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REVIEW

Suboptimal infection prevention and control in the healthcare culture

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Abstract
Healthcare associated infections are one of the most common complications of hospitalised patients although they are largely preventable through compliance with infection prevention and control standards and guidelines. Clinical performance has been associated with culture in health care. By exploring the influence of culture in health care on infection prevention and control practice, understanding and insight into suboptimal IPC practice may be exposed. This paper discusses the cultural milieu of IPC practice and embedded norms proposing a cultural shift is mandatory to address suboptimal IPC practice. Recommendations are made that a cultural shift to blend the cure and prevention paradigms that effectively supports optimal infection prevention and control practice be envisaged by healthcare workers and implemented.

Keywords: safety culture, healthcare associated infections, infection control, healthcare workers

Introduction
During the last 20 years healthcare associated infections (HAIs) have been one of the most common complications of hospitalised patients,[1] with the rate of HAIs trending upwards.[2,3] To date guidelines, policy, and education initiatives have broadly yielded little sustained behavioural change.[4,5,6] Studies however do support performance being impacted by culture in healthcare.[7,8] The influence of the healthcare culture on infection control practice has not been explored[9] even though studies show association between patient outcomes and culture.[4,3,10] This paper discusses the cultural milieu of infection prevention and control (IPC) practice and embedded norms, proposing a cultural shift is mandatory to address suboptimal IPC practice.

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Methods

The methodology used for data collection was a search of databases using key words and phrases in English. The databases searched were Science Direct Pubmed, Cinahl, PychINFO, Google Scholar and ProQuest for the years from 2000 to 2017. The keywords and phrases included in searches were infection control, healthcare associated infections, health care workers, infection prevention and control, cultural factors and infection control, healthcare culture and infection control, medico-centric culture, infection control education, group think and change theory.

Current state of suboptimal IPC practice

There is evidence IPC practice has low priority in clinical practice.[11,12] Suboptimal IPC practice is reported to occur in most healthcare professions,[13,14,15] most clinical areas[13], and in the performance of most IPC procedures.[16,17] According to Fuller *et al*.,[18] the majority of explanations (68%) by healthcare workers (HCWs) for suboptimal IPC practice focus on the point of care and in the main describe cognitive states that limit appropriate responses to infection risk: forgetting, concentration on other tasks (42%) and knowledge deficit (26%). Other cognitive states reported in the literature include confusion,[18,17] misconceptions,[19] inadequate motivation,[20,1] lack of awareness of specific expectations,[21] little confidence,[14] and self-assessment biases.[22] In addition organisational factors account for 9% of explanations[18] and involve heavy workload,[11,20] insufficient allocation of resources,[12,18,15] unsupportive management[11,5,2] and inconsistencies in implementation and interpretation of guidelines.[19] Improvement strategies applied to date have mainly addressed the point of care,[23,24] resulting in short-term success with compliance rates tending to return to baseline.[25,26,27] A literature review concluded a broader view is necessary.[28] As cultural modelling is purported to explain between 25% and 50% of variance in infection related processes and outcomes[29] the cultural milieu in which clinical performance occurs has high relevance.

ICP practice and the cultural milieu

According to Jacobs *et al*.[30] organisational culture has the potential to impact upon efficiency by embedding shared values, beliefs and norms, so shaping the ways in which members interact and engage with each other. As culture is a medium of social control it can affect perception, thinking, feeling and action within shared environments, social structures and interactions.[31,32] Within health care the organisational culture is complex with professional hierarchies and different clinical services giving rise to multiple and overlapping subgroups.[33] Key elements of this culture are held in underlying assumptions, values and artefacts.[34] For example in medical care, deeply ingrained assumptions of measurability, aggregation and transferability are held alongside the value of clinical freedom and the artefact of reliance on self-regulation.[34] A review of evidence suggests organisational culture can be a relevant factor in health care performance.[35] The examination of the inter-relationship between organisational culture and behavioural attitudes by health care professionals and how organisational culture can impact on IPC compliance by De Bono *et al*.[36] identified how various elements appear to impact on IPC related behaviour. Therefore, it is reasonable to consider the culture of the health care organisation can impact on performance having the potential to lead to suboptimal IPC practice as it can influence decision-making, reporting, response to errors, working relationships and inter-professional synergies.

