

Infection Prevention and Control

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April 2026

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1. Bridging Knowledge, Attitudes, and Practices: Hand Hygiene Behaviour Among Nursing Students

Authors: Abdullah, Nor Fadhilah; Ahmad, Balqis Humaira and Muhd Razali, Hasnora, Shafira Aida

Publication Date: 2026

Journal: Fundamental & Management Nursing Journal 9(1), pp. 36–46

2. Assessment of a European training programme in infection prevention and control and its impact on practices

Authors: Bogaert, C.; Männer, J.; Meşe, E. A.; Tsioutis, C.; Birgand, G.; Mutters, N. T.; Krone, M. and Kleppe, L. K.

Publication Date: 2026

Journal: The Journal of Hospital Infection 170, pp. 44–47

3. Relationships among clinical competence, self-efficacy, organizational culture for infection control, and compliance with standard precautions in early career nurses

Authors: Cho, Jae Yoon and Kim, Namhee

Publication Date: 2026

Journal: American Journal of Infection Control 54(5), pp. 524–530

Abstract: Background: This study examined the impact of clinical competence, self-efficacy, and organizational culture for infection control on early career nurses' compliance with standard precautions.; Methods: Participants were 154 clinical nurses with 6 to 35 months of experience working at a tertiary and secondary hospital in South Korea. Data were collected using a structured online questionnaire in April 2024, and analyzed using SPSS 29.0.; Results: The mean and SD for clinical competence was 3.42 ± 0.52 out of 5, self-efficacy was 2.72 ± 0.37 out of 4, organizational culture for infection control was 5.53 ± 0.76 out of 7, and compliance with standard precautions was 12.70 ± 4.00 out of 20. Compliance with standard precautions exhibited a significant positive correlation with clinical competence, self-efficacy, and organizational culture for infection control. The factors associating compliance with standard precautions were clinical competence ($\beta = 0.21$, $P = .017$) and organizational culture for infection control ($\beta = 0.37$, $P < .001$). The regression model explained 21.3% of the variance.; Conclusions: Improving clinical competence and fostering positive organizational culture for infection control are imperative to enhancing compliance with standard precautions among early career nurses. These findings should be used as foundational data to develop strategies to enhance compliance with standard precautions and address individual and organizational factors among early career nurses. (Copyright © 2025 Association for Professionals in Infection Control and Epidemiology, Inc. Published by Elsevier Inc. All rights reserved.)

4. Intraoperative wound irrigation for surgical site infection prevention after laparotomy - A systematic review and network meta-analysis of randomised clinical trials

Authors: Davey, Matthew G.; Kennedy, Czara A.; Alazzawi, Mohammed; Toale, Conor; Cullinane, Carolyn and Donlon, Noel E.

Publication Date: 2026

Journal: American Journal of Surgery 256, pp. 116930

Abstract: Introduction: There are conflicting recommendations surrounding the use of intraoperative wound irrigation (IOWI) to reduce surgical site infections (SSIs) for patients undergoing laparotomy. This study aimed to perform a systematic review and network meta-analysis of randomised clinical trials (RCTs) to elucidate the most appropriate IOWI solution to reduce SSIs following laparotomy.; Methods: A systematic review and network meta-analysis (NMA) was performed as per preferred reporting items for systematic reviews and meta-analysis (PRISMA)-NMA extension. Data analytics were performed using shiny and R.; Results: 11 RCTs were included involving 2943 patients. Overall, 1292 patients were randomised to normal saline (NS) (43.9%), 771 to povidone iodine (PI) (26.2%), 519 to polyhexidine (PH) (17.6%), 180 to electrolysed strongly acidic aqueous solution (ESAAS) (6.1%), 102 to none (control) (3.5%) and 79 to olanexidine (O) (2.7%). Non-significant differences in patient age, gender, body mass indices, or American Society of Anaesthesiologist grade were observed for each IOWI group (all $P > 0.050$). At NMA, IOWI using PH significantly reduced all cause SSIs in patients undergoing laparotomy (odds ratio

(OR): 0.54, 95% confidence interval (CI): 0.36 - 0.80). Furthermore, IOWI using PH (OR: 0.54, 95% CI: 0.36 - 0.80) and ESAAS (OR: 0.36, 95% CI: 0.13 - 0.98) significantly reduced superficial SSI (SSSI) in patients undergoing laparotomy. For patients undergoing laparotomy in the elective setting, PH significantly reduced both SSI (OR: 0.41, 95% CI: 0.25 - 0.68) and SSSI (OR: 0.42, 95% CI: 0.22 - 0.82) rates.; Conclusion: IOWI with PH reduces SSIs in patients undergoing laparotomy and should therefore be considered in patients undergoing this procedure. (Copyright © 2026 The Authors. Published by Elsevier Inc. All rights reserved.)

