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Using a multi-modal strategy to improve patient hand hygiene

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Using a multi-modal strategy to improve patient hand hygiene

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Abstract:	Objective: The role of healthcare worker hand hygiene in preventing healthcare associated infections (HCAI) is well established. There is less emphasis on the hand hygiene of hospitalised patients; in the context of COVID-19 mechanisms to support it are particularly important. The purpose of this study was to establish if providing patient hand wipes and a defined protocol for encouraging their use was effective in improving the frequency of patient hand hygiene (PHH). Design: Before and after study Setting: General Hospital, United Kingdom. Participants: All adult patients admitted to six acute elderly care/rehabilitation hospital wards between July and October 2018. Methods: Baseline audit of PHH opportunities conducted over 6 weeks. Focus group with staff and survey of the public informed the development of a PHH bundle. Effect of bundle on PHH monitored by structured observation of HH opportunities over 12 weeks. Results: During baseline 303 opportunities for PHH were observed; compliance with PHH was 13.2% (40/303; 95%CI 9.9-7.5). In the evaluation of PHH bundle 526 PHH opportunities were observed with HH occurring in 58.9% (310/526); an increase of 45.7% vs. baseline (95%CI 39.7–51.0%; p<0.001). Conclusion: Providing patients with multi-wipe packs of handwipes is a simple, cost-effective approach to increasing patient hand hygiene and reducing the risk of HCAI in hospital. Healthcare workers play an essential role in encouraging PHH.

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Response to reviewers comments

Please add the dates of the intervention.
Apologies – this is a good point and have now done this in the methods and results section

Awareness of infection prevention and hand hygiene has changed dramatically with the pandemic. I assume that this was a pre pandemic study, but assuming isn't good.
Have added a sentence at the end of the introduction to indicate it was conducted prior to the pandemic

Do not use 1 sentence paragraphs.
Apologies – this was actually intended to be part of a list under Box 1. We have now made this clearer that this is part of that illustration

Title Page

Using a multi-modal strategy to improve patient hand hygiene

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Word count: 3005

Running title: Strategy to improve patient hand hygiene

Using a multi-modal strategy to improve patient hand hygiene

Abstract

Objective: The role of healthcare worker hand hygiene in preventing healthcare associated infections (HCAI) is well established. There is less emphasis on the hand hygiene of hospitalised patients; in the context of COVID-19 mechanisms to support it are particularly important. The purpose of this study was to establish if providing patient hand wipes, and a defined protocol for encouraging their use, was effective in improving the frequency of patient hand hygiene (PHH).

Design: Before and after study

Setting: General Hospital, United Kingdom.

Participants: All adult patients admitted to six acute elderly care/rehabilitation hospital wards between July and October 2018.

Methods: Baseline audit of PHH opportunities conducted over 6 weeks. Focus group with staff and survey of the public informed the development of a PHH bundle. Effect of bundle on PHH monitored by structured observation of HH opportunities over 12 weeks.

Results: During baseline 303 opportunities for PHH were observed; compliance with PHH was 13.2% (40/303; 95%CI 9.9-7.5). In the evaluation of PHH bundle 526 PHH opportunities were observed with HH occurring in 58.9% (310/526); an increase of 45.7% vs. baseline (95%CI 39.7–51.0%; $p<0.001$).

Conclusion: Providing patients with multi-wipe packs of handwipes is a simple, cost-effective approach to increasing patient hand hygiene and reducing the risk of HCAI in hospital. Healthcare workers play an essential role in encouraging PHH.