Paradigms of care within health services address cure and prevention. The cure paradigm is strongly medically focused with IPC being primarily preventive focused. The orientation of these two paradigms in the clinical setting from the perspective of knowledge and power can be considered to marginalise the prevention paradigm in acute care settings. This marginalisation is further influenced by the medical model, cure paradigm, being certified by the community[37,38] so socially transmitting information about health beliefs, knowledge, skills, and practices that guides clinical actions.[39,40,32] The status of medical knowledge rests upon the assertion that it is objective, scientific and evidence-based.[41] Infection prevention knowledge, in contrast, is considered experiential, intuitional and of limited clinical value.[42,5,43,44]

The cure paradigm, medical model, is powerfully dominant in the care delivered by HCWs. The medical model leads HCWs to automatically "construct" healthcare experiences through medically relevant

narratives that define the performance environment exclusively in terms of cure or management, not prevention of disease.[45,46,47] In a medico-centric environment IPC relies on conscious effort.[43,48] Such conscious attention is time consuming, cognitively effortful, impaired by time pressure and concurrent cognitive tasks.[48] As conscious attention is relied on for IPC practice, infection risk cues are easily subject to distraction; apt to constitute cognitive noise (confusion, ambiguity); prone to motivational fluctuations, lapses of concentration and memory; exposed to inadequate self-monitoring and misconceptions; influenced by the example of colleagues;[49,50] and easily displaced by other imperatives.[43] In this medico-centric milieu there is little support and incentive for HCWs to develop an effective infection risk perception skill-base or mindset.[27,17] Healthcare workers therefore are contextually not sufficiently predisposed / primed to recognize the significance of, and attend to, infection risk cues.[49,51,52,53] An example of insufficient attention to infection risk cues is hand hygiene (HH) practice. Doctors interviewed about HH said practice required a conscious decision and reminders were necessary.[49] Findings by Fuller *et al*. [18] showed HCWs' explanations of their own HH non-compliance were accounted for by the domain of memory / attention / decision making (42%) with the three main themes being: knowing HH was required but forgetting to do it; being unaware of behaviour; and being interrupted.

The daily clinical decision-making of doctors and nurses involves medical knowledge.[54] The dominance of the medical voice exerts more authority and autonomy than non-medical voices.[55] The response to an initiative to reduce catheter use in the emergency department, for example demonstrates this influence, "We're very busy, we really don't have time to deal with all this toileting, but when the…medical director made it a priority, it changed the tone [and] we did see a good improvement."[56] The medical discourse is highly authorative and ever present in giving care.

When battling cancer, heart disease and other similar diseases, HCWs resent being pestered about what they see as a minor matter.[57] Infection is regarded as an inferior order of medical problem and an unavoidable complication of life-saving highly interventionist medical practice,[58] being referred to by McAlearney[59] as the "cost of doing business". Studies show doctors generally are less likely to think HAIs are preventable,[60] are more negative about guidelines[11] and consider strategies for improving infection control practices have significantly less impact on their practice.[61] When doctors ignore IPC protocols, such as hand washing, glove use, and isolation precautions other clinicians are reluctant to intervene.[62,17] The complications of infection in relationship to attention to serious illness are a lower priority.

This lower priority is identified in many studies that found a lack of information necessary for effective IPC practice was significant.[14] According to Burnett *et al*.[14] nurses claim they lacked information about infected patients and management strategies. This, they argued, influenced their practice and lowered the standard of care they delivered. A national collaborative of regional HAI programs found feedback was provided haphazardly: by some daily, others weekly, monthly, or quarterly.[2] Findings from Hedayati *et al*.[63] identified notifications and feedback from audits were not widely disseminated, breaches to protocols not sanctioned, and national policies not enforced. In the absence of information, HCWs tend to believe their compliance with IPC is better than it is[61] and better than that of their peers.[60] Staff with developed habitual behaviours can avoid information that challenges that behaviour.[64] Disconfirming information can threaten staff stability as it questions shared assumptions and requires new learning and behaviour.[32] Hence information that challenges HCWs can be perceived as annoying and dismissed. According to Hedayati *et al*.[63] insufficient evidenced-based information flow to IPC practice perpetuates incorrect and declining quality of practice over time in clinical settings. Welsh[2] confirms the value of clinical data stating IPC compliance data is vital to improve practice.

The IPC knowledge base of HCWs is found to be consistently unsatisfactory.[19,14,65,66,17] Liu[67] reports nurses have insufficient knowledge of isolation precautions, HH, handling blood and blood fluids, standard precautions, and medical microbiology. Seibert *et al*.[66] report only 45% of HCWs correctly identified scenarios in which IPC actions should be taken, with more than half not knowing MRSA lives on surfaces for days and alcohol rubs are the most effective

HH method for killing it. A recent review showed some HCWs do not have the correct understanding of the importance of HH: "Do you really have to rub for 15-20 seconds with that stuff?"[20] Some medical students regard learning about HH a 'waste of time', and oppose its inclusion in their course.[27] It has been proposed the disparity in practice may be attributed to medical education emphasising cure, while nursing education emphasises care.[47] Persistence of erroneous beliefs, lack of understanding and risk-based behaviour can be considered consequences of insufficient valuing of formal education.