5. Bare-below-the-elbow based hand hygiene intervention to improve compliance among allied healthcare professionals and students

Authors: Doddangoudar, Vijaya C.;Kanishan, Chaithra;Joylin, Stelyna;Dharman, Krishna Kumar and Nayak, Asmitha G.

Publication Date: 2026

Journal: Journal of Infection Prevention , pp. 17571774261440776

Abstract: Introduction: Nosocomial infections are known to cause poor clinical outcomes. Hand hygiene is recognised as an effective tool in controlling infections. However, poor hand hygiene practice is evident worldwide. Thus, this work aimed to determine the effect of hand hygiene intervention on bare-below-the-elbow, before and after the use of mobile communication devices among allied healthcare professionals and students. Methods: Data was collected in four stages; stage-I was to verify the existence of protocols for hand hygiene. Stage-II was a pre-intervention blind-field observation to determine the compliance rate. Stage-III involved the administration of interventions and stage-IV was based on post-intervention observation to determine the effect of the intervention. The intervention was delivered using scientific literature on hand hygiene and supplemented with a manual demonstration of the same by an infection control nurse. The obtained data was analysed by Kendall rank coefficient test. Results: The compliance rate was found to be 22.0% and 53.0% in the pre- and post-intervention stage respectively, indicating significant improvement in the hand hygiene practices. Discussion: This study advocates active participation of the infection control team and suggests the need of periodic interventions on appropriate hand hygiene, particularly to internship students to sustain the hand hygiene practices and control the spread of nosocomial pathogens. (© The Author(s) 2026.)

6. Trends of economic evidence in infection prevention and control practices for hospital-acquired infections

Authors: Elangovan, Shalini and Graves, Nicholas

Publication Date: 2026

Journal: American Journal of Infection Control 54(5), pp. 480–484

Abstract: Background: Hospital-acquired infections impose substantial clinical and economic burdens but are preventable. Although economic evaluations can show decision-makers which programmes will generate the most health benefits per dollar invested, their representation

amongst published evidence is unclear. This study identified infection prevention practices implemented in Singapore and assessed the availability of supporting economic evidence.; Methods: Five infection prevention nurses identified implemented practices. Three were selected: automated surveillance, portable high-efficiency particulate air filters, and Ultraviolet-C disinfection machines. PubMed records from 2015 to 2025 were analyzed using bibliometric software to map keyword frequencies across five themes: cost-effectiveness, clinical, science and technology, environmental health, and the COVID-19 pandemic.; Results: Cost-effectiveness-related keywords averaged fewer than 6 per year, compared with over 100 to 400 per year for clinical, science and technology, and environmental themes. Pandemic-related keywords increased from 2020 and still exceeded cost-effectiveness terms, with 12 to 18 per year.; Discussion: Cost-effectiveness-related keywords were rare compared with other themes across all 3 infection prevention and control (IPC) practices. This suggests that published economic evaluations remain scarce even when interest in IPC interventions is heightened.; Conclusions: The lack of cost-effectiveness evidence indicates that IPC adoption might be informed by clinical and technical considerations rather than published economic appraisals. Broadening the use of economic evaluation might be warranted. (Copyright © 2025 Association for Professionals in Infection Control and Epidemiology, Inc. Published by Elsevier Inc. All rights reserved.)

7. Infection prevention and control risk assessment and policy for respiratory viral infections in National Health Service trusts in England: a national survey

Authors: Foster, C. R.;Weston, D.;Maynard-Smith, L.;McGuire, E.;Taylor-Egbeyemi, J.;Carter, H.;Fry, C.;Ritchie, L.;Wilcox, M.;Reilly, J. S.;Brown, C. S. and Sharp, A.

