healthcare facility in Delhi. Variables included fabric type (polyester, cotton, and 70:30 polyester:cotton blend), duration of use (one and three shifts), and ambient conditions (March to August). Fabrics were prepared by scouring followed by rinsing, drying, and ironing. Patches of size 6 cm × 10 cm cut from the three fabrics were stitched together to make patches of 18 cm × 10 cm which were wrapped in aluminium foil and autoclaved. Fixing of composite patches on nurses' coat, and sampling for bacterial counts, were performed as per Gupta *et al*. [5,6]. Bacterial contamination was assessed after the first and third shifts (one shift typically of 6 h duration). A total of 58 patches per fabric (total 174 samples) were processed over the study period. Each patch (~48 cm^2) was placed in a sterile Falcon tube with 4.7 mL of phosphate-buffered saline for 5 min and vortexed for 30 s (3000 rpm) to dislodge the bacteria into the solution. A volume of 100 μL appropriately diluted solution was inoculated in Luria Agar. Inoculated plates were dried and incubated for 24 h. SPSS 16.0 for Windows was used to analyse the data. Comparison of mean values was made using Duncan's multiple range test at $P < 0.05$ [7]. One-way analysis of variance was used for comparing different test fabrics.

Maximum bacterial load on all fabrics was detected in the month of June, when ambient temperature (34°C) and relative humidity (49%) were both high. Bacterial abundance on all test samples increased significantly after the third shift (107% on cotton, 83% on polyester, and 67% on blend). This indicates that coats should not be used for more than one shift. Polyester–cotton blend fabric attracted the maximum number of bacteria under all test conditions (Figure 1). We hypothesize that in blend fabric, the cotton component attracts more bacteria because of its hydrophilic nature, and the polyester component holds the bacteria due to hydrophobic–hydrophobic interactions. This creates a synergistic effect leading to increased accumulation of bacteria on the blended fabric. However, this needs further investigations. Bacterial load was not related to the number of patients admitted.

We conclude that bacterial abundance on nurses' coat is related to the type of fabric used, duration of use, and ambient conditions. Effect of fibre composition and fabric characteristics on degree of contamination and retention of microbes needs to be studied further and specific guidelines prescribed by the health ministry for selecting the fabric of white coats.

The total bacterial load considered in the present study may include the nurses' own skin flora as well as environmental flora. Further studies are ongoing to identify the specific bacterial species present on the patches. The three fabrics used in the study had different physical characteristics, which could influence microbial adhesion. Besides, only the emergency ward was sampled in the present study. The microbial load can vary in different wards of the hospital.

Acknowledgements
The investigators thank the hospital administration and nurses of IITD Hospital for participating in this study.

Conflict of interest statement
None declared.

Funding sources
Faculty Interdisciplinary Research Project (MI01681G) and Grand Challenge Scheme (MI1798G), Indian Institute of Technology Delhi to S.S. and D.G. for consumables, and DST-INSPIRE fellowship to S.V.

References

[1] Chugh TD. Hospital infection control – are we serious? Med Updat 2012;22:74–7.
[2] Banu A, Anand M, Nagi N. White coats as a vehicle for bacterial dissemination. J Clin Diagn Res 2012;6:1381–4.
[3] Zahra M, Yasaman F, Mahboubeh NN, Emran A. Study on bacteria associated with white coats of healthcare workers in two tertiary hospitals, Mashhad, Iran. J Med Bacteriol 2013;2:17–25.
[4] Tse G, Withey S, Yeo JM, Chang C, Burd A. Bare below the elbows: was the target the white coat? J Hosp Infect 2015;91:299–301.
[5] Gupta P, Bairagi N, Priyadarshini R, Singh A, Chauhan D, Gupta D. Bacterial contamination of nurses' white coats made from polyester and polyester cotton blend fabrics. J Hosp Infect 2016;1:92–4.
[6] Gupta P, Bairagi N, Priyadarshini R, Singh A, Chauhan D, Gupta D. Bacterial contamination of nurses' white coats after first and second shift. Am J Infect Control 2017;1:86–8.
[7] Little TM, Hills FC. Agricultural experimentation. Hoboken, NJ: Wiley; 1978.