In summary, the dominance of the cure paradigm and subsequent focus of clinical interventions, the attention to serious /life threatening illnesses, poor availability of necessary clinical information about infections, responses to compliance data and persistent erroneous beliefs, lack of understanding and risk-based behaviour are embedded in the cultural milieu underlying suboptimal IPC practice.

Suboptimal practice as an acceptable norm

Suboptimal practice has become an acceptable norm.[68] The apparent 'normalcy' of 'nosocomial' events, and national and worldwide variations in statistical reporting, may render suboptimal IPC practice invisible.[69] Norms between professional groups enhance co-operation and compliance.[70,59] The impact on cooperation is shown by Von Lengerke[71] who found that when respondents perceived poor cooperation on a ward, 60% stated they always disinfected their hands when compared with 86% who perceived good cooperation. The nursing profession, the most populace in healthcare, reports a continuing struggle with doctors who do not apply good infection control practices.[17] Doctors do not respond well to corrective interventions.[71] This may be why poor practice is not challenged by nurses.[17,9] The majority of studies around the world report higher compliance with standard precautions among nurses than doctors.[72] The dissonance that exists between professions about IPC can adversely affect practice.[57]

Healthcare workers report their decisions about IPC practices are strongly shaped by observations of the behaviour of others.[73,74,20,75] Temptation to copy the majority is very powerful.[76] Individuals have been shown to have a 90% probability of copying a trait that 60% of people possess.[77] Copying individuals to whom others show deference or respect is highly influential.[77,78] Poor examples by superiors can cultivate a culture of non-compliance.[79] For example a paediatric resident commented, "…the staff physician had…walked out [without washing his hands] …at that point I almost felt like maybe I shouldn't have done that (washed hands)."[20] Conversely "…after seeing that the attending physician had washed his hands, all the others followed suit."[80] Flanagan *et al.*[15] report a commonly cited reason for not implementing the HAI reduction initiatives was leadership considered it unnecessary. Poor role modelling by mentors, supervisors and colleagues lessens perception of the importance of IPC and necessity of good practices is portrayed as "an additional extra rather than integral to care."[19] Poor practice can be learned in the absence of appropriate role models and accountability.[5]

Among HCWs there is pressure to 'fit in'. Concerns include fear of reputational harm, reprisal, not being accepted, ineffectiveness of speaking up, inability to speak assertively.[62,17,74,20,81] Comments by HCWs exemplify this: "…when you're in practice, it's really difficult… because you're worried that…if you started to cause a bit of trouble, or say something to upset somebody, that could then affect you getting signed off;" and "On this ward I've probably lowered my standards a bit…just try and fit in."[15] Forty five percent of a study population feared reporting sharps injuries because it might have an adverse effect on their academic success.[82] For some a barrier to reporting needle-stick injuries is the perception peers would consider them professionally incapable.[81,5] Conformity pressure among HCWs can therefore lead to defective decision making resulting from conformity bias as identified by Asch.[83] Healthcare workers concerned with fitting in are pressured towards uniformity and collective rationalisation, both symptoms of group think proposed by Janis.[84] Overall acceptance of suboptimal IPC practice among health care professionals, ongoing exposure to suboptimal practice and pressure towards uniformity are dynamics that perpetuate suboptimal practice.

The professional challenge

Macqueen[85] argues there is an intrinsic reluctance to take responsibility for prevention of HAIs in healthcare. The prevention paradigm in healthcare needs to acquire sufficient normative power in the healthcare discourse to support optimal IPC, otherwise interventions will generally continue to be wanting in effectiveness. The healthcare culture's 'blind spot' to the harm associated with suboptimal IPC practice must be addressed. There is an urgent need to raise awareness of the extent of HAI and associated morbidity and mortality and to optimise IPC practice through embedding clear expectations of performance standards into clinical care processes,[28] developing domain specific self-efficacy, and providing social support. Knobloch *et al*.[86] consider starting with assessment of compliance with guidelines (e.g., HH, personal protective equipment use) may not be the best approach. Allowing frontline staff time and space to reflect and evaluate the complex nature of their jobs may be more effective. Enabling clinicians to observe and rethink their actions each day takes into consideration the impact of what is said and done, and can promote self-awareness of actions that lead to infection while treating patients. Change can only occur if there is sufficient disequilibrium, or unfreezing of the dominant paradigm.[32]

