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Original Research Article

Targeted hand hygiene audits and training: an effective tool for improvement in hand hygiene compliance

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ABSTRACT

Background: Hand hygiene (HH) is the simplest, but most effective infection prevention and control measure. This study was aimed to determine HH compliance among health care workers (HCWs) in a cancer hospital and the impact of targeted and phased training over changes in HH compliance and determination of Hawthorne effect among HCWs.
Methods: Prospective observational study conducted in two phases by HH trained auditor (Overt observer) and ICN (Covert observer) performing 30 minutes HH audit at ICU, haemato-lymphoid (HL) ward and paediatric ward to observe the pattern of HH compliance among HCW for HH moments and its impact over Hawthorne effect for HH compliance.
Results: Highest compliance for HH was observed at HL ward (59.34%) in first phase and at ICU (70.08%) in second phase. Gradual and significant improvement in HH compliance was observed for ICU (52.24% to 70.08%), HL ward (59.34% to 68.48%) and paediatric ward (43.42% to 53.46%). Profession specific Hawthorne effect was observed for nurses with higher compliance in covert observation in first phase and for doctors with higher compliance in overt observation in second phase of the study.
Conclusions: Regular targeted HH audit with motivational training is the better influential tool for improving HH compliance. Regular audits also improve efficiency of auditor for effective HH compliance supervision. Decentralization and availability of workstation specific HH auditor is the most of effective cost saving approach for achieving significant progressive improvement in HH adherence.

Keywords: HH, Audit, Compliance, Moment, Infection

INTRODUCTION

Hospital acquired infections (HAIs) is one of the major causes of morbidity and mortality in hospitalised patients. Multidrug resistant organisms (MDROs) are more likely to infect or colonise immunocompromised patients, especially those admitted in intensive care unit (ICU). Most effective way to prevent spread of HAIs is HH.[1] HH is a cornerstone among infection control practices. Transmission of HAIs by HCWs is most commonly by direct contact of high touch surface areas in the ward/ICU.[2] Unlike developed countries, very minimal efforts are made in order to prevent and control HAIs. The most effective way to prevent such infections is by improvement and continuous efforts to enhance HH adherence and cleaning of environmental surfaces in the wards/ICU.[3]

Environment contains dust particles, which serves as a medium for transportation of microbes and plays an important role in transmission of antimicrobial resistant organisms like methicillin resistant *Staphylococcus aureus* (MRSA), vancomycin resistant *Enterococci* (VRE), carbapenem resistant organisms (CROs), Clostridium difficile etc. Also prolonged hospitalised patients asymptomatically harbour MDROs and can also spread such infective organisms directly or indirectly to other patients and/ HCWs.[4,5] Transmission of such organisms from high touch areas like patient's bedside, bed railings, ventilator monitor, and bedside table can be curtailed by ensuring proper compliance to HH practices and effective surface decontamination strategy.[6]

The world health organisation (WHO) has defined 5 moments to be followed by HCWs while practising HH: these are before patient contact, before an aseptic procedure, after bodily fluid exposure risk, after patient contact, and after contact with patient surroundings.[7] HH compliance is substandard in India especially in government hospitals.[8] Various ways by which hand hygiene adherence rate (HHAR) can be measured are (a) direct observation, (b) indirect measurements and (c) self-reporting practices.[9] HH audit by direct observation method is recommended as gold standard by WHO.[10] This is because it has many benefits as we can collect data about type of moment, how many steps of HH were followed, type of HCW involved and any Hawthrone effect present or not. Hawthrone effect leads to exaggerated HHAR in many studies.[11]

The purpose of this study was to determine HH adherence rate of HCWs at ICU and wards in a tertiary care cancer centre, impact of audit and training for HH over its adherence rate and also to determine Hawthorne effect by means of overt and covert observation methods.

METHODS

It was a prospective observational study conducted in a Homi Bhabha cancer hospital, Varanasi, Uttar Pradesh for a total duration of six months (September 2021-December 2021 and March 2022-May 2022) in two phases to study the impact of HH auditing and training over HH compliance of various health care staff. The study was conducted in the ICU, HL ward and paediatrics ward.

