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Effects of Disinfectant Wipes on Sensitive Healthcare Surfaces

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OBJECTIVES

The main objective of this study was to test different disinfectant wipes on sensitive surfaces and examine any effects on the surface appearance and quality.

METHODS

Disinfectant Wipe Products Tested

The disinfectant wipes used in this study are outlined in Table 1 below.

Table 1: Disinfectant Wipe Products	
Product	Active Ingredients
Product S	70.5% Ethanol, 0.2% Chlorhexidine gluconate
Product T	19.9% Ethanol, 0.1% Chlorhexidine gluconate
Product C*	0.28% diisobutylphenoxyethoxyethyl dimethyl benzyl ammonium chloride (Quat), 17.2% isopropanol
Product O/V	0.5% Hydrogen peroxide
Product Cl	0.55% Sodium hypochlorite
*Product C also contains 1-5% Ethylene glycol monobutyl ether (Butyl Cellosolve) as a non-active ingredient	

Swabbing at Long Term Care Facilities and Dental Offices

Samples were taken from point-of-care touch screens, keyboards, computer mice, waiting area chairs, and dental operator chairs at Long Term Care (LTC) facilities and dental offices across the Greater Toronto Area. Surfaces were swabbed using swabs dipped in phosphate buffered saline (PBS) and then plated on tryptone soy agar (TSA) and Sabouraud dextrose agar (SDA) to isolate bacteria and fungi, respectively. Surfaces were sampled before and after use of Product T. Surfaces were wiped with a single wipe, going over the surface three times to ensure coverage. A contact time of three minutes was allowed to elapse before taking the second set of swab samples. TSA plates were incubated at 30-35°C for 24-48hr, while SDA plates were incubated at 20-25°C for 5-7 days. Images of the sample plates “Before” and “After” use of the disinfectant wipe were captured.

Testing Disinfectant Wipes on Surfaces

A point-of-care touch screen (CareWorx, Orangeville, ON) and mobile tablet (Apple, Inc.) were divided into sections, while pieces of mattress coverlet and dental chair polyvinyl chloride (PVC) fabrics (J. Ennis Fabrics, Mississauga, ON) were fixed onto a cardboard surface for testing of different disinfectant wipes. The surfaces were wiped up to 20 times daily for 25-50 days with the test disinfectant wipes and observed for any changes in colour and/or appearance. The touch screen and mattress coverlet sections were swabbed before and after the initial wipe with a sterile swab dipped in PBS. The swab was plated in 12ml of tryptone soy broth (TSB) and vortexed to mix. For each TSA and SDA plate, 5ml of the sample solution was filtered through a 0.22um membrane filter and plated. TSA and SDA plates were incubated as above. The remaining 2ml of sample was incubated at 30-35°C for 24-48hr for use in specific organism testing (Pseudomonas aeruginosa, Staphylococcus aureus, E. coli and Salmonella). Following incubation, 100ul of the enriched samples were plated onto each of mPAC, MSA, MacConkey and XLD agar plates. The samples were spread over the surface of the plates with a sterile glass hockey stick and allowed to dry. Once dry, plates were inverted and incubated at 30-35°C for 24-72hr. Colonies present on plates were examined and samples were designated as positive or negative for the presence of the specific microorganisms based on the criteria listed in Table 2. Swab samples were also taken halfway through and at the end of the study to determine if antimicrobial activity was sustained throughout the course of the project.

ACKNOWLEDGEMENTS

We would like to thank CareWorx for providing the touch-screen and J. Ennis Fabrics for providing the PVC fabrics used in this study.

Swabbing at Long Term Care Facilities and Dental Offices

All sampled surfaces, including touch screens, keyboards, computer mice and phones, showed varying levels of contamination with both bacteria and fungi. Surfaces that were used more often showed higher levels of contamination. At the long term care facility, most of the touch screens, keyboards and phones that were sampled also showed evidence of *S. aureus*.

After using Product T, all surfaces showed an absence of contamination. Figures 1 and 2 show examples of the plates isolated from surfaces before wiping with Product T.