Conclusion

Clearly it is necessary to shift the culture within which HCWs provide care. Use of change theory[87] skilful executed to unfreeze the current culture in a non-threatening critical professional manner by clinical leaders of all healthcare professional types followed by the envisioning of a newly blended culture of cure and prevention that supports optimal IPC practice, its implementation and bedding down of this agreed culture in practice is a possible pathway. Inclusive in creating the necessary disequilibrium (unfreezing) a process that involved HCWs in taking ownership of current culture, identifying core beliefs, values and attitudes of quality clinical behaviour and positioning themselves on a common professional platform from which to develop the existing culture of suboptimal IPC practice to optimal IPC practice. The approach overall needs to be non-punitive, supportive and inter-professional, accepting of diversity leading to convergence, and genuinely engaging the efforts of all to identify strategies, set aims and plan actions to achieve desired outcomes. Prior to implementation all HCWs need to have the proposed action planned explained, have their apprehension and concerns addressed and be advised of the availability of ongoing support during the change process. Implementation then needs to be linked to progressive evaluation so refinement and modifications occur. The involvement of key respected professionals as coaches to nurture and support the process may be beneficial.

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References

1. Graf K, Ott E, Wolny M, *et al*. Hand hygiene compliance in transplant and other special patient groups: An observational study. *Am J Infect Control* 2013; **41(6)**: 503-508. https://doi.org/10.1016/j.ajic.2012.09.009
2. Welsh CA, Flanagan ME, Hoke SC, Doebbeling BN, Herwaldt L. Reducing health care-associated infections (HAIs): Lessons learned from a national collaborative of regional HAI programs. *Am J Infect Control* 2012; **40(1)**: 29-34. https://doi.org/10.1016/j.ajic.2011.02.017
3. Raveis VH, Conway LJ, Uchida M, Pogorzelska-Maziarz M, Larson EL, Stone PW. Translating infection control guidelines into practice: Implementation process within a health care institution. *Qual Health Res* 2014; **24(4)**: 551–560. https://doi.org/10.1177/1049732314524488
4. Caris MG, Kamphuis Dekker GA, de Bruijne MC, van Agtmael MA, Vandenbroucke-Grauls CMJE. Patient safety culture and the ability to improve: A proof of concept study on hand hygiene. *Infect Control Hosp Epidemiol* 2017; **38(11):** 1277-1283. https://doi.org/10.1017/ice.2017.209
5. Edwards R, Charani E, Sevdalis N *et al*. Optimisation of infection prevention and control in acute health care by use of behaviour change: a systematic review. *Lancet Infect Dis* 2012; **12(4)**: 318–329. https://doi.org/10.1016/S1473-3099(11)70283-3
6. Ward DJ. The role of education in the prevention and control of infection: A review of the literature. *Nurse Educ Today* 2011; **31(1):** 9–17. https://doi.org/10.1016/j.nedt.2010.03.007
7. Callen JL, Braithwaite J, Westbrook JI. Cultures in hospitals and their influence on attitudes to, and satisfaction with, the use of clinical information systems. *Soc Sci Med* 2007; **65(3)**: 635-639. https://doi.10.1016/j.socscimed.2007.03.053
8. Gifford BD, Zammuto RF, Goodman EA. The relationship between hospital unit culture and nurses' quality of work life. *J Healthc Manag* 2002; **47(1)**: 13-25. https://doi.org/10.1097/00115514-200201000-00005
9. Macbeth DA. An investigation of the assumptions that inform contemporary hospital infection control programs. PhD thesis. Queensland University of Technology 2005.

10. Sinkowitz-Cochran RL, Burkitt KH, Cuerdon T, *et al*. The associations between organizational culture and knowledge, attitudes, and practices in a multicenter Veterans Affairs quality improvement initiative to prevent methicillin-resistant *Staphylococcus aureus*. *Am J Infect Control* 2012; **40(2)**:138-143 https://doi.org/10.1016/j.ajic.2011.04.332

11. Zingg W, Holmes A, Dettenkofer M, *et al*. Hospital organisation, management, and structure for prevention of health-care-associated infection: a systematic review and expert consensus. *Lancet Infect Dis* 2015; **15(2)**: 212-24. https//: doi.org/10.1016/S1473-3099(14)70854-0

12. Kinlay JR, Scanlon P, Mehrotra P, Potter-Bynoe G, Sandora T. Barriers to the use of face protection for standard precautions by health care workers. *Am J Infect Control* 2014; **42(6)**: S97-S98. https://doi.org/10.1016/j.ajic.2014.03.219

13. Shah N, Castro-Sa´nchez E, Charani E, Drumright LN, Holmes AH. Towards changing healthcare workers' behaviour: a qualitative study exploring non-compliance through appraisals of infection prevention and control practices. *J Hosp Infect* 2015; **90(2)**: 126-134. https://doi.org/10.1016/j.jhin.2015.01.023