Daily 30 minutes' observation were performed by the trained HH auditor (overt observer-trained senior resident of microbiology department) at the specified locations for HH adherence for five WHO HH moments (before touching a patient, before a procedure, after a procedure or body fluid exposure risk, after touching a patient and after touching a patient's surroundings). Daily again trained infection control nurse (ICN) (covert observer) took separate 30 minutes' observations in these locations to cross check HH adherence compliance for determining Hawthrone effect for HH adherence by comparing with the adherence data collected by HH auditor. Inclusion criteria: All observation during the audit were included in the study. There were no exclusion criteria. The calculation of the sample size will be performed using the formula, where,

Expected proportion in population=50%

Margin of error=3%= 1.96 for 95% CI.

Therefore, on calculation the sample size is obtained as 1067.

SPSS Statistics is a statistical software was used for data analysis.

Monthly once separate HH trainings were given to the available staff during the observation time at ICU, HL ward and paediatric ward by HH auditor. In that training the HH compliance data for respective locations were also shared with those particular staff. The gradual improvement in the HH compliance of the HCWs evaluated.

Approval has been taken for this study from the institutional ethics committee with letter number OIEC/11000517/2021/00003.

RESULTS

In the first phase of study (September 2021 to December 2021) a total of 1738 HH opportunities of HCWs were assessed with a HH compliance of 54.08% (940/1738) and statistically significant improvement ($p<0.001$) in HH compliances were noticed in the second phase (March 2022-May 2022) where 2239 opportunities were assessed with HH compliance of 62.26% (1394/2239). Fluctuating trends for HH compliance were noticed among various categories of HCW and even for specific hospital locations (ICU, HL ward and Paediatric wards) shown in Figure 1-3. In the 1st phase highest HH compliance was there at HL ward of 59.34 % and in the second phase it was observed for ICU of 70.08% as shown in Table 1. In this phased study, gradual and significant improvement in HH compliance was observed for ICU (52.24% to 70.08%, p=2.827e-07), HL ward (59.34% to 68.48%, p=0.0280) and paediatric ward (43.42% to 53.46%, p=0.0069). Among profession specific HH compliance, significant improvement in HH compliance was observed for doctors p=1.417e-05) and Nurses (p=0.0007) at ICU and only for doctors in HL ward (p=0.0272) and paediatric ward (p=0.0096).

As per the auditor's observation shown in Table 2, HH opportunities were observed most commonly for moment 1, 4 and 5 at all locations. Comparatively at HL ward, auditors got less opportunities to observe moment specific HH compliance. Overall, there was significant improvement in HH compliance for moment 5 (p=4.74e-08), but in ICU improved compliance was observed in moment 4 (p=0.0235) and 5 (0.00002) and for moment 5

(p=0.0020) in paediatric ward. Doctors and Nurses in ICU (p=0.0079, 0.0015) and paediatric wards (p=0.0001, 0.0456) had shown significant improvement in compliance against moment 5. Similar findings were observed for doctors (p=0.0084) in ICU for moment 1.

During the entire study duration, efforts were made to figure out Hawthorne effect in HH practices, where a total 3977 opportunities were observed (Overt observations were 2168 and covert observations were 1809). Overall compliance rate was higher with covert observation than overt observation (60.20% vs 57.43%, p=0.0826). As shown in table 3 profession wise significant Hawthorne effect was observed in 1st session with nursing category with higher compliance in covert observation (61.96% vs 52.45 %, p=0.0012) and in 2nd session, Hawthorne effect was observed among doctors, with higher compliance with overt observation (67.01% vs 54.73%, p=0.0049). As evident from Table 3 among various locations, significant Hawthorne effects were observed in ICU for both the sessions (p=0.005 and 0.0438).