Keywords: Patient hand hygiene, care bundle, handwipes, compliance, before and after study, feedback

Graphical Abstract (for review)

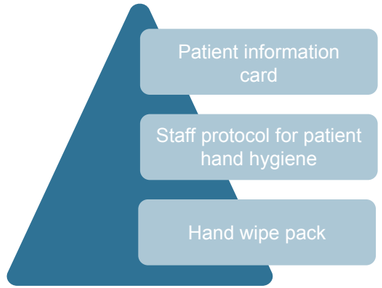
Click here to access/download;Graphical Abstract (for review);AJIC_Infographic_25-11-2020_AWOL.pdf

Using a Multi-Modal Strategy to Improve Patient Hand Hygiene

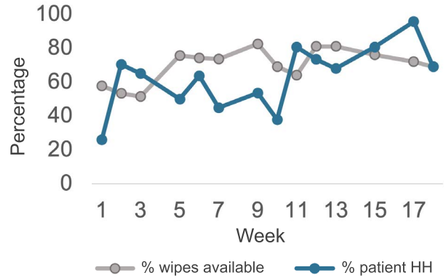
Phase 1
Baseline Audit of Patient Hand Hygiene

Hand Hygiene (HH) opportunity	% with HH access	% HH occurred
Before food/drink	29%	5%
After using the toilet	58%	44%
Total (n=303)	31%	13%

Phase 2
Co-production of Patient Hand Hygiene Bundle



Phase 3
Implementation and Monitoring of Patient Hand Hygiene Bundle



Increase in compliance with patient hand hygiene during the 18-week intervention period

Phase 4
Patient and Staff Acceptability

53 patients surveyed said wipes were:

- Important for their care (87%)
- Helped them clean their hands (86%)
- Prompted staff to help them clean their hands (76%)

Using a multi-modal strategy to improve patient hand hygiene: key points

- Patients hands become contaminated with pathogens which may then cause infection
- Patients rarely decontaminate their hands whilst they are in hospital
- Patient handwipe packs & information for staff/patients increased compliance to 69%
- Prompting by staff influences whether patient hand hygiene occurred
- Patient handwipes are a cost-effective method of increasing patient hand hygiene

Manuscript (without author identifiers)

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Title Page

Using a multi-modal strategy to improve patient hand hygiene

Word count: 3005

Running title: Strategy to improve patient hand hygiene

Using a multi-modal strategy to improve patient hand hygiene

Introduction

The role of the hands of healthcare workers (HCW) in the transmission of healthcare associated infections (HCAI) is well established and multi-modal strategies are recommended to support effective hand hygiene among HCW[1]. In contrast, there are few studies on the role of patients' hands in the transmission of HCAI or mechanisms to support patient hand hygiene (PHH) in healthcare settings[2]. Laboratory-based studies have demonstrated the ability of a range of pathogenic microorganism to be acquired from the environment and survive for prolonged periods on hands, including rhinoviruses, Gram negative and positive bacteria, gastrointestinal viruses such as hepatitis A and multi-resistant pathogens[2-6].

Significant levels of carriage are also found on the hands of patients, including coliforms[7] and multidrug resistant pathogens[8], and a higher prevalence of carriage of pathogens on patient hands than staff hands[8,9]. A study that sampled the hands of 100 patients after 48hrs spent in an acute care setting found that 39% were contaminated with at least one pathogen, including *C. difficile*, methicillin-resistant Staphylococcus aureus (MRSA), vancomycin-resistant enterococcus (VRE), and Gram-negative organisms[10]. It has been suggested that pathogens are transferred either directly onto the skin of patients or their immediate environment by HCW un-gloved or gloved hands[11]. Once contaminated, patients' hands may contribute to HCAI by contaminating susceptible sites such as intravenous devices, urinary catheters or wounds.

The acquisition of gastrointestinal pathogens such as *C. difficile* or norovirus is dependent on ingestion and patients' hands are likely to be a significant means of transmission[12,13]. Improving patient hand hygiene has been shown to reduce the transmission of MRSA and respiratory viruses[14,15]. Mechanisms to support PHH have taken on increased significance since the emergence of the COVID-19 pandemic given the role that hand hygiene plays in disseminating respiratory viruses.

Studies conducted on whether patients wash their hands while in hospital suggest that whilst HCW believe that they offer patients the opportunity to wash their hands, both patient reports and direct observation suggest that this rarely happens[16-18]. Unsurprisingly, patients who require assistance to clean their hands are more likely to have their hands contaminated with pathogens than those that can manage without assistance[10].

Studies investigating strategies to improve PHH have focused on a range of interventions, including education, adaptation of the World Health Organisation (WHO) 5 moments to fit patient hand hygiene moments and electronic reminders to improve self-initiated hand hygiene[18-23].