14. Burnett E, Kearney N, Johnston B, Corlett J, MacGillivray S. Understanding factors that impact on health care professionals' risk perceptions and responses toward *Clostridium difficile* and meticillin-resistant *Staphylococcus aureus*: A structured literature review. *Am J Infect Control* 2013; **41(5)**: 394-400. https://doi.org/10.1016/j.ajic.2012.12.013

15. Flanagan ME, Welsh CA, Kiess C, Hoke S, Doebbeling BN. A national collaborative for reducing health care-associated infections: Current initiatives, challenges, and opportunities. *Am J Infect Control* 2011; **39(8)**: 685-689. https://doi.org/10.1016/j.ajic.2010.12.013

16. Carter EJ, Pouch SM, Larson EL. Common infection control practices in the emergency department: A literature review. *Am J Infect Control* 2014; **42(9)**: 957-962. https://doi.org/10.1016/j.ajic.2014.01.026

17. Ward DJ. Infection control in clinical placements: experiences of nursing and midwifery students. *J Adv Nurs* 2010; **66(7)**: 1533–1542. https://doi.org/10.1111/j.1365-2648.2010.05332

18. Fuller C, Besser S, Savage J, McAteer J, Stone S, Michie S. Application of a theoretical framework for behaviour change to hospital workers' real-time explanations for noncompliance with hand hygiene guidelines. *Am J Infect Control* 2014; **42(2)**: 106-110. https://doi.org/10.1016/j.ajic.2013.07.019

19. Cox JL, Simpson MD, Letts W, Cavanagh H. Re-thinking microbiology/infection control education to enhance the practice-readiness of health professional students: More than just a curriculum issue. *Journal of Learning Design* 2015; **8(1)**: 55-67. https://doi.org/10.5204/jld.v8i1.224

20. Smiddy MP, O' Connell R, Creedon SA. Systematic qualitative literature review of health care workers' compliance with hand hygiene guidelines. *Am J Infect Control* 2015; **43(3)**: 269-774. https://doi.org/10.1016/j.ajic.2014.11.007

21. Calfee DP. Crisis in hospital-acquired, healthcare-associated infections. *Annu Rev Med* 2012; **63**: 359–371. https://doi.org/10.1146/annurev-med-081210-144458

22. Morrow E, Griffiths P, Rao GG, FlaxmanD. "Somebody else's problem?" Staff perceptions of the sources and control of meticillin-resistant *Staphylococcus aureus*. *Am J Infect Control* 2011; **39(4)**: 284-291. https:// doi.org/10.1016/j.ajic.2010.06.018

23. Krein SL, Damschroder LJ, Kowalski CP, Forman J, Hofer TP, Saint S. The influence of organizational context on quality improvement and patient safety efforts in infection prevention: A multi-center qualitative study. *Soc Sci Med* 2010; **71(9):** 1692-1701. https://doi.org/10.1016/j.socscimed.2010.07.041

24. Brownson RC, Seiler R, Eyler AA. Measuring the impact of public health policy. *Prev Chronic Dis* 2010; **7(4)**: A77. http://www.cdc.gov/pcd/issues/2010/jul/09_0249.html [Accessed November 8, 2017]

25. Martino P, Ban KM, Bartoloni A, Fowler KF, Saint S, Mannelli F. Assessing the sustainability of hand hygiene adherence prior to patient contact in the emergency department: A 1-year postintervention evaluation. *Am J Infect Control* 2011; **39(1)**: 14-18. https://doi.org/10.1016/j.ajic.2010.06.015

26. Davis R, Parand A, Pinto A, Buetow S. Systematic review of the effectiveness of strategies to encourage patients to remind healthcare professionals about their hand hygiene. *J Hosp Infect* 2015; **89(3)**: 141-162. https://doi.org/10.1016/j.jhin.2014.11.010

27. Kaur R, Razee H, Seale H. Facilitators and barriers around teaching concepts of hand hygiene to undergraduate medical students. *J Hosp Infect* 2014; **88(1)**: 28-33. https://doi.org/10.1016/j.jhin.2014.06.006

28. Lewis VR, Parker SH, Stephens RJ, Clark L, Fairbanks RJ. Why aren't we achieving better results? A literature review of healthcare associated infection interventions. *Proc Hum Factors Ergon Soc* 2012; **56(1)**: 829-833. https://doi.org/10.1177/1071181312561173

29. Borg MA. Cultural determinants of infection control behaviour: understanding drivers and implementing effective change. *J Hosp Infect* 2014; **86(3)**: 161-168. https://doi.org/10.1016/j.jhin.2013.12.006

30. Jacobs R, Mannion R, Davies H, Harrison S, Konteh F, Walshe K. The relationship between organizational culture and performance in acute hospitals. *Soc Sci Med* 2013; **76(1)**: 115-125. https://doi.org/10.1016/j.socscimed.2012.10.014