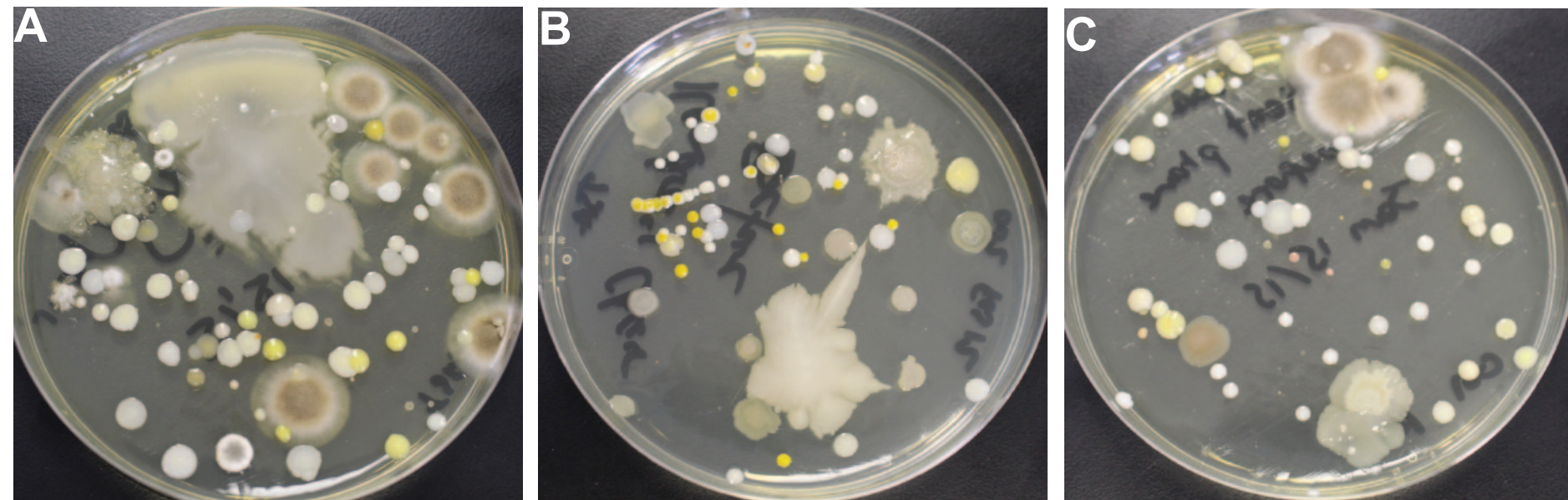


Figure 1: Samples of bacterial plates isolated from a dental office. (A) Sample from a recovery room chair. (B) Sample from a dental operator chair. (C) Sample from a waiting room phone. All samples taken after wiping with Product T showed no growth of colonies.