Key considerations for promoting PHH including timing and technique, product design and placement, and education and training for patients, their families and healthcare workers[24]. Furthermore, a different approach to HCW hand hygiene is indicated because the most critical moments for PHH will not match the 5 moments recommended for staff (WHO 2009); mobility and confinement affect the patients' ability to perform hand hygiene without assistance, and the product formulations that are most appropriate and acceptable for patient hand cleansing are likely to be different to those of staff[24]. Patient handwipes had been evaluated in a previous study and an antimicrobial handwipe applied for sixty seconds was found to be as good as soap and water in removing microbial contamination from hands.[25]

There are a lack of studies on the efficacy and feasibility of PHH strategies to enhance patient safety in acute healthcare settings. The aim of this study, which was conducted prior to the COVID-19 pandemic, was to establish if the introduction of patient hand wipes in conjunction with a defined protocol for encouraging patients to use them, provided a feasible approach to improving the frequency of patient hand hygiene (PHH).

METHODS

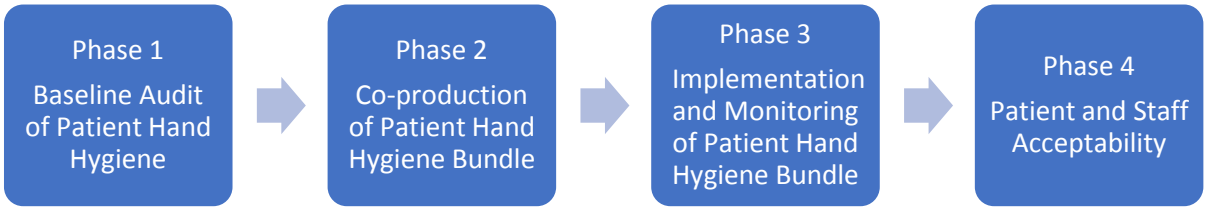
Study design

A before and after design was used to support the implementation of the PHH strategy in the acute care setting. As PHH is a fundamental element of patient care it would be ethically unacceptable to use a quasi-experimental control design. The study was conducted in four phases (Figure 1).

Setting

The study took place between July and October 2018 in six implementation wards in the care of older people speciality at a large District General Hospital in England. Three wards admitted acutely ill patients, one was. A neurorehabilitation unit, and two were for step down care. The median number of beds was 28 and average bed occupancy ranged from 95.2 to 99.8%. Patients on these wards were likely to have physical and/or cognitive impairments that contributed to increased dependency, and a longer than average length of hospital stay.

Figure 1 Diagram of Study Phases



Ethical Approval

Ethical approval was given by the University of West London, College of Nursing, Midwifery & Health Research Ethics Committee and permission given by the NHS Trust Research and Development and Quality Governance Departments.

Phase 1: Baseline audit of hand hygiene practice

Data was captured on the number of PHH opportunities (defined as before meal, before touching and after touching an invasive device, after using toilet, after sneezing/coughing, after vomiting) and the proportion where HH was completed across the six participating wards. For each opportunity information was recorded on patient dependency and cognitive status, the type of opportunity, who was present, whether the patient had access to HH, specifying the method available/used. Access to HH was defined as at least one option (soap & water, blue wipes or patient own wipes) available to the patient at the point of care, and which they would be able to reach independently.