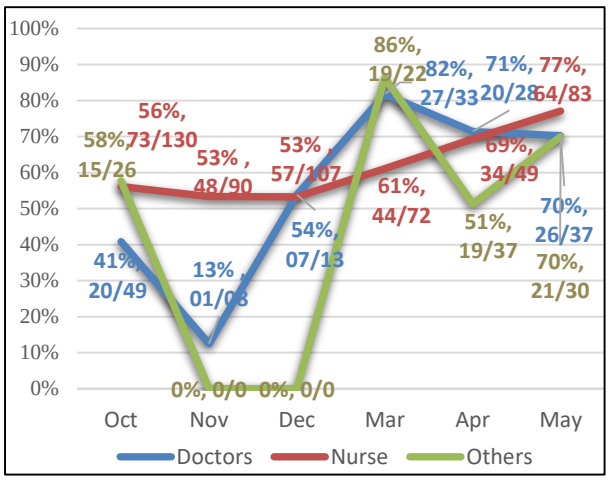

Figure 1: HHAR trend of HCW in ICU.

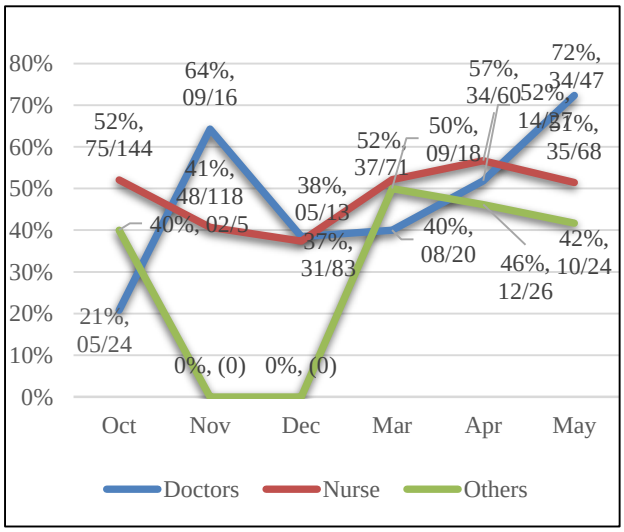

Figure 2: HHAR trend in HCW in paediatric ward.

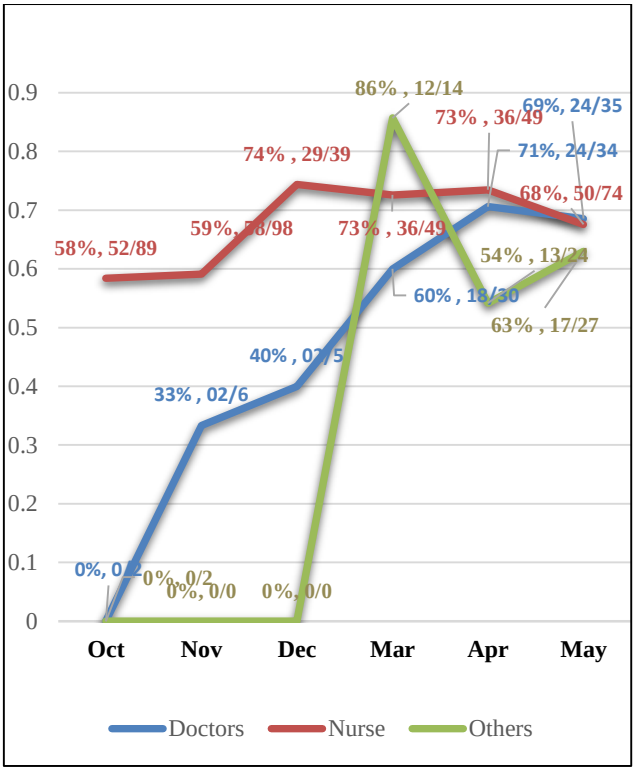

Figure 3: HHAR trend in HCW in HL ward.

Table 1: Hand hygiene compliance by the health care workers of ICU, HL ward, and pediatric ward by overt observer.