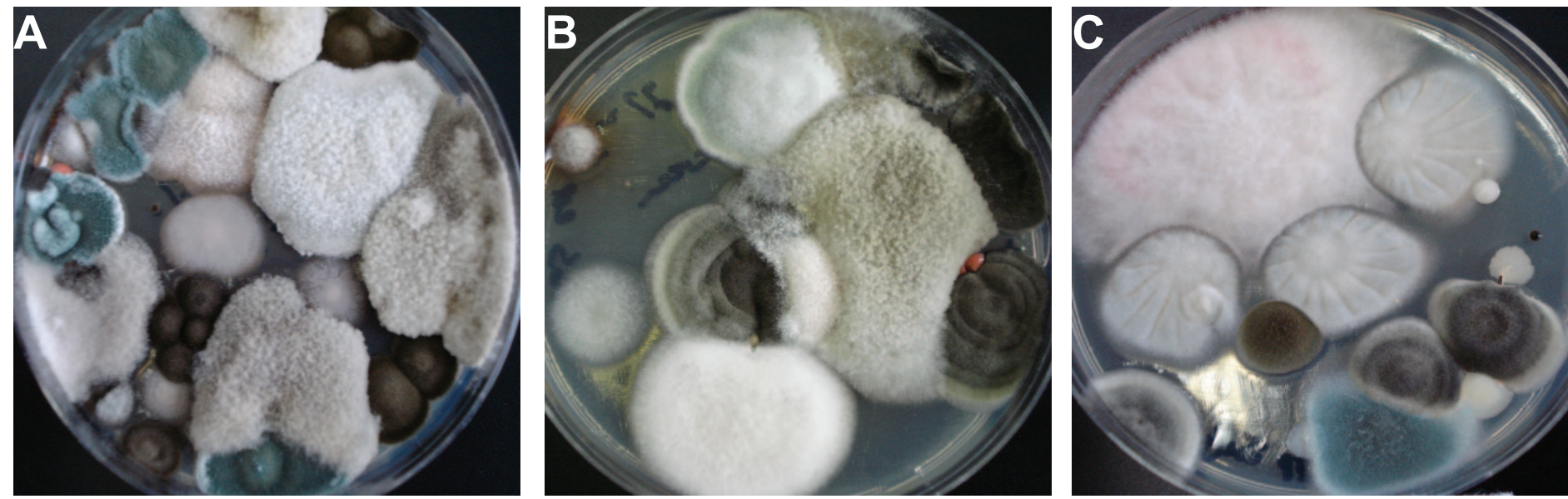


Figure 2: Samples of fungal plates isolated from Long Term Care touch screens and keyboards. (A) Sample from a computer keyboard. (B) Sample from a touch screen located on a mobile cart. (C) Sample from a computer keyboard. All samples taken after wiping with Product T showed no growth of colonies.

Effect of Disinfectant Wipes on Touch Screens

The point-of-care screen was wiped a total of 133 times over the course of the study for all products except the bleach wipe, which was used 127 times due to the product having fewer wipes per canister compared to the other test products. The tablet screen was wiped a total of 170 times for all products. The point-of-care screen surface was swabbed before and after the first wipe, after 71 wipes, and again at the end of the study to determine antimicrobial efficacy over the course of the project. At the start of the study, all four screen sections showed heavy bacterial and fungal contamination (Figure 3). In addition, most of the surfaces also showed evidence of *P. aeruginosa*, *S. aureus*, *E. coli* and *Salmonella*. Samples taken partway through and at the end of the study showed an absence of bacteria and fungi, including the specific organisms listed above.