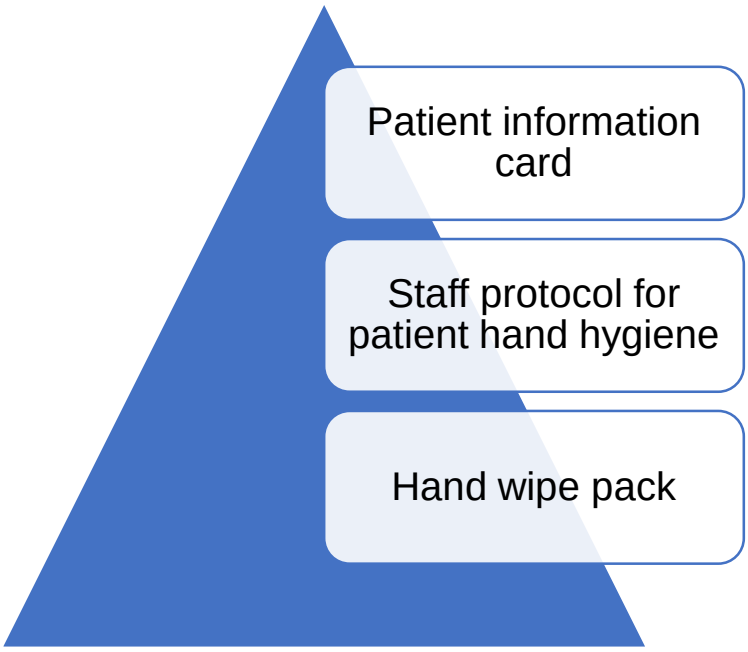
Observations were undertaken in three-hour periods between 7am and 7pm over a six-week period. Data were captured by three researchers using a standardised observation schedule and entered into IBM SPSS 24™. All data were binary/categorical and were analysed using Chi-squared and binary logistic regression as appropriate.

Phase 2: Co-design of PHH bundle

A focus group of staff from on the participating units was conducted to explore opinions about the importance of patient hand hygiene and strategies to support patient hand hygiene. A nominal group technique[26] was used to identify the most important points during the patients' day when patient hand hygiene should occur and. Participants were also asked to evaluate the preferred hand wipe pack design and information for patients about hand

hygiene. Members of public were asked to complete a brief questionnaire on each of the wipes being considered for inclusion in the bundle to obtain their views on ease of removal, effectiveness in cleaning hands, smell and feel, attractiveness of the packaging. The information captured from this phase was used to inform the development the Patient Hand-Hygiene Bundle' (see Box 1)

Box 1: Patient Hand hygiene bundle



Patient information card: encourages patients to use the hand wipe to clean their hands after using the toilet, before eating food, after sneezing, coughing, blowing their nose

Staff protocol for patient hand hygiene: Prompt patients to clean their hands by offering them a hand wipe before meals, after using the toilet, bedpan, commode, after coughing or sneezing. Other times when hand hygiene could be prompted include: after vomiting, if touching an invasive device, before taking medication

Hand wipe pack: Pack of 40 wipes issued to each patient, replace with new pack when used

Phase 3: Implementation of the PHH bundle

Ward staff were inducted to the PHH bundle by face-to-face meetings and by distribution of a written protocol. All patients on the participating wards at the beginning of the implementation phase received an individual pack of hand wipes and information about PHH. New packs of hand wipes and PHH information were issued as required and to new patients admitted to the wards. All hand wipe packs were provided by GAMA Healthcare. The intervention was commenced in June 2018 and continued to October 2018. An initial period of three weeks enabled staff to become familiar with the PHH bundle and ensure that

patients were provided with wipes and information on admission. Twelve observation periods by two researchers were undertaken over a subsequent 14-week period in the six participating wards to measure compliance with the bundle. Data on the number of patients on the ward and the number with hand wipes, PHH opportunity, whether PHH occurred, the type of staff present, who initiated and completed hand hygiene. These data were recorded onto standardised data collection forms at each observation session. Data on the availability of wipes and compliance with patient hand hygiene was feedback to ward staff on weeks 5 and 11.

Interrupted Time Series regression was used to estimate the size and significance of the intercept shift by creating a dummy variable D set to zero before week 4 and to 1 afterwards.

Consumption of wipes: Data on the number of packs issued, number of packs and wipes used was captured during the implementation period to provide evidence of wipe usage and estimate the costs of the PHH bundle.

Phase 4: User acceptably

The user experience of the PHH bundle was evaluated through a patient questionnaire administered to patients on the study wards who volunteered to complete the survey during the last four weeks of the implementation period. Staff acceptability was evaluated in a focus group with staff at the end of the study.