Publication Date: 2026

Journal: The Journal of Hospital Infection 170, pp. 246–252

Abstract: Background: Guidance on the use of fluid-resistant surgical masks (FRSMs) and filtering facepiece protection level 3 (FFP3) respirator masks by healthcare staff in England is produced nationally and applied locally by hospital trusts. In April 2022, national infection prevention and control guidance was updated with reference to the importance of local risk assessment when considering the use of FFP3 respirator masks.; Aim: Our aim was to evaluate local hospital policies for use of face masks and risk assessment for healthcare staff.; Methods: A cross-sectional online survey (February-March 2023) of National Health Service trusts in England was conducted. Responses were analysed using Fisher's exact tests and the framework approach.; Results: Fifty nine percent (109/186) of eligible hospital trusts responded. All trusts required staff to wear FRSMs or FFP3 respirator masks when providing direct care to patients with suspected respiratory viral infection (RVI), 87% (95/109) and 13% (14/109), respectively. FFP3 respirator masks were required by 13% of trusts (14/109) when providing direct care to individuals with suspected RVI and by 9% of trusts (10/109) when present in a bay/ward with patients with suspected RVI. Over half of the trusts used locally developed risk assessment tools.; Conclusions: There was clear variation in policies for use of face masks and use of workplace and individual risk assessments across hospital trusts. There was also variation in application of mask use, fit testing and audit of adherence. Further work is required to explore whether development of further guidance and national implementation tools could reduce unwarranted variation. (Crown Copyright © 2026. Published

8. Optimization of environmental surveillance-driven carbapenem-resistant organisms infection prevention and control strategies in intensive care units: A 4-year multicampus prospective intervention study

Authors: Ge, Tianxiang;Feng, Haiting;Ni, Lingmei;Wang, Fang;Zhan, Qing;Zhao, Ningqiu;Shangguan, Yanwan;Chen, Hui;Shen, Ping;Cai, Hongliu and Qu, Tingting

Publication Date: 2026

Journal: American Journal of Infection Control 54(5), pp. 505–511

Abstract: Background: Carbapenem-resistant organisms (CROs) are among the most concerning antimicrobial resistance pathogens, especially in intensive care units (ICUs). The role of environmental contamination in the transmission of CROs has been increasingly recognized. The aim of this study was to establish a replicable strategy on CROs' infection prevention and control (IPC) in ICUs.; Methods: This study was conducted in 4 phases. Environmental surveillance of CROs was conducted in ICUs every month to identify specific risks, and targeted IPC measures were implemented accordingly. Incidence rates of CRO-related healthcare-associated infections (HAIs) were calculated in each phase to assess the effectiveness of the IPC strategies.; Results: The detection of CROs in the ICU environment showed a downtrend during the study, with a significant decrease from 3.27% in baseline phase to 1.07% in phase III ($P < .05$). The detection of CROs in the open-bay ICU environment was significantly higher than that in the single-patient room ICU at baseline (3.97% vs 1.51%, $P < .05$) and became comparable in phase III after the implementation of our IPC strategies. The incidence of CRO-related HAIs per 1,000 ICU patient-days also decreased significantly from 2.333 in the baseline phase to 1.143 in phase III ($P < .001$).; Conclusions: Our environmental surveillance-driven CRO IPC strategies were associated with reductions in environmental CRO contamination and CRO-related HAIs in ICUs; however, the results were limited by unmeasured confounders and the quasi-experimental design. (Copyright © 2025 The Authors. Published by Elsevier Inc. All rights reserved.)

9. Driving change in hand hygiene: A strategic blend of monitoring, targeted education, and leadership support in inpatient units

Authors: Guanche Garcell, H.;Herrera Vives, Y.;Figueredo Arias, K.;Frometa Rodriguez, Y.;Rivero Companioni, P.;Martinez Aguilera, L.;Jorge Ponce, N.;Rojas Castellanos, M.;Pardo Milan, I.;Diaz Sanchez, D.;Villanueva Arias, A.;Gonzalez Perez, S. I. and Fernandez Hernandez, T. M.