31. Kim LM, Muhitdenova AM, Kamaldinova AA, Shakhnaza K. Phenomenon of social identification: the fundamental problems. *Procedia Soc Behav Sci* 2014; **140**:687-690. https.//doi.org/10.1016/j.sbspro.2014.04.495

32. Schein EH. *Organizational Culture and Leadership*, 4th edn. San Francisco: Jossey-Bass 2010.

33. Mannion R, Davies H. Understanding organisational culture for healthcare quality Improvement. *BMJ* 2018; **363:** k4907. https://doi:org10.1136/bmj.k4907. https://www.bmj.com/content/363/bmj:bmj.k4907.full [Accessed January 31, 2019]

34. Davies H, Nutley SM, Mannion R. Organisational culture and quality of health Care. *BMJ Qual Saf* 2000; **9**: 111-119. http://dx.doi.org/10.1136/qhc.9.2.111

35. Scott T, Mannion R, Marshall M, Davies H. Does organisational culture influence health care performance? A review of the evidence. *J Health Serv Res Policy* 2003; **8(2)**: 105-117. https://doi.org/10.1258/135581903321466085

36. De Bono S, Heling G, Borg MA. Organizational culture and its implications for infection prevention and control in healthcare institutions. *J Hosp Infect* 2014; **86(1)**: 1-6. https://doi10.1016/j.jhin.2013.10.007

37. Hofstede G, Hofstede GJ. *Cultures and Organizations: Software of the Mind*, 2nd edn. New York: McGraw-Hill 2005.

38. Rehg W. The social authority of paradigms as group commitments: Rehabilitating Kuhn with recent social philosophy. *Topoi* 2013; **32(1)**: 21–31. https://doi.org/10.1007/s11245-012-9138-137

39. Mesoudi A. Cultural evolution: A review of theory, findings and controversies. *Evol Biol* 2016; **43(4)**: 481–497. https://doi.org/10.1007/s11692-015-9320-0

40. Sperber D, Hirschfeld LA. The cognitive foundations of cultural stability and diversity. *Trends Cogn Sci* 2004; **8(1)**: 40-46. https://doi.org/10.1016/j.tics.2003.11.002

41. Doidge N. *The Brain That Changes Itself: Stories of Personal Triumph from the Frontiers of Brain Science*. Carlton, North Victoria Australia: Scribe publications 2007.

42. Jackson C, Lowton K, Griffiths P. Infection prevention as "a show": A qualitative study of nurses' infection prevention behaviours. *Inter J Nurs Stud* 2014; **51(3)**: 400–408. https://doi.org/10.1016/j.ijnurstu.2013.07.002

43. 43. Sladek RM, Bond MJ, Phillips PA. Why don't doctors wash their hands? A correlational study of thinking styles and hand hygiene. *Am J Infect Control 2008*; **36(6)**: 399-406. https://doi.org/10.1016/j.ajic.2007.11.002

44. Jenner EA, Fletcher BC, Watson P, Jones FA, Miller L, Scott GM. Discrepancy between self-reported and observed hand hygiene behaviour in healthcare professionals. *J Hosp Infect* 2006; **63(4)**: 418-422. https://doi.org/10.1016/j.jhin.2006.03.012

45. Sullivan SS, Dickerson SS. Facing death: A critical analysis of advance care planning in the United States. *Adv Nurs Sci* 2016; **39 (4)**: 320–332. https://doi.org/10.1097/ANS.0000000000000138

46. 46. McGrath P, Holewa H. Missed opportunities: Nursing insights on end-of-life care for haematology patients. *Int J Nurs Prac* 2006; **12**: 295–301. https://doi.org/10.1111/j.1440-172X.2006.00585

47. Becker PT, Grunwald PC. Contextual dynamics of ethical decision making in the NICU. *J Perinat Neonat Nurs* 2000; **14(2)**: 58–72. https://doi.org/10.1097/00005237-200009000-00007

48. Kahneman D. *Thinking Fast and Slow.* London: Penguin 2011.

49. Squires JE, Linklater S, Grimshaw JM, *et al*. Understanding practice: Factors that influence physician hand hygiene compliance. *Infect Control Hosp Epidemiol* 2014; **35(12)**:1511-1520. https://doi.org/10.1086/653027

50. Lee K. Student and infection prevention and control nurses' hand hygiene decision making in simulated clinical scenarios: A qualitative research study of hand washing, gel and glove use. *J Infect Prev* 2013; **14(3)**: 96-103. https://doi.org/10.1177/1757177413484784.