Baseline data were entered into IBM SPSS 24™ binary/categorical and analysed using Chi-squared and binary logistic regression as appropriate. Data from the implementation period were entered into Microsoft ExcelTM and analysed using frequencies and descriptive statistics. The rate of patient hand wipes usage during the study period was calculated using the number of packs (or wipes included in the pack) distributed the wards as the numerator and the number of bed-days on the participating wards as the denominator

RESULTS

Audit of patient hand hygiene practice

A total of 43 hours of structured observations of PHH were conducted. Complete data were collected on 303 of 325 HH opportunities observed and were included in the analysis. PHH occurred on only 13.2% (40/303) of opportunities (Table 1). A mechanism to enable patients to clean their hands at the point of care was available on 31.4% (93/303; 95%CI

26.4-36.8) of opportunities. PHH was more likely to occur when there a HH mechanism was available (Odds Ratio [CI 95% 10.6- 91.8]; p=0.000).

Table 1: Baseline data: Frequency of patient HH by type of opportunity and access to mechanism of undertaking HH

Hand hygiene opportunity	No. (%) opportunities	No. (%) of opportunities with access to mechanism of HH *	No. (%) of opportunities where HH occurred
Before food/drink	*191 (63.0%)*	56 (29.3%)	9 (4.7%)
After using the toilet	*66 (21.8%)*	38 (57.6%)	29 (43.9%)
toilet	*33 (10.9%)*	*28.0 (84.8%)*	*22 (66.7%)*
commode/bedpan/urinal	*33 (10.9%)*	*10 (30.3%)*	*7 (21.2%)*
Touching nose/mouth	*36 (11.9%)*	-	-
Touching invasive devices	*1 (0.3%)*	-	-
Exposure to body fluids	*5 (1.7%)*	-	-
During personal hygiene	*4 (1.3%)*	3 (75%)	3 (75.0%)
Total	**303 (100%)**	**95 (31.4%)**	**40 13.2%)**

*Alcohol hand cleanser, soap and water, hand cleansing wipe within reach of the patient

Staff were present at 76% (230/303) of PHH opportunities but the presence of staff did not significantly affect the likelihood of PHH occurring (31/230 vs 9/73; Odds Ratio 1.1 [CI95% 0.50-2.45]; p=0.8). In terms of access to a mechanism to perform patient HH, soap and water was available for 13% (39/303) of opportunities and 75% (27/39) of these opportunities were when using the toilet. Single-use wrapped patient hand wipes were available for 16% (47/303) of opportunities, but 95% (45/47) of these were before eating or drinking as this wipe was commonly place on patient meal trays. These wipes were only used to clean hands for 13% (3/45) of these occasions and the wipes were otherwise discarded unopened with the contents of the meal tray.

Implementation of patient hand hygiene bundle

In total, 68 periods of observation of PHH were conducted across the six wards. During these periods 526 opportunities for PHH were identified and hand hygiene occurred in

58.9% (310/526). This reflected an increase of 45.7% compared to the compliance of 13.2% (40/303) observed prior to the intervention (95%CI 39.7 – 51.0%; p < 0.001) (Table 2).

Table 2: Implementation phase: Patient hand hygiene opportunities observed and proportion where patient hand hygiene occurred

Ward (no. beds)	No. of patient hand hygiene opportunities	No. where patient hand hygiene occurred	% where patient hand hygiene occurred	No. of patients on ward	% patients with wipes available	% patients with wipes availability
3B (28)	103	70	68	292	176	60
1C (12)	64	39	61	115	100	87
6H (21)	104	58	56	169	135	80
5L (26)	105	45	43	256	175	68
2M (28)	71	49	69	243	191	79
4W (28)	79	49	62	285	210	74
Total	**526**	**310**	**59**	**1360**	**987**	**73**

Over the period as a whole, compliance with availability of patient hand wipes was 73% (987/1360). Figure 2 illustrates the trend in proportion of patients who had wipes available and the proportion of PHH opportunities where hand hygiene occurred over the 16-week intervention period. The proportion of patients with wipes available increased over the intervention period from 57.75% (67/116) in week 1 to 68.8% (86/125) in week 16 (95%CI -1.1 – 22.8%; p = 0.076).