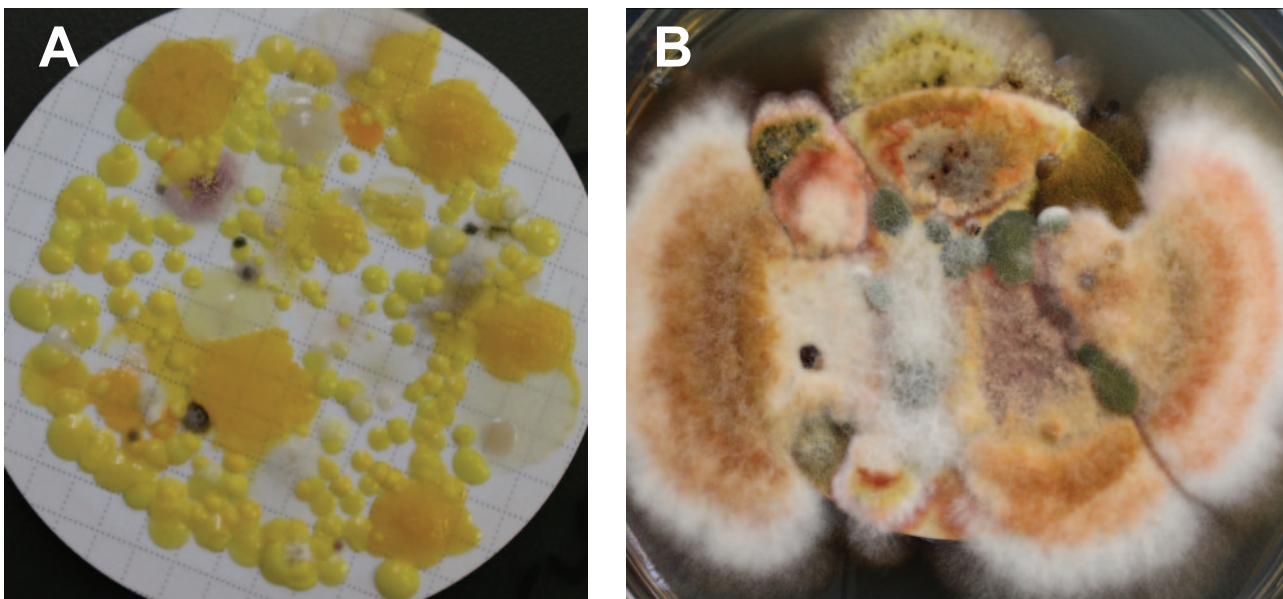


Figure 3: Cultured samples from touch screen. Bacteria (A) and fungi (B) isolated from point-of-care touch screen. Samples were taken at the start of the study before use of the first disinfectant wipe. All samples taken after the first wipe were clear of both bacteria and fungi.

Table 2 summarizes the effects the disinfectant wipes had on the point-of-care and tablet screens. The appearance of each screen section as described remained similar over the course of the study. Figures 4 and 5 show images of the screens over the course of the project.

Table 2: Effects of Disinfectant Wipes on Touch Screens

Product	Point-of-Care Screen	Tablet Screen
Product C	Slight spotting after 3-4 wipes. More pronounced spotting after 16 wipes.	Slight spotting after 2 wipes. More pronounced spotting after 15 wipes.
Product Cl	Light film and streaking after 3-4 wipes. Substantial white film and residue after 16 wipes. Build-up of a white crusty residue along corners of screen after 21 wipes.	Light film left on screen after 2 wipes. More substantial residue and spotting after just 5 wipes. Build-up of white crusty residue after 10 wipes.
Product O/V	Light filming and streaking after 3-4 wipes. More visible film after 16 wipes.	Slight spotting and residue after 2 wipes. More visible film after 15 wipes.
Product S	Not tested	No film, residue or spotting throughout study period.
Product T	No film, residue or spotting throughout study period.	Slight film after 5 wipes with no further change over study period.

Effect of Disinfectant Wipes on Fabrics

Pieces of a mattress coverlet and PVC fabric were wiped a total of 133 times with all test products. Swab samples taken of the mattress coverlet before the first wipe showed contamination with both bacteria and fungi, although not as much as the point-of-care screen samples, as well as evidence of *P. aeruginosa*, *S. aureus*, *E. coli* and *Salmonella*. Samples taken after 71 wipes and at the end of the study showed an absence of any bacterial and fungal growth.

Table 3 summarizes the effects of the disinfectant wipes on the mattress coverlet and PVC fabrics. Figures 6 and 7 present images of the mattress coverlet and PVC materials at the end of the study period.

RESULTS

Table 3: Effects of Disinfectant Wipes on Fabrics

Product	Mattress Coverlet	PVC Fabrics
Product C	After 92 wipes, material began to show slight discoloration and dullness. By end of study, material lost its sheen and had a rough texture. Some edges were white, indicative of fraying.	Slight filming after 5-6 wipes. More visible filming after 15 wipes. By end of study the light brown PVC appears slightly dull, while there is a shiny, sticky residue left on the dark brown and blue PVCs.
Product Cl	After 21 wipes, fabric began to appear lighter in colour. By end of study, the fabric was significantly lighter compared to other products and the untreated sample. Fabric felt rougher, lost its sheen and was more absorbent to liquids.	Slight filming and spotting after 4-5 wipes. More pronounced film and residue seen after 25 wipes. By end of study, all fabrics have a white residue on their surface and the materials appear dull compared to the other products and controls.
Product O/V	Similar colour and sheen compared to untreated sample by end of study, but material felt slightly rougher compared to samples treated with Products S and T. Some edges were white and fraying, but not as much as Product C.	Slight spotting after 4-5 wipes. Left a shiny residue on fabrics after 30 wipes. Left a sticky residue on the surface of fabrics after 50 wipes that remained until the end of the study.
Product S	No discoloration or other damage. Fabric retained its sheen and was still soft and supple by end of study.	Left a slight residue on fabrics after 30 wipes that remained unchanged to the end of the study.
Product T	No discoloration or other damage. Fabric retained its sheen and was still soft and supple by end of study.	No film, spotting or residue observed. Fabrics appear similar to controls.