Publication Date: 2026

Journal: Journal of Healthcare Quality Research 41(4), pp. 101208

Abstract: Background and Aims: Achieving compliance with hand hygiene (HH) to ensure safe healthcare remains a constant challenge. Observations in inpatient units revealed suboptimal adherence and the need for a quality improvement (QI) intervention. The study aim

was to increase HH adherence from 50% to 85% by September 2024 in selected units.; Methods: From May to September 2024, the intervention was implemented in five inpatient units of a community hospital in Qatar. It included multimodal monitoring (entry/exit method, alcohol-based hand rub [ABHR] consumption), staff education through various formats (in-person sessions, printed materials, online training, practical workshops), and targeted feedback to staff and leaders.; Results: A total of 8638 HH opportunities were recorded: 4625 before entering and 4013 after leaving patient rooms. Adherence before entry reached the target ($\geq 85\%$) during the final two weeks; after exit, from week 5 onwards, except week 11 (81.7%). Nursing staff showed higher compliance than physicians and aides. ABHR consumption increased by 52.4% compared to baseline.; Conclusions: The intervention improved HH compliance both before entry and after exit, with better performance among nursing staff. Key measures and surgical hand hygiene were identified as areas for future intervention. (Copyright © 2026 FECA. Publicado por Elsevier España, S.L.U. All rights reserved.)

10. Predictors of hand hygiene performance among family caregivers: A cross-sectional study using the Health Belief Model

Authors: Jang, Da-Jin and Jang, Seung Gyeong

Publication Date: 2026

Journal: American Journal of Infection Control 54(5), pp. 544–551

Abstract: Background: Family caregivers often provide direct bedside care in hospitals but are typically excluded from infection prevention efforts. Despite their frequent contact with patients and the environment, little is known about cognitive and belief-based predictors of their hand hygiene performance.; Methods: This cross-sectional study included 134 family caregivers from 2 general hospitals in South Korea. A structured questionnaire based on the Health Belief Model assessed hand hygiene performance and its predictors, including perceived susceptibility, severity, benefits, barriers, cues to action, knowledge, and self-efficacy. Multiple linear regression identified significant predictors.; Results: Hand hygiene performance was significantly associated with perceived benefits ($\beta = 0.29$, $P = .002$), perceived barriers ($\beta = 0.24$, $P = .001$), knowledge ($\beta = 0.16$, $P = .032$), habitual use of hand sanitizer ($\beta = 0.23$, $P = .003$), and age ($\beta = 0.32$, $P < .001$). The model explained 36.0% of the variance (adjusted $R^2 = 0.359$). Self-efficacy and other constructs showed limited predictive value.; Conclusions: This study highlights the role of cognitive and contextual factors in promoting hand hygiene among family caregivers. Interventions should emphasize perceived benefits and knowledge while addressing behavioral and environmental barriers. Findings support the inclusion of family caregivers as active participants in infection prevention strategies. (Copyright © 2025 Association for Professionals in Infection Control and Epidemiology, Inc. Published by Elsevier Inc. All rights reserved.)

11. A pilot study to explore the impact of just-in-time patient hand hygiene education and alcohol-based handrub use on hand contamination in outpatient settings

Authors: Knighton, Shanina; Torres-Teran, Maria; Cadnum, Jennifer; Colosimo, Linda and Donskey, Curtis J.

Publication Date: 2026

Journal: American Journal of Infection Control 54(5), pp. 538–543

Abstract: Background: Patients' hands can serve as reservoirs for health care-associated and transient pathogens, both of which can contribute to illness and transmission. Most hand hygiene programs target health care workers, even though transient bacteria on patients' hands are removable with proper technique. While inpatient initiatives such as the Patients' 4 Moments for Hand Hygiene have reduced contamination, little is known about outpatient settings or the effect of just-in-time education.; Methods: We conducted a prospective before-after pilot study of 61 outpatients at a Veterans Affairs medical center. Each participant provided bilateral hand cultures before and after alcohol-based handrub (ABHR) use, accompanied by just-in-time education based on the Visitors' 4 Moments framework.; Results: Before ABHR, 52 of 61 patients (85.2%) had bacterial growth, commonly nonenteric gram-negative rods (27.9%), Enterococcus species (23.0%), and Staphylococcus aureus (16.4%). Health care-associated pathogens included methicillin-resistant S aureus (3.3%) and carbapenem-resistant Enterobacteriaceae (6.6%). After ABHR, 67.2% had no detectable growth ($P < .001$). Residual growth reflected low-density transient flora.; Conclusions: Outpatients frequently carry transient and health care-associated bacteria capable of causing infection but largely removable with effective ABHR use. A brief, just-in-time education intervention significantly reduced hand contamination, supporting patient-centered hand hygiene as a feasible, low-cost strategy to interrupt transmission in ambulatory care settings. (Copyright © 2026 Association for Professionals in Infection Control and Epidemiology, Inc. All rights reserved.)