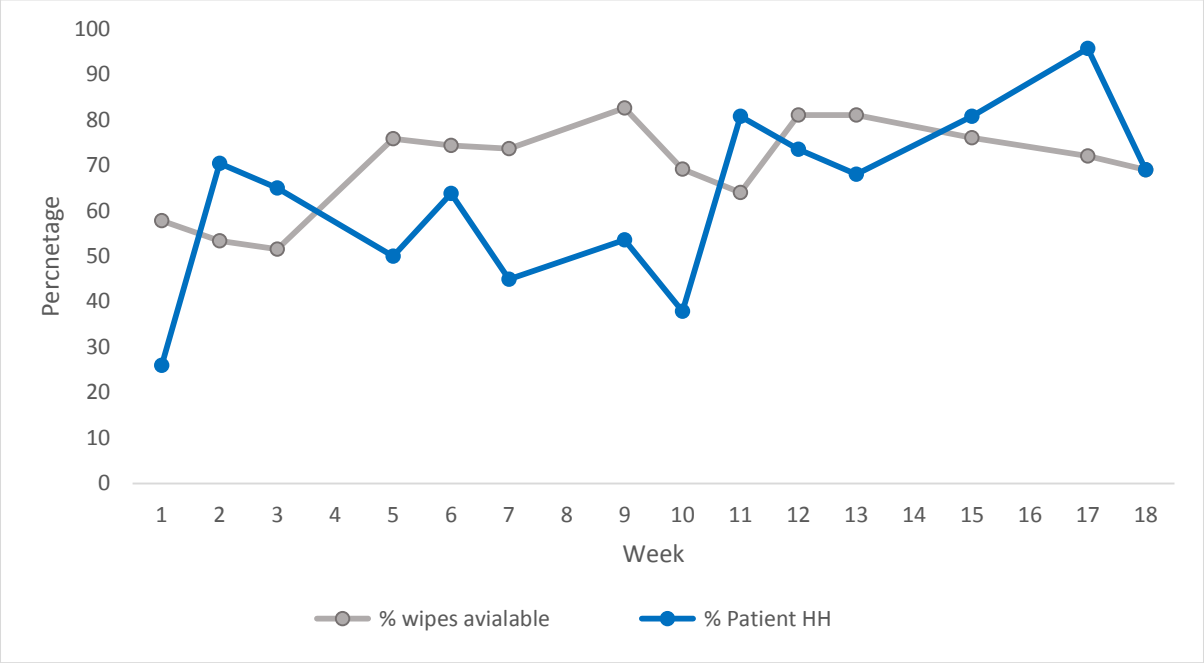
The proportion of hand hygiene opportunities when PHH occurred significantly increased between the beginning and the end of the intervention period from 22.5% (16/71) in week 1 to 69% (29/42) in week 16 (95%CI 27.85 – 60.91%; p < 0.001).

All wards increased both the availability of patient hand wipes and the proportion of opportunities where PHH occurred. However, the proportion of opportunities where patient HH occurred varied between wards with an overall compliance on the best ward of 68% (70/103) compared to 43% (45/105) on the poorest performing ward. All the wards made the patient hand wipes available for most patients with the best performing ward having wipes

available for 87% (100/115) at the point of observation and even the most poorly performing ward had wipes available for 60% (176/292) of patients (Table 2).

Figure 2: Trend in compliance with patient hand hygiene during the 18-week intervention period (June to October 2018).