S. Varshney[a]
S. Sharma[a]
D. Gupta[b,*]
[a]*Department of Biochemical Engineering and Biotechnology, Indian Institute of Technology Delhi, Hauz Khas, New Delhi, India*
[b]*Department of Textile Technology, Indian Institute of Technology Delhi, Hauz Khas, New Delhi, India*

* Corresponding author. Address: Department of Textile Technology, Indian Institute of Technology Delhi, Hauz Khas, New Delhi 110016, India. Tel.: +91 11 26591417.
E-mail address: deepti@textile.iitd.ac.in (D. Gupta)

Available online 22 February 2019

https://doi.org/10.1016/j.jhin.2019.02.014

Managing seasonal influenza in hospitalized patients – without an influenza point-of-care test

Sir,

We note with interest the impact of the point-of-care tests (POCTs) for diagnosing influenza and other respiratory viruses

[1]. But if none is available (or affordable) in your hospital, what else can you do?

Although national guidance highlights the benefits of commencing early empirical antiviral therapy for suspected influenza infection in at-risk (e.g. elderly, pregnant, immunosuppressed, etc.) patient populations during the influenza season, this is not always done [2—4].

During the predominantly influenza A/H1N1pdm09 2018—2019 season, our laboratory tested respiratory samples in batches, on a respiratory multiplex polymerase chain reaction assay (16-well, AusDiagnostics UK Ltd), three times daily during the week (twice daily at weekends and during bank holidays). In the absence of any POCT, during Monday to Friday 09:00—18:00, we instigated a policy of calling out all new influenza-positive results directly to the wards, to enable earlier patient isolation and treatment, as appropriate.

If the patient had not yet been isolated, we also advised antiviral post-exposure prophylaxis (oseltamivir 75 mg once daily for 10 days) and swabbing all at-risk patient contacts in the same bay. If any of these patient contact swabs were positive for influenza, these contacts were given the higher antiviral treatment dose (oseltamivir 75 mg twice daily for five days). We also recorded whether the teams already knew about the result (from checking the electronic patient records), and/or whether they had already been discharged on what treatment.

During our peak seasonal influenza period, January 1st to March 31st 2019, 179 calls were made. The median time from sample collection to reporting was 28 h and 33 min. Of the 168 calls where data were available, 73 (43.5%) patients were not on antivirals by the time the result was called, and 47 (28.0%) patients were not isolated. These non-isolated patients usually had three to five other at-risk patient contacts within the same bay. Therefore, approximately 141—235 inpatients may potentially have been exposed to confirmed cases of influenza over this period. Further, this is a likely underestimate as it does not include weekend influenza statistics and at-risk patient contacts in acute admissions units or emergency departments. Despite antiviral prophylaxis, some of these patients later developed laboratory-confirmed influenza infection. This was likely due to the prophylaxis having been initiated too late because of late diagnosis and/or isolation of the index case.

From the laboratory side, there was a median time of 1 h 20 min between results being reported and being phoned to the ward teams. At least 102 (56.9%) of these results were not known at the time they were called out. Elsewhere, the clinical teams had already checked the results, or the infection prevention and control team (who receive alerts when influenza cases are confirmed) had already phoned the wards and given infection control advice. It was likely that many of these results would not otherwise have been seen until the following day, during morning ward rounds.

Overall, 76 (24.6%) of the 309 total influenza-positive samples in this three-month period were from patients who had already been discharged. Discharge information was available for 71 (93.4%) of these 76 patients: 46 (64.7%) went home with antibiotics (co-amoxiclav or amoxicillin ± doxycycline), 38 (53.5%) with antivirals (oseltamivir), and 26 (36.6%) with antibiotics and antivirals.

We did not record and therefore cannot comment on whether there was concurrent bacterial infection. However, there is the potential to reduce the number of antibiotic prescriptions and increase the number of antiviral prescriptions, if influenza diagnostic results are known earlier, prior to discharge [5—7].

There are numerous reasons for the late diagnosis of influenza infection in hospitals, including sample transport delays and the time required for sample processing, testing and reporting. This is where POCTs can be helpful, especially on wards containing at-risk patient populations. A rapid, accurate, and reliable POCT can confirm the diagnosis within 20—30 min, enabling prompt and appropriate antiviral prescribing and patient isolation, potentially reducing length of stay and the spread of the virus to others, as well as unnecessary antibiotic use [5—7].

During the annual influenza season, when hospitals are at their highest ever capacity, any strategy to improve patient flow requires consideration. For influenza, delays in antiviral treatment may also lead to poorer patient outcomes [2—4]. Thus, POCTs can contribute usefully to strategies to enhance both patient flow and clinical outcomes. Recent guidance issued by Public Health England lends support for the use of POCTs, though it falls short of a formal recommendation [8].

However, the introduction of POCTs is costly, and whether there is a need to continue parallel testing with any existing laboratory assays will need some discussion. Such duplicate testing for influenza may be useful if the laboratory test detects other non-influenza respiratory viruses and provides useful surveillance data. These decisions and related business cases need to be made by individual clinical teams and hospitals, according to local needs.

Conflict of interest statement
None declared.

Funding sources
None.

References

[1] Youngs J, Marshall B, Farragher M, Whitney L, Glass S, Pope C, et al. Implementation of influenza point-of-care testing and patient cohorting during a high-incidence season: a retrospective analysis of impact on infection prevention and control and clinical outcomes. J Hosp Infect 2019;101:276—84.

[2] Public Health England. Guidance on use of antiviral agents for the treatment and prophylaxis of seasonal influenza. Version 9.1, January 2019. Available at: https://www.gov.uk/government/publications/influenza-treatment-and-prophylaxis-using-anti-viral-agents [last accessed April 2019].

[3] Muthuri SG, Venkatesan S, Myles PR, Leonardi-Bee J, Al Khuwaitir TSA, Al Mamun A, et al. Effectiveness of neuraminidase inhibitors in reducing mortality in patients admitted to hospital with influenza A H1N1pdm09 virus infection: an individual participant data meta-analysis. Lancet Respir Med 2014;2:395—404.

[4] Katzen J, Kohn R, Houk JL, Ison MG. Early oseltamivir after hospital admission is associated with shortened hospitalization: a five-year analysis of oseltamivir timing and clinical outcomes. Clin Infect Dis 2018 Oct 9, http://dx.doi.org/10.1093/cid/ciy860 [Epub ahead of print].

[5] Dale AP, Ebell M, McKay B, Handel A, Forehand R, Dobbin K. Impact of a rapid point of care test for influenza on guideline consistent care and antibiotic use. J Am Board Fam Med 2019;32:226—33.

[6] Hernandez DR, Pellitteri GP, Kimmich DJ, Heiter BJ, Smeal K, Wolk DM. Near point-of-care adoption of Cepheid Xpert® Flu/RSV

XC testing within an integrated healthcare delivery network. Diagn Microbiol Infect Dis 2019;94:28–9.
[7] Rahamat-Langendoen J, Groenewoud H, Kuijpers J, Melchers WJG, Wilt GJ. Impact of molecular point-of-care testing on clinical management and in-hospital costs of patients suspected of influenza or RSV infection: a modeling study. J Med Virol 2019 April 5, http://dx.doi.org/10.1002/jmv.25479 [Epub ahead of print].
[8] Public Health England. Point of care tests for influenza and other respiratory viruses. November 2018. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/762344/point_of_care_tests_for_influenza_and_other_respiratory_viruses.pdf [last accessed April 2019].

G. Hills[a,b]
M. Kennedy[a,b]
O. Ahmed[a,b]
J.W. Tang[a,c,*]
[a]*Clinical Microbiology, University Hospitals of Leicester NHS Trust, Leicester, UK*
[b]*Infectious Diseases Unit, University Hospitals of Leicester NHS Trust, Leicester, UK*
[c]*Respiratory Sciences, University of Leicester, Leicester, UK*
* Corresponding author. Address: University Hospitals of Leicester, Clinical Microbiology, Leicester Royal Infirmary, Infirmary Square, Leicester LE1 5WW, UK. Tel.: +44 (0)116 258 6516; fax: +44 (0)116 255 1949.
E-mail address: Julian.tang@uhl-tr.nhs.uk (J.W. Tang)

Available online 21 May 2019
https://doi.org/10.1016/j.jhin.2019.05.006

'The method used to dry washed hands affects the number and type of transient and residential bacteria remaining on the skin'

Sir,

We were interested to read the study by Mutters and Warnes concerning the claimed effects of hand washing and drying on bacteria remaining on hands [1]. We believe that some omissions in the report should be clarified as, currently, experimental repetition would not be possible. In addition, we would like to highlight some limitations of the study.

The hand washing regime used potash soap for 1 min and therefore does not represent real-world practice. We realize that this is an EN standard but emphasize that it will likely disturb/dislodge more resident bacteria than a real-world hand wash; both National Health Service and World Health Organization guidance recommends ~20 s of hand washing [2,3]. A 1 min process is excessive unless the hands are heavily contaminated with, for example, grease, which was not the case here.

We also note that the drying time used with the jet air dryer was 1 min. Again, this is unrealistic and contradicts the manufacturer's instructions for using a Dyson Airblade, which state 10–12 s [4]. Moreover, this type of dryer usually cuts out after a set time, and so we assume, although it is not stated, that the timer was deactivated for this study. No drying time is specified for the use of paper towels; was this the same as with the jet air dryer, i.e. 1 min? If so, this is excessive and unnecessary since towels (both textile and paper) and jet air dryers achieve ~90% dryness within 10 s. It is impossible to achieve 100% dryness even after 1 min [5]. The use of an excessive drying time with paper towels is likely to have caused further disturbance of resident bacteria and release of skin squames. The manufacturer of the paper towel used in this study makes several different specifications, which vary in softness and absorbency, but this was not specified and would affect results, especially when the drying time is excessive, due to possible unnecessary abrasion of the skin and release of resident dermal bacteria.

In our opinion the results presented in Table I are confusing. Column 3 headed 'Mean no. of *E. coli* recovered' and the last three rows suggest that the researchers considered some of the *E. coli* isolated as resident, when it is actually a transient bacterium on the hands. We are surprised by the results shown in Figure 1. The numbers of 'faecal coliforms' (presumably meaning the *E. coli* indicator strain) seem very high for any of the drying methods following hand washing, which we would expect to remove most of the artificial contamination. Drying for 1 min would further reduce the numbers of Gram-negative bacteria, which are susceptible to desiccation. This result deserves more explanation. Did the volunteers wear jewellery or did they have uncut or artificial nails that could explain this result? In Figures 1 and 2 the variation is >1000-fold in some of the results, which is surprisingly high.

We consider the list of bacteria recovered from washed hands in Table II as puzzling. After hands have been washed and dried, by whatever means, we would not expect to find such a wide range of Gram-negative bacteria (for the reasons cited above). *Pseudomonas* spp. are ubiquitous in the environment, including some water sources, but we would not expect isolation of these bacteria from washed hands, unless perhaps the washing liquid was contaminated.

The mention of hot air dryers and the Snelling *et al.* study seems curious since this type of dryer it is not directly relevant to this current study [6]. Moreover, the article fails to mention that Snelling *et al.* concluded that using paper towels was the best means of reducing the bacterial load on the fingertips. Similarly, the discussion of the aerosolization of pathogens by dryers, the attempt to explain the results of the Best *et al.* study, and a particular selected extract favouring a jet air dryer also appear to be unbalanced [7]. We note that the report does not provide an explanation of any limitations of the study and does not mention whether ethical approval was sought or obtained. We are also surprised that no conflict of interest was declared when the study, described as 'independent', was funded by a commercial organization.

In conclusion, we believe that interpretation of the results and conclusions drawn by this study report are limited by