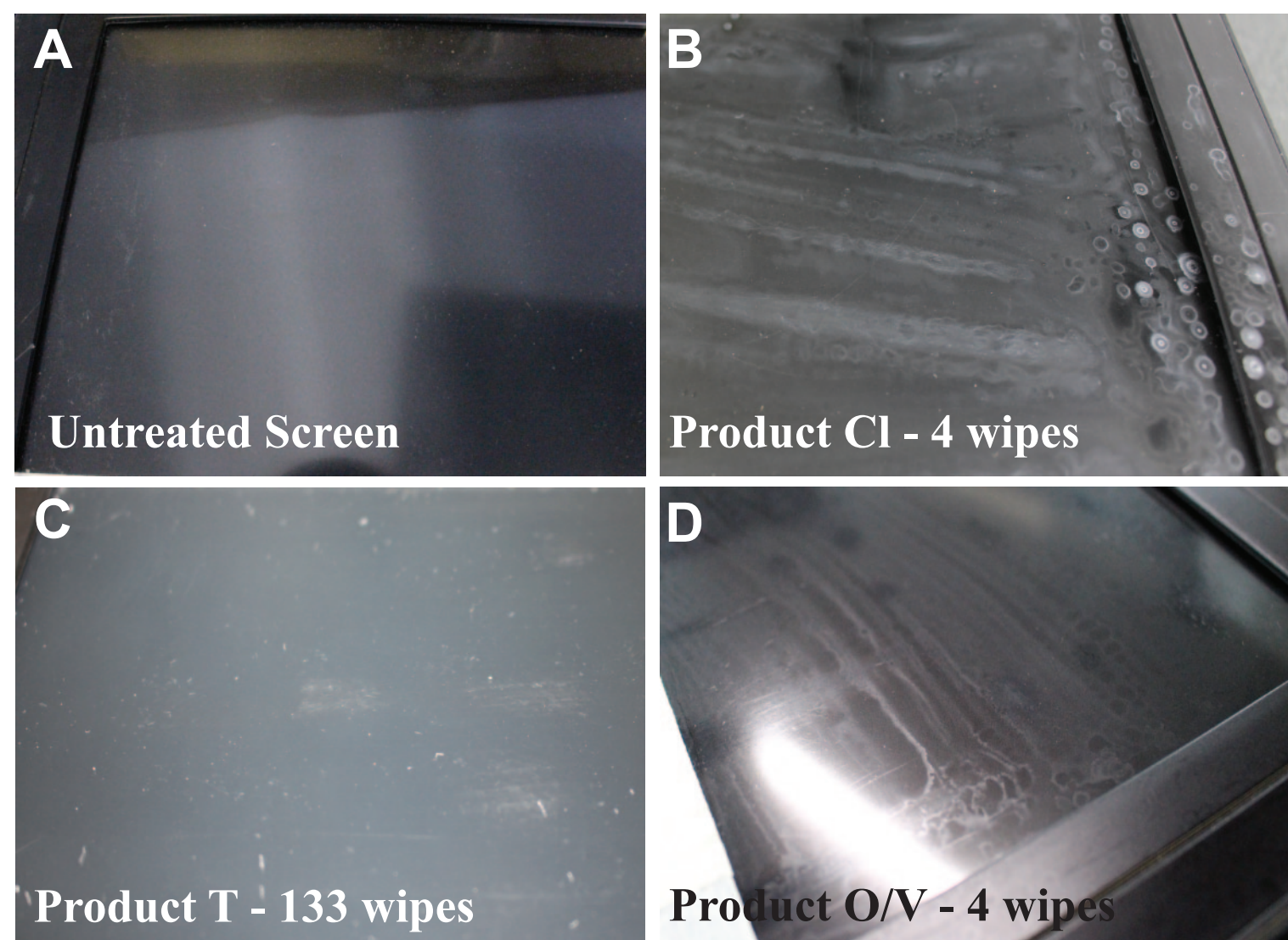


Figure 4: Appearance of point-of-care touch screen after use of disinfectant wipes. (A) Untreated touch screen at the start of the study. (B) Screen after using 4 wipes of Product Cl, showing heavy residue and filming. (C) Screen after using 133 wipes of Product T, showing no film or residue on the surface. (D) Screen after using 4 wipes of Product O/V, showing appearance of a film on the surface of the screen.

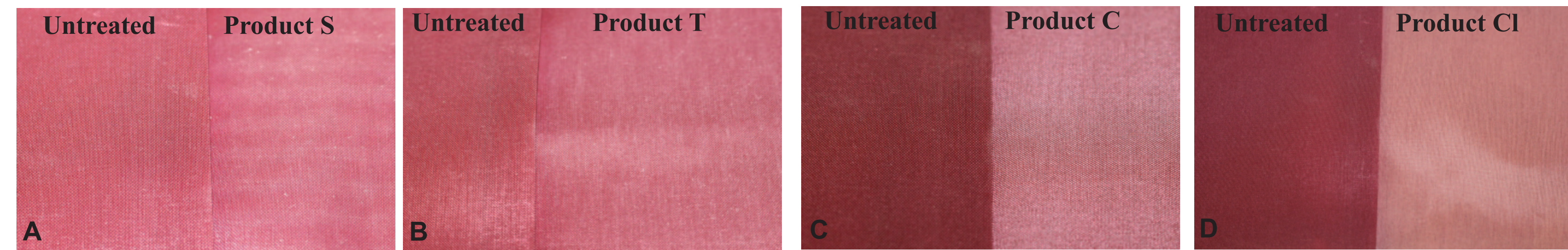


Figure 5: Appearance of tablet touch screen after use of disinfectant wipes. (A) Screen after using 15 wipes of Product C showing spotting on the surface. (B) Screen after using 150 wipes of Product S, showing absence of spotting, filming and residue. (C) Screen after using 150 wipes of Product T, showing slight film on the surface. (D) Screen after using 10 wipes of Product Cl, showing appearance of spotting and residue on the surface of the screen. (E) Screen after using 150 wipes of Product O/V, showing slight spotting on the surface.



Figure 6: Mattress coverlet material treated with disinfectant wipes. (A) Material treated with 133 wipes of Product S, showing similar colour to untreated fabric. (B) Material treated with 133 wipes of Product T, showing similar colour to untreated fabric. (C) Material treated with 133 wipes of Product C, showing discoloration of material compared to untreated control. (D) Material treated with 127 wipes of Product Cl, showing significant discoloration compared to untreated fabric.



High-touch surfaces can serve as reservoirs for bacteria and fungi that can cause infections. Disinfectant wipes are effective at removing bacterial and fungal pathogens from high-touch surfaces. Wipes containing ethanol and chlorhexidine did not damage or leave a film on any of the test surfaces, suggesting they can be used on a variety of surfaces and materials.

The bleach wipes significantly damaged the mattress coverlet material and left the most residue on the touch screens and fabrics compared to the other products, while the quat-based and accelerated hydrogen peroxide wipes produced some damage to the materials and produced filming and spotting on the touch screens.

Caution must be taken when selecting a disinfectant for use on high-touch surfaces, so as to minimize damaging effects on sensitive and costly equipment.

CONCLUSIONS