HH indication and ward	Overt observation		P value
	1st session	2nd session	
ICU	52.24% (221/423)	70.08% (274/391)	2.827e-07
Doctor	40% (28/70)	74.49% (73/98)	1.417e-05
Nurse	54.43% (178/327)	69.61% (142/204)	0.0007
Others	57.69% (15/26)	66.29% (59/89)	0.5669
HL ward	59.34% (143/241)	68.48% (239/349)	0.0280
Doctor	30.77% (4/13)	66.67% (66/99)	0.0272
Nurse	61.50% (139/226)	70.81% (131/185)	0.0611
Others	0% (0/2)	64.61% (42/65)	0.2632
Paediatric	43.42% (175/403)	53.46% (193/361)	0.0069
Doctor	35.85% (19/53)	59.57% (56/94)	0.0096
Nurse	44.64% (154/345)	53.27% (106/199)	0.0641
Others	40% (2/5)	45.59% (31/68)	0.999

Table 2: Hand hygiene compliance moment wise by the health care workers.

Location	HCW staff	Moment 1		Moment 2		Moment 3		Moment 4		Moment 5	
		1st session	2nd session	1st session	2nd session	1st session	2nd session	1st session	2nd session	1st session	2nd session
		P value		P value		P value		P value		P value	
All locations	All HCW	58.16% (285/490)	63.88% (435/681)	59.61% (31/52)	68.29% (28/41)	54.17% (13/24)	100% (6/6)	59.06% (290/491)	61.11% (418/684)	46.99% (321/683)	61.18% (506/827)
		0.0547		0.5184		0.1074		0.5176		4.74e-08	
ICU	All HCW	63.55% (68/107)	69.06% (96/139)	30% (6/20)	50% (4/8)	53.33% (8/15)	-	55.66% (59/106)	70.50% (98/139)	45.71% (80/175)	72.38% (76/105)
		0.4395		0.5746		NA		0.0235		0.00002	
HL ward	All HCW	56.72% (38/67)	64.46% (78/121)	25% (1/4)	90.91% (10/11)	50% (1/2)	100% (1/1)	65.71% (46/70)	68% (85/125)	58.16% (57/98)	71.43% (65/91)
		0.3736		0.0584		0.9999		0.8673		0.0796	
Paediatric ward	All HCW	41.73% (53/127)	52.38% (66/126)	57.14% (4/7)	16.67% (1/6)	57.14% (4/7)	-	49.19% (61/124)	52% (65/125)	37.86% (53/140)	58.65% (61/104)
		0.1162		0.3557		NA		0.7519		0.0020	
ICU	Doctor	33.33% (4/12)	80% (28/35)	100% (3/3)	60% (3/5)	100% (1/1)	-	53.85% (7/13)	74.28% (26/35)	31.71% (13/41)	69.56% (16/23)
		0.0084		0.6733		NA		0.3138		0.0079	
	Nurse	67.78% (61/90)	67.09% (53/79)	17.65% (3/17)	33.33% (1/3)	46.15% (6/13)	-	55.68% (49/88)	67.09% (53/79)	49.58% (59/119)	79.07% (34/43)
		0.9999		0.9999		NA		0.1769		0.0015	
	Others	60% (3/5)	60% (15/25)	-	-	100% (1/1)	-	60% (3/5)	72% (18/25)	53.33% (8/15)	66.67% (26/39)
		0.999		NA		NA		0.9999		0.5524	
HL ward	Doctor	25% (1/4)	63.64% (21/33)	0% (0/1)	80% (4/5)	-	-	66.67% (2/3)	64.71% (22/34)	20% (1/5)	70.37% (19/27)
		0.3435		0.6985		NA		0.9999		0.1022	
	Nurse	59.68% (37/62)	65.22% (45/69)	33.33% (1/3)	100% (6/6)	50% (1/2)	100% (1/1)	66.67% (44/66)	77.14% (54/70)	60.21% (56/93)	64.10% (25/39)
		0.6359		0.1564		0.9999		0.2422		0.8238	
	Others	0% (0/1)	63.16% (12/19)	-	-	-	-	0% (0/1)	42.86% (9/21)	-	84% (21/25)
		0.8341		NA		NA		0.9999		NA	
Paediatric ward	Doctor	50% (6/12)	53.12% (17/32)	50% (1/2)	20% (1/5)	50% (1/2)	-	58.33% (7/12)	62.50% (20/32)	14.81% (4/27)	72% (18/25)
		0.9999		0.9999		NA		0.9999		0.0001	
	Nurse	40.71% (46/113)	51.90% (41/79)	60% (3/5)	0% (0/1)	60% (3/5)	-	48.18% (53/110)	50% (39/78)	43.75% (49/112)	63.41% (26/41)
		0.1659		0.9999		NA		0.9222		0.0456	
	Others	50% (1/2)	53.33% (8/15)	-	-	-	-	50% (1/2)	40% (6/15)	0% (0/1)	44.74% (17/38)
		0.9999		NA		NA		0.9999		0.9999	

Table 3: Comparison of hand hygiene compliance by overt and covert observer.