12. How many infection control staff are needed in acute care hospitals: A Delphi approach

Authors: Mulder, Marlies; Sarink, Maarten; Stoffer, Gerrie; Mes, Miriam; van Oorschot, Els; van Dommelen, Laura; Voss, Andreas; Severin, Juliëtte A.; Veldkamp, Karin-Ellen and van Mansfeld, Rosa

Publication Date: 2026

Journal: The Journal of Hospital Infection

Abstract: Introduction: The Dutch recommendation on infection prevention and control (IPC) staffing in acute care hospitals from 2007 is outdated due to evolving hospital care, including shorter admissions, more complex and day-care procedures, more vulnerable patients, increasing antimicrobial resistance, and enhanced regulatory demands. Therefore, an updated staffing norm for IPC is needed.; Methods: Minimum weekly hours required for IPC activities was determined by Delphi method across three model hospitals: academic, large non-academic, and small non-academic. Four questionnaire rounds were conducted among IPC practitioners (IPCP) and clinical microbiologists (CM). Staffing needs per role and hospital type were calculated. After three rounds a core expert team focus group formulated a new full time equivalent (FTE) norm which was proposed in the final round.; Results: For academic hospitals, 100% consensus was achieved for a minimum of 0.15 FTE CM and 1.23 FTE IPCP

per 5000 annual hospital admissions, plus 0.05 FTE CM and 0.41 FTE IPCP per 5000 annual day admissions, respectively. For non-academic hospitals, 92% supported the proposed norm for CM (same values), and 89% agreed with the proposed norm for IPCP: 1.10 FTE per 5000 hospital admissions and 0.37 FTE per 5000 day admissions.; Conclusion: A new consensus-based staffing norm, endorsed by most Dutch IPC professionals, recommends an increase in IPCP. This reflects increased demands on IPC teams and suggests diversification of professionals working in IPC teams, not accounted for in the previous norm. This minimum norm is needed to effectively protect patients and healthcare workers from infections. Although this consensus was achieved in a Dutch setting, the method applied and overall outcome can be useful for other settings. (Copyright © 2026 The Author(s). Published by Elsevier Ltd.. All rights reserved.)

13. Using artificial intelligence to advance pediatric infection prevention and control

Authors: Murray, Thomas S.;Quan, Morgan;Aniskiewicz, Michael and Pak, Theodore R.

Publication Date: 2026

Journal: Current Opinion in Pediatrics 38(2), pp. 142–148

Abstract: Purpose of Review: Recent literature describes the deployment of different artificial intelligence (AI) technologies to potentially support infection prevention and control (IP&C) in both the community and healthcare environment. However, most studies focus on adults. This review explores the data and potential for AI to enhance IP&C for pediatric populations as well as recognizing important limitations.; Recent Findings: In community settings, AI can educate families about infections and risk, recognize potential clusters and outbreaks of infectious pathogens, and prescreen individually infected patients prior to entering a healthcare facility. For admitted patients, AI has been used to identify patients at risk for healthcare-associated infections (HAIs) such as central line associated blood stream infections, and may assist infection preventionists in abstracting chart data for HAI surveillance. Limitations include potential biases in training data and the lack of prospective studies validating the use of AI for IP&C purposes, especially in heterogeneous pediatric populations.; Summary: AI can be a valuable tool in recognizing and controlling infections in both the community and healthcare settings. However, more studies in pediatric populations are needed, including prospective studies that validate tools created and trained on retrospective cohorts. (Copyright © 2026 Wolters Kluwer Health, Inc. All rights reserved.)