51. Brühwasser C, Hinterberger G, Mutschlechner W, Kaltseis J, Lass-Flörl C, Mayr A. A point prevalence survey on hand hygiene, with a special focus on Candida species *Am J Infect Control* 2016; **44(1)**: 71-73. https://doi.org/10.1016/j.ajic.2015.07.033

52. Sax H, Clack L. Mental models: a basic concept for human factors design in infection prevention. *J Hosp Infect* 2015; **89(4)**: 335-339. https://doi.org/10.1016/j.jhin.2014.12.008

53. Bargh JA, Schwader KL, Hailey SE, Dyer RL, Boothby EJ. Automaticity in social-cognitive processes. *Trends Cogn Sci* 2012; **16(12)**: 593-605. https.//doi: 10.1016/j.tics.2012.10.002

54. Ogden J, Baig S, Eamshaw G, *et al*. What is health? Where GPs' and patients' worlds collide. *Patient Educ Couns* 2001; **45(4)**: 265-269. https://doi.org/10.1016/S0738-3991(01)00128-8

55. Long D, Lee BSB, Braithwaite J. Attempting clinical democracy: Enhancing multivocality in a multidisciplinary clinical team. In: Iedema R, Caldas-Coulthard CR, eds. *Identity Trouble: Critical Discourse and Contested Identities*, Australian Institute of Health Innovation, Macquarie University, 2008; 250-272.

56. Krein SL, Kowalski CP, Harrod M, Forman J, Saint S. Barriers to reducing urinary catheter use: A qualitative assessment of a statewide initiative. *JAMA Intern Med* 2013; **173(10)**: 881-886. https://doi.org/10.1001/jamainternmed.2013.105

57. Saint S, Krein SL, Stock RW. *Hospital Infections: Real-world Problems, Realistic Solutions*. New York; Oxford University Press 2015.

58. Gilbert GL, Cheung PY, Kerridge IB. Infection control, ethics and accountability. *Med J Aust* 2009; **190(12)**: 696–698. https://www.mja.com.au/system/files/issues/190_12_150609/gil10962_fm.pdf [Accessed November 8, 2017]

59. McAlearney AS, Hefner JL, Robbins J, Harrison MI, Garman A. Preventing central line–associated bloodstream infections: A qualitative study of management practices. *Infect Control Hosp Epidemiol* 2015; **36(5)**: 557 – 563. https://doi.org/10.1017/ice.2015.27

60. Berhe M, Edmond MB, Bearman GML. Practices and an assessment of healthcare workers' perceptions of compliance with infection control knowledge of nosocomial infections. *Am J Infect Control* 2005; **33(1)**: 55-57. https://doi.org/10.1016/j.ajic.2004.07.011

61. Squires JE, Suh KN, Linklater S, *et al*. Improving physician hand hygiene compliance using behavioural theories: a study protocol. *Implement Sci* 2013; **8(16)**: 1-9. https://doi.org/10.1186/1748-5908-8-16

62. Szymezak JE. Infections and interaction rituals in the organisation: Clinician accounts of speaking up or remaining silent in the face of threats to patient safety. *Sociol Health Illn* 2016; **38(2)**: 325–339. https://doi.org/10.1111/1467-9566.12371

63. Hedayati H, Marjadi B, Askarian M. Barriers to standard precautions adherence in a dental school in Iran: A qualitative study. *Am J Infect Control* 2014; **42(4)**: 750-754. https://doi.org/10.1016/j.ajic.2014.04.001

64. Nilsen P, Roback K, Brostrom A, Ellstrom P. Creatures of habit: Accounting for the role of habit in implementation research on clinical behaviour change. *Implement Sci* 2012; **7:** 53. https://doi.org/10.1186/1748-5908-7-53

65. Brown B, Tanner J, Padley W. This wound has spoilt everything: Emotional capital and the experience of surgical site infections. *Soc Health Illn* 2014; **36(8)**: 1171–1187. https://doi.org/10.1111/1467-9566.12160

66. Seibert DJ, Speroni KG, Oh KM, Mary C. DeVoe MC, Jacobsen KH. Knowledge, perceptions, and practices of methicillin-resistant *Staphylococcus aureus* transmission prevention among health care workers in acute-care settings. *Am J Infect Control* 2014; **42(3)**: 254-259. https://doi.org/10.1016/j.ajic.2013.09.005

67. Liu LM, Curtis J, Crookes PA. Identifying essential infection control competencies for newly graduated nurses: a three-phase study in Australia and Taiwan. *J Hosp Infect* 2014; **86(4)**:100-109. https://doi.org/10.1016/j.jhin.2013.08.009

68. Shah N, Castro-Sa´nchez E, Charani E, Drumright LN, Holmes AH. Towards changing healthcare workers' behaviour: A qualitative study exploring non-compliance through appraisals of infection prevention and control practices. *J Hosp Infect* 2015; **90(2)**: 126-134. https://doi.org/10.1016/j.jhin.2015.01.023

69. Rosenweg PN, Langan-Fox J. *Culture and compliance with hospital infection protocols*. Faculty of Business and Enterprise, Swinburne University, Melbourne; 2009.