HH indication and ward	1st session		P value	2nd session		P value
	Overt	Covert		Overt	Covert	
All doctor	37.50% (51/136)	40.24% (33/82)	0.7952	67.01% (195/291)	54.73% (133/243)	0.0049
All nurse	52.45% (471/898)	61.96% (272/439)	0.0012	64.45% (379/588)	61.92% (444/717)	0.3762
All others	51.51% (17/33)	64% (96/150)	0.250	59.46% (132/222)	62.36% (111/178)	0.6261
ICU	52.24% (221/423)	62.73% (207/330)	0.0050	70.08% (274/391)	63.37% (308/486)	0.0438
Doctor	40% (28/70)	45.24% (19/42)	0.7293	74.49% (73/98)	62.96% (51/81)	0.1333
Nurse	54.43% (178/327)	63.46% (99/156)	0.0755	69.61% (142/204)	61.03% (177/290)	0.0620
Others	57.69% (15/26)	67.42% (89/132)	0.4653	66.29% (59/89)	69.56% (80/115)	0.7293
HL ward	59.34% (143/241)	62.50% (100/160)	0.5957	68.48% (239/349)	64.20% (156/243)	0.3176
Doctor	30.77% (4/13)	33.33% (5/15)	0.9999	66.67% (66/99)	65.22% (45/69)	0.9764
Nurse	61.50% (139/226)	66.20% (94/142)	0.4248	70.81% (131/185)	66.22% (100/151)	0.4332
Others	0% (0/2)	33.33% (1/3)	0.9999	64.61% (42/65)	47.83% (11/23)	0.2436
Pediatric ward	43.42% (175/403)	51.93% (94/181)	0.0690	53.46% (193/361)	54.77% (224/409)	0.7716
Doctor	35.85% (19/53)	36% (9/25)	0.9999	59.57% (56/94)	39.78% (37/93)	0.0105
Nurse	44.64% (154/345)	56.03% (79/141)	0.0292	53.27% (106/199)	60.51% (167/276)	0.1386
Others	40% (2/5)	40% (6/15)	0.9999	45.59% (31/68)	50% (20/40)	0.8073

DISCUSSION

Over the past few decades there has been substantial improvement in cancer care, but infections still remain one of the leading causes of death in cancer patients. We need to strengthen the basic and core elements of Infection prevention and control to combat this rising trend of infections due to drug resistant bugs in cancer setup. In this phase study, we have observed an HHAR of 54.08% (980/1738) in the first phase and 62.26% (1394/2239) in the second phase. In the second phase, comparatively auditors were able to observe more HH opportunities. With regular and continuous practice of HH audit, even the efficiency of trained auditors also improves. There are very limited studies addressing the effect of phased audits and training over HHARs of HCWs. Kumar et al in a limited monthly phased audit cycle of four months, also observed an increase in HH compliance as 40.6%, 52.9%, 54.2% to 69.8%.[12] In a yearly phased study conducted by Bharara et al for 3 years observed an increase in HH compliance from 21% to 59%.[13] As, this is a tertiary care cancer centre where more immunocompromised patients are getting admitted, requiring more focused approach towards infection preventive steps through dedicated training and surveillance from ICN, which could be the reason for comparatively better HH compliance.

In the first phase maximum HH compliance was observed in HL ward, where patients eligible for bone marrow transplants are being admitted and in second half this locus was shifted to ICU. At these locations a limited number of critical patients are being admitted, where even more trained and competent staff are posted. We are also able to maintain adequate patient to staff ratio at ICU and HL wards for focused approaches towards prevention of MDR infections are practically applied in these locations. As awareness, lack of education and forgetfulness are major contributing factors for low HH adherence.[14] It is easy to motivate staff working in ICU and HL ward to follow standard precautions at their workplace.

Comparatively in the second phase of study increase in HHARs were noted for both doctors and nurses in all three locations (ICU, HL ward, paediatric ward). Similar results were found in study by Teker et al and Anwar et al showed that HHAR in nurses were higher than doctors and other HCWs, also it observed that continuous educational programs and audits help in more HH compliance.[14,15] Study by Saharman et al observed a significant increase in HH compliance through intensive training and educational sessions.[16] In our study overall moment 5 showed significant ($p<0.0000004$) increase in HH adherence compliance as compared to other moments. At ICU moment 4 ($p=0.0235$) and moment 5 (0.00002) and at pediatrics ward, moment 5 ($p=0.002$) showed increased HH compliance. Oliveira et al also showed increased compliance to moment 5. HCW at HL ward are more focused towards minimum contact policy with specific high touch surfaces like door handles, bedside railing and tables, which could be the reason for getting less moment specific HH opportunities.[17]

Overall compliance rate was higher with covert observation than overt observation (62.26% vs 57.43%, $p=0.0826$). Hawthrone effect and HH educational training have significantly affected the HH performance of hospital staff. Hawthrone effect is a major limitation of direct observation for HH practices in any clinical setting. As per the table 3 in the first phase more HH compliance were noted by the covert observer, but in the second phase health care staff showed more compliance towards HH in presence of HH auditor (Overt observation). Covert observation was performed by ICN of the

institute, which might be the reason for having more compliance than trained HH auditors' observations, in the first half of the study. According to WHO, provision of feedback for HH adherence to the auditees is essential for changing behavioural attitude of HCW towards HH practices.[18] In the second phase of the study, HH auditor observed more HH compliance reflecting the approach of HCWs towards any targeted intervention/ training implemented at any health care centre under regular supervision. HH compliance observation and its correction among HCW is one of the daily activities performed by ICN, but in the limited time span more HH opportunities were noted by HH auditor, as the auditor was focused only for observing HH activities conducted by HCW at specific locations. Study by Gould et al suggested that presence of an observer disrupts the behaviour of HCWs and leads to Hawthorne effect.[19] Another study by Srigley et al observed nearly threefold increase in HH compliance in the presence of an auditor.[20] To achieve better HH adherence, Institutions need to prioritise the availability of hand rubs, designated hand wash sinks with uninterrupted water supply and posters at all strategic locations. Hospital administration also needs to focus on adequate staffing at locations according to the severity of infections or criticality of therapeutic interventions over patients. Positive reinforcement acts like appreciation certificates, positive role modelling, and consideration in annual staff performance grading, provision of HH champion trophies or financial rewards for better HH performance could be effective to achieve sustainable positive effect over HH performance at any institutional setup.

Limitations

There are some limitations with this study, firstly the audits were done for a specific time period and duration, with small sample size and even the same overt and covert auditors were involved in both phases of the study. Secondly our study also had bias inherent to any observational study such as observers bias and selection bias. Despite these limitations, we believe that our direct HH observational audit data reflect overall improvement of HH compliance in a tertiary care cancer centre along with reflection of human behaviour towards performance of HH, during regular HH audits and training. However, this study must be continued to assess the long-term effect of HH audits towards HH compliance, Hawthorne effect and additionally its impact on infection rates in the particular ICU/wards or entire hospital.

CONCLUSION

Regular training sessions and awareness campaigns about HH are essential for effective and sustained infection control practices. Regular, daily meticulous HH auditing with constant motivational training towards the indicative steps of HH will surely bring significant change in behaviour/attitude of HCW in implementing basic infection preventive steps and particularly in HH adherence compliance. Frequent HH audit also improves efficiency of HH auditors towards observation of its compliance by HCWs and also influences them to improve and sustain a positive approach for HH practices. Decentralisation and workstation specific HH motivational auditor will be the most effective and cost saving approach at least for developing countries for achieving significant progressive improvement in HH adherence.

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