14. Infection prevention and control knowledge, attitudes, and practices among home health care patients and their family caregivers: Findings from a multisite survey

Authors: Russell, David;McDonald, Margaret V.;Chastain, Ashley M.;Xu, Zidu;Vergez, Sasha M.;Onorato, Nicole;Brasch, Judith;Ramos, Evette;Wang, Jinjiao;Perera, Uduwanage Gayani E.;McGoldrick, Mary and Shang, Jingjing

Publication Date: 2026

Journal: American Journal of Infection Control 54(5), pp. 531–537

Abstract: Background: Home health care (HHC) patients face elevated infection risks, yet adherence to infection prevention and control (IPC) practices by patients and caregivers remains understudied. This study assessed IPC-related knowledge, attitudes and practices in this population.; Methods: Surveys were administered to HHC patients at high/very high infection risk or their family caregivers from two large Medicare-certified HHC agencies in New York State.; Results: Among 250 respondents (132 HHC patients, 118 caregivers), participants demonstrated adequate IPC knowledge (mean proportion = 0.77), attitudes (mean proportion = 0.88), and adherence (mean proportion = 0.79). However, handwashing knowledge needed improvement (mean proportion = 0.63). Regression analyses showed higher IPC knowledge and more favorable attitudes predicted better IPC practice adherence.; Discussion: Unlike prior research among HHC nurses where only attitudes predicted practices, both knowledge and attitudes were associated with adherence among patients and caregivers.; Conclusions: Interventions should enhance IPC knowledge, particularly proper handwashing, and emphasizing infection prevention importance to improve adherence among HHC patients and caregivers, especially older populations. (Copyright © 2025 The Authors. Published by Elsevier Inc. All rights reserved.)

15. A tailored serious game for central line-associated bloodstream infection prevention: From needs assessment to an innovative educational tool

Authors: Tavares, Bruno de Melo;Guedes, Ana Rubia;Souza, Nidia Cristina de;Silva, Karen Cristina da Conceição Dias;Macete, Thiago Cezar;Maciel, Amanda Luiz Pires;Piastrelli, Filipe Teixeira;Boszczowski, Icaro;Nogueira, Maria Dolores Santos da Purificação;Costa, Magda Machado de Miranda;Assis, Denise Brandão de;Vieira Perdigão Neto, Lauro;Oliveira, Maura Salaroli de and Levin, Anna S.

Publication Date: 2026

Journal: American Journal of Infection Control 54(4), pp. 436–442

Abstract: Central line-associated bloodstream infection prevention remains challenging in clinical settings. This experience describes how barriers identified through a needs assessment in Brazilian hospitals were translated into a tailored serious game to support catheter care practices. Using the Octalysis Framework, real-world challenges were converted into interactive missions simulating catheter care. This approach illustrates how context-specific barriers can be operationalized into an educational tool to support health care workers' adherence to central line-associated bloodstream infection prevention measures. • Barriers to preventing central line infections in Brazil were identified. • The game design followed the Octalysis model to strengthen motivation and focus. • A serious game was developed to support active learning for healthcare workers.

16. Changes in hand hygiene compliance and technique among non-healthcare professionals in a tertiary-care hospital: Before and during the COVID-19 pandemic

Authors: Warnke, Philipp;Frickmann, Hagen;Schumann, Hannah Charlotte;Hahn, Andreas and Podbielski, Andreas

Publication Date: 2026

Abstract: Background: We assessed changes associated with the SARS-CoV-2 (severe acute respiratory coronavirus 2) pandemic on hand disinfection compliance and technique among inpatients and visitors in a German tertiary-care hospital.; Methods: Hand disinfection compliance and technique were directly observed. Approximately 10% of observed individuals were included in a questionnaire-based study on motivations and knowledge (voluntary participation). A pre-pandemic period of 5 months was compared with a pandemic period of 10 months during the early phase of the SARS-CoV-2 pandemic in 2020.; Results: A total of 5,517 individuals observed as well as 456 observed and questioned were included in the assessment. Among observed individuals, hand disinfection compliance increased from 8.7% (181/2,087) to 24.0% (823/3,430) ($P < 0.0001$), and correct technique increased from 4.4% (91/2,087) to 10.0% (343/3,430) ($P < 0.0001$) during the pandemic period. Among volunteers participating in the questionnaire arm, compliance was high pre-pandemic (47.2%; 58/123) and remained stable during the pandemic period (45.6%; 152/333) ($P = 0.8325$). In this subpopulation, correct technique declined from 28.5% (35/123) to 17.7% (59/333) ($P = 0.0136$).; Conclusions: Moderate pandemic-period-associated improvements in hand disinfection compliance and technique among non-healthcare professionals in healthcare settings may not increase indefinitely, but may reach a saturation level in individuals who already show comparatively high adherence.

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