Familiarisation period week 1 – 3; feedback reports given in week 5 & 11

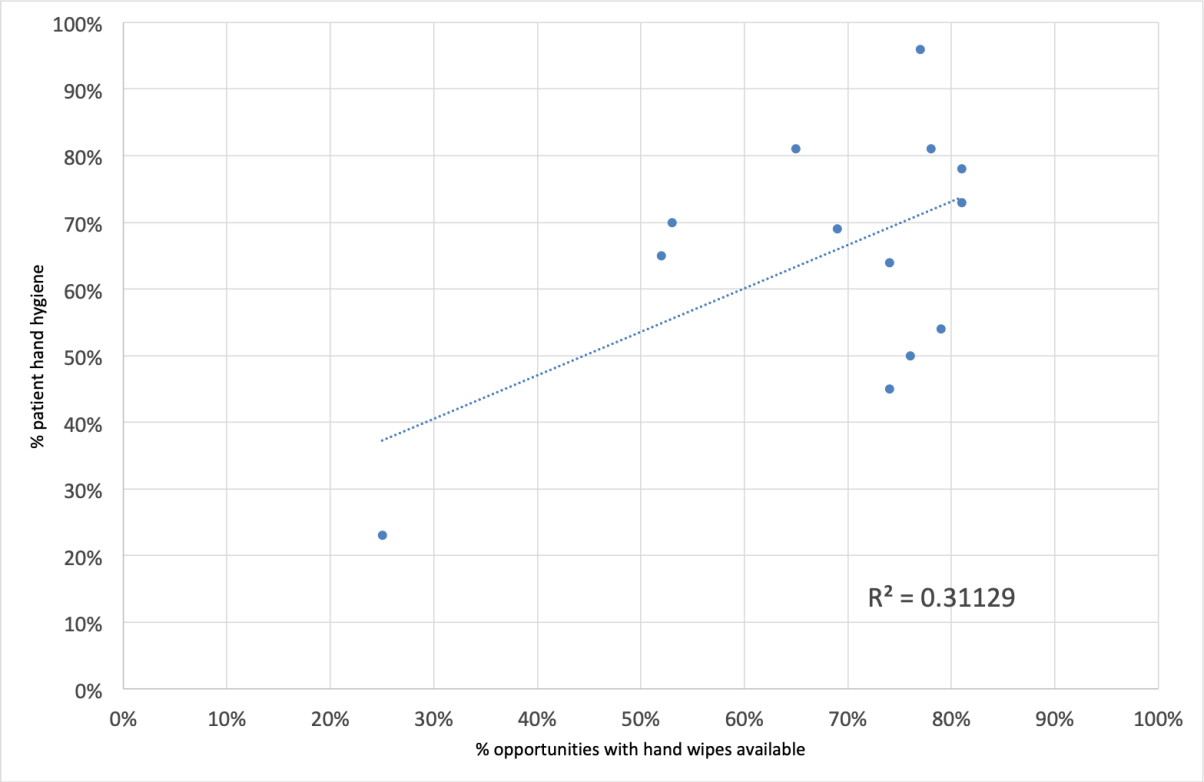


The ITS regression estimated that after the familiarisation period the availability of wipes increased by 11% ($p < 0.01$) and an average weekly increase in compliance of 3% ($P<0.001$).

Figure 3 shows the correlation between the availability of wipes and compliance with PHH (R^2 0.311) which suggests a moderate correlation between compliance of PHH and the availability of wipes.

There was a total of 66,232 wipes used in six wards over 5 months, corresponding to an average usage of 2207 wipes per ward per month. The average number of wipes used was 3308 wipes per 1000 bed-days, ranging between wards from 2,872 to 4,653 wipes per 1000 bed-days. The overall costs for these wipes was £2186 (wipes = £1,973.71) or an average of £73 per ward per month, or £3 per bed per month.

Figure 3: Correlation between wipe availability and proportion of opportunities where patient hand hygiene occurred



Use acceptance

A total of 53 questionnaires were completed by patients during the intervention period; 79% (42/53) indicated that they had used hand wipes and 87% (37/42) agreed or strongly agreed that the wipes were a good idea, In particular they agreed that the wipes enabled them to clean their hands themselves (86%; 36/42) and that they helped staff to clean their hands (76%; 32/42). The majority of the patients found the wipes made their hands feel clean and were easy to remove from the pack. Some patients indicated that they preferred soap and water, one patient did not realise they were hand wipes not 'general cleans' and one patient said she was allergic to them. Only 66% (35/53) of patients said they would usually wash their hands after using the toilet when at home and 57% (30/53) before a meal. Feedback from staff was positive with ward managers highlighting that patient experience was improved and patient awareness of the need for had hygiene increased "patients started to ask for their wipes" with the possibility that hand hygiene behaviour would "be taken home" on discharge. In terms of acceptability for staff, the opinion was that ease of access was important and that being able to secure them to the bed table was an advantage as this made the packs readily accessible and staff didn't "have to hunt for them. Overall the wards

wanted to continue to promote patient hand hygiene and felt that patient wipes was a more efficient and practical means of enabling patients to clean their hand with assistance or independently.

DISCUSSION

Our results highlight the importance of multi-modal approaches to improve PHH. This study has confirmed the findings of other studies that patients rarely decontaminate their hands whilst in hospital.[17,18] and although nursing staff recognise patient hand hygiene as an important infection control measure, they rarely make hand hygiene available for patients.[16] Prior to implementing the PHH bundle, we found that overall patient compliance with HH was only 13% and although more likely to occur after using the toilet, less than 5% of patients performed HH before eating. This was considerably lower than that suggested in a recent study by Srigley *et al*[27] where compliance was 30% after using the bathroom and 39% at mealtimes, although in this study the use of an electronic monitoring may over-estimate hand hygiene among a more mobile patient population. PHH prior to eating is particularly important given the risk of transferring pathogens acquired though touching the environment or staff onto mucous membranes or their ingesting when handling and consuming food in a hospital ward. In addition, given that the predominant route of transmission of SARS-CoV-2 virus is via respiratory droplets which will contaminate infected patients' hands and elements of their immediate environment that they touch, mechanisms that support regular patient hand hygiene should be a key component of strategies to minimise transmission in healthcare settings.

The approach taken by our study attempted to create a multi-modal strategy to improve PHH by introducing a bundle comprising individual patient hand wipe packs, a patient hand hygiene protocol for staff, information about patient hand hygiene for patients and monitoring and feedback of rates of compliance. The pack of hand wipes proved popular with both patients and staff and markedly improved the availability of options for hand hygiene for this group of elderly patients, who predominantly had limited mobility. Results from another study on improving PHH highlighted the importance of having products for PHH available at the bedside particularly for patients who are bed bound.[29]

The PHH bundle was associated with a significant increase in compliance with patient hand hygiene; patient hand wipes were observed to be available at the point of use on three-quarters of occasions and patient compliance with hand hygiene increased from 13% pre-intervention to 60% after the intervention. However, compliance with both availability of wipes and patient hand hygiene varied between wards and over time; the availability of

wipes at the point of use inevitably had an impact on whether patient hand hygiene occurred. Sunkesula *et al*[18] also used staff to encourage patient hand hygiene in combination with canisters of hand wipes and posters. They found a similar increase in compliance with hand hygiene from an overall 10% before the intervention to 79% before meals after the intervention. Our study also found that the healthcare worker was critical in determining whether patient hand hygiene occurred as they prompted almost 80% of the patient hand hygiene events. Given that only about half of this patient group reported that they would wash their hands prior to eating and only two-thirds after using the toilet, the healthcare worker needs to be proactive in supporting the best interests of their patients.

The limitations of this study include the potential Hawthorne effect by using direct observations.[29] We attempted to mitigate this by undertaking very short periods of observation of compliance with PHH, before staff became overtly aware of our presence. The study was undertaken in a single NHS trust and was restricted to six medical wards over an 17-week period and the number of opportunities observed were concentrated around specific times during the day. However, baseline observations suggested that these were the most appropriate periods, given the ward activity. In addition, the hand wipes used for this study had not been designed specifically for patient use and therefore did not have intentionally patient-focused packaging which may have been helpful in encouraging patients to use the wipes.

Making individual multi-wipe packs available to patients is a simple, cost-effective approach to increasing patient hand hygiene and reducing the risk of them acquiring healthcare associated infections whilst in hospital. In addition, hand wipe packs may provide a more practical, low cost, means of enabling staff to support patient hand hygiene than attempting to access soap and water, particularly important for older patients who may have limited mobility. However, staff need to be educated about the importance of PHH, be encouraged to ensure hand wipes are readily available and to actively prompt and support patients to use them.

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Potential conflicts of interest: This study was partