accessed 16th March 2020]

32 <https://www.centralbanking.com/central-banks/currency/7509046/will-cash-survive-covid-19> [Accessed 20th March 2020]

33 https://zoom.us/rec/play/u5V8f-yrqjw3GYCV4wSDUPcvW42-f_isgCIX_volmBzgVSQGMFulb7Mba-twFgMwZ6JlfPJdNCmwsVy?continueMode=true&_x_zm_rtaid=PJ8-bDaAS5SKIL3y3Bobsq.1589134907879.bcc8a7c4b5a0c18368623d0a182f169d&_x_zm_rhtaid=175 [Accessed 7th April 2020]

- Some central banks, with circulating banknotes overseas or who circulate banknotes issued by another country, have adopted policies to quarantine incoming banknotes.³⁴

The Moral, Societal and Economic Impacts of Cash Related Policies

There are a growing number of calls to ensure that people can pay for essential goods and services. Digital and mobile payments play a role here but for billions of people around the world this means ensuring continued access to cash. In some instances this had led to commentary that refusing to accept cash is a form of discrimination.³⁵ The International Currency Association points out that cash is essential for social inclusion, it cannot be hacked and that it protects the privacy and anonymity of its users.³⁶ Central banks have put out statements, policies have been considered and various initiatives are underway.

- The Bank of Canada has emphasized the importance of cash and accepting cash: “During this time of heightened public health measures intended to limit the transmission of COVID-19, some consumers and businesses are choosing not to use cash to limit potential exposure. Refusing cash could put an undue burden on people who depend on cash as a means of payment. The Bank strongly advocates that retailers continue to accept cash to ensure Canadians can have access to the goods and services they need.”²²
- The Canadian Association of Secured Transportation echoes the Bank of Canada: “the continued availability of the option to pay with cash is also of crucial importance to Canadians who depend upon using currency each day. We are not aware of any reliable scientific evidence indicating that practicing good hygiene, or safeguarding the public’s health, requires consumers and businesses to give up the convenience, security, or privacy protections that cash transactions offer.”³⁷
- The Bank of Finland has put the relative risks into perspective to emphasise why it is important that cash continues: “Cash is the preferred form of payment for about 10% of Finns. For these people, cash may be the only possible payment method and it is important that they get their purchase done. Cash can be used as usual during a coronary pandemic. However, the most important thing is careful hand hygiene, regardless of the payment method,” Päivi Heikkinen, Head of the Payment Systems Department, Bank of Finland.³⁸

34 <https://www.bullionstar.com/blogs/jp-koning/banknotes-and-coronavirus/> [Accessed 13th May 2020]

35 https://sf.eater.com/2020/3/25/21194256/restaurants-cash-san-francisco-coronavirus?utm_content=124742606&utm_medium=social&utm_source=twitter&hss_channel=tw-743477599800786944 [Accessed 5th April 2020]

36 https://www.irishtimes.com/opinion/letters/cash-is-here-to-stay-1.4231756?utm_content=126763487&utm_medium=social&utm_source=twitter&hss_channel=tw-743477599800786944 [Accessed 18th April 2020]

37 https://www.globenewswire.com/news-release/2020/05/06/2028611/0/en/COVID-19-Currency-Poses-No-Greater-Risks-Than-Bank-Cards-or-Mobile-Phones.html?utm_content=128993173&utm_medium=social&utm_source=twitter&hss_channel=tw-743477599800786944 [Accessed 13th May 2020]

38 Bank of Finland Blog: “Käteisen käytöstä koronapandemian aikana (Use of cash during Corona pandemic)” <https://www.eurojatalous.fi/fi/blogit/2020/kateisen-kaytosta-koronapandemian-aikana/> [Accessed 25th March 2020]

- Fan Yifei, a deputy governor at the People's Bank of China, has taken a slightly stronger stance, going as far as to say it would "continue to punish merchants who refused to accept banknotes and coins."²⁶
- Erick Lacourrège, Director General of Services to the Economy and of the Banque de France Network, sent a letter to distributors reminding them that they cannot refuse a payment in cash³⁹

Globally there is significant activity designed to ensure continued access to cash, including mobile ATMs,^{40,41} extensions to schemes allowing others to support vulnerable people in obtaining their cash,⁴² reducing commissions and raising the limits on cash withdrawals^{43,44} as well as putting appropriate social distancing measures in place to ensure that cash payments can continue.^{45,46}

Recommendations

Advice for those handling cash frequently

Cash handlers will touch banknotes more frequently than the average person and so the advice around frequent hand washing and not touching your face is particularly important for this group of people. The risk of contracting the coronavirus through normal banknote handling processes remains low. There are however some sensible precautions for cash handlers to take:

- Wash hands frequently – ideally with soap and water, but an alcohol-based hand rub can also be used
- Avoid touching banknotes and then touching your eyes, nose or mouth
- Avoid licking your thumb or fingers to aid manual banknote sorting
- Where possible minimise unnecessary transfer of banknotes between people
- Where possible minimise the number of users per piece of cash handling equipment and wipe down the equipment at the end of the shift

39 <https://www.lsa-conso.fr/la-banque-de-france-rappelle-qu-il-est-interdit-de-refuser-un-paiement-en-especes,345530> [Accessed 10th April 2020]

40 https://kashmirvision.in/2020/04/22/mobile-atm-facility-provided-in-red-zone-areas-in-kupwara/?utm_content=127863633&utm_medium=social&utm_source=twitter&hss_channel=tw-743477599800786944 [Accessed 25th April 2020]

41 <https://t.co/REiBmYVCO7?amp=1> [Accessed 7th April 2020]

42 <https://www.bbc.co.uk/news/business-52229698> [Accessed 13th April 2020]

43 https://www.euroweeklynews-com.cdn.ampproject.org/c/s/www.euroweeklynews.com/2020/04/05/some-spanish-banks-reduce-commissions-and-increase-maximums-for-cash-machine-withdrawals/amp/?utm_content=124916992&utm_medium=social&utm_source=twitter&hss_channel=tw-743477599800786944 [Accessed 7th April 2020]

44 https://www.forbes.com/sites/advisor/2020/03/19/banking-and-cash-during-covid-19-crisis-some-branches-close-atm-fees-may-be-waived/?utm_content=124744747&utm_medium=social&utm_source=twitter&hss_channel=tw-743477599800786944#1c2433f11c6d [Accessed 8th April 2020]

45 https://losangeles.cbslocal.com/2020/04/01/coronavirus-farmers-markets-reopen/?utm_content=124680390&utm_medium=social&utm_source=twitter&hss_channel=tw-743477599800786944 [Accessed 4th April 2020]

46 https://www.thenewsminute.com/article/pics-boxes-and-circles-ground-ensure-social-distancing-while-shopping-121214?utm_content=124072378&utm_medium=social&utm_source=twitter&hss_channel=tw-743477599800786944 [Accessed 1st April 2020]

- Avoid sneezing or coughing onto a banknote – ideally carry tissues that can be used to cover your nose and mouth prior to being disposed of

Should I varnish my banknotes or move to polymer?

Given the relatively low risks associated with banknotes, discussed earlier, it is highly unlikely that transitioning from paper to polymer banknotes (or vice-versa) will have any significant impact on the spread of COVID-19. If a central bank has a concern about the perception of banknotes in circulation, then a review of the central bank's clean note policy may be sensible.

An evaluation of technologies with anti-viral properties is underway at De La Rue. Please be aware that no product will have been tested on COVID-19 as COVID-19 is currently classified as a hazard and not available commercially for testing purposes. Please also consider that banknotes are passed between people in a matter of seconds. If laboratory results indicate a product can kill coronavirus variants in e.g. 24 hours it doesn't necessarily mean that it reduces the risk of coronavirus passing between people when the notes are exchanged in a matter of seconds. The WHO advise about frequently washing hands when touching physical surfaces will still apply, even for banknotes that are treated with some type of anti-viral treatment.

Disinfecting or quarantining banknotes

There is a range of behaviors taken by central banks in this area, including the decision to continue as normal, disinfecting (typically by UV light or heat, although supercritical CO₂ will also work) or quarantining banknotes. Some central banks, including the Bank of England, have said that they are not disinfecting or quarantining banknotes.

For central banks wanting to do something (either "just in case" or because of a desire to be seen to be doing something) then quarantine will be the simplest and cheapest route forward, if vault space permits. Those who are opting to quarantine their banknotes are typically doing so for between seven and fourteen days, which seems sensible given the literature review typically indicates the virus will typically last on a surface for less than a week. De La Rue is aware of one central bank holding notes in quarantine for four weeks.⁴⁷

If considering storage at higher temperature (e.g. prolonged periods at 60 or 70°C or short periods at 150°C) then paper notes will become drier, and more brittle particularly at the higher temperatures, but will reabsorb moisture once exposed to normal temperatures and humidity, then return to normal. There is no evidence that varnish will yellow over time if exposed to higher temperatures. Polymer banknotes are OK at the lower temperatures and exposure to higher temperatures for a few seconds should not give major issues. However 150°C is within the melting point range of the base polymer. At

⁴⁷ <https://english.alarabiya.net/en/News/gulf/2020/03/12/Coronavirus-Kuwait-Central-Bank-quarantines-banknotes-for-four-weeks.html> [Accessed 13th May 2020]

150°C the notes may stick together more if under pressure and increased temperature. Our limited testing at a higher temperature shows notes are more likely to distort particularly if handled/pulled and a few minutes at high temperature can lead to shrinking. De La Rue does test routinely in heated air (105°C for 30 mins) and washing machines at 95°C and banknotes are stable under these tests.

If considering prolonged exposure to UV light then please be aware that this can lead to fading of some inks. The UV inks, in particular blue and reds, are most susceptible.

Overall central banks considering disinfection or quarantine of banknotes need to balance the cost and disruption to the cash cycle with the overall risk associated with handling banknotes and the impact that any quarantine or disinfection initiatives will have on the spread of COVID-19, given the other surfaces people touch and the higher risk associated with face-to-face contact.