70. Scott T, Mannion R, Marshall M, Davies H. Does organisational culture influence health care performance? A review of the evidence. *J Health Serv Res Policy* 2003; **8(2)**: 105–117. https://doi.org/10.1258/135581903321466085

71. von Lengerke T, Lutze B, Graf K, *et al*. Psychosocial determinants of self-reported hand hygiene behaviour: a survey comparing physicians and nurses in intensive care units. *J Hosp Infect* 2015; **91(1)**: 59-67. https://doi.org/10.1016/j.jhin.2015.04.018

72. Ogoina D, Ponde K, Adetunji B, Chima G, Isichei C, Gidado S. Knowledge, attitude and practice of standard precautions of infection control by hospital workers in two tertiary hospitals in Nigeria. *J Infect Prev* 2015; **16(1)**: 16– 22. https://doi.org/10.1177/1757177414558957

73. Loveday HP, Lynam S, Singleton J, Wilson J. Clinical glove use: Healthcare workers' actions and perceptions. *J Hosp Infect* 2014; **86(2)**: 110-116 https://doi.org/10.1016/j.jhin.2013.11.003

74. Cheung K, Chu PH, Lau NY, Li WK. Predictors for compliance of standard precautions among nursing students. *Am J Infect Control* 2015; **43(7)**: 729-734. https://doi.org/10.1016/j.ajic.2015.03.007

75. Atkisson C, O'Brien MJ, Mesoudi A. Adult learners in a novel environment use prestige-biased social learning. *Evol Psychol* 2012; **10(3)**: 519-537. https://doi.org/10.1177/147470491201000309

76. Rendell L, Fogarty L, Hoppitt WJE, Morgan TJH, Webster MM, Laland KN. Cognitive culture: Theoretical and empirical insights into social learning strategies. *Trends Cogn Sci* 2011; **15(2)**: 68-76. https://doi.org/10.1016/j.tics.2010.12.002.

77. Muthukrishna M, Morgan TJH, Henrich J. The when and who of social learning and conformist transmission. *Evol Hum Beh* 2016; **37(1)**: 10–20. https://doi.org/10.1016/j.evolhumbehav.2015.05.004

78. Acerbi A. A cultural evolution: Approach to digital media. *Front Hum Neurosci* 2016; **10**: 636. https://doi.org/10.3389/fnhum.2016.00636

79. Ong M, Magrabi F, Post J, *et al*. Communication interventions to improve adherence to infection control precautions: A randomised crossover trial. *BMC Infect Dis* 2013; **13**: 72. http://www.biomedcentral.com/1471-2334/13/72 [Accessed December 1, 2017]

80. Pan S, Lai T, Tien K, *et al*. Medical students' perceptions of their role as covert observers of hand hygiene. *Am J Infect Control* 2014; **42(3)**: 231-234. https://doi.org/10.1016/j.ajic.2013.09.032

81. Koehler N, Vujovic O, Dendle C, McMenamin C. Medical graduates' knowledge of bloodborne viruses and occupational exposures. *Am J Infect Control* 2014; **42(2)**: 203-205. https://doi.org/0.1016/j.ajic.2013.08.005

82. Salzer HJF, Hoenigl M, Kessler HH, *et al*. Lack of risk-awareness and reporting behaviour towards HIV infection through needlestick injury among European medical students. *Int J Hyg Environ Health* 2011; **214(5)**: 407– 410. https://doi.org/10.1016/j.ijheh.2011.05.002

83. Asch SE. Studies of independence and conformity. A minority of one against unanimous majority. *Psychological Monographs* 1956; **70 (9)**: 1-70. https//doi:10.1037/h0093718.

84. Janis IL. *Groupthink*, 2nd edn. Boston: Houghton Mifflin 1982.

85. Macqueen S. Anthropology and germ theory. *J Hosp Infect* 1995; **30 (Suppl)**: 116-126. https://doi.org/10.1016/0195-6701(95)90012-8

86. Knobloch MJ, Thomas KV, Patterson E, Zimbric ML, Musuuza J, Safdar N. Implementation in the midst of complexity: Using ethnography to study health care–associated infection prevention and control. *Am J Infect Control* 2017; **45(10)**: 1058-1063. https://doi.org/10.1016/j.ajic.2017.06.024

87. Lewin K. Frontiers in group dynamics: Concept, method and reality in social science; social equilibria and social change. *Human Relations* 1947; **1**: 5–41. https//doi:10.1177/001872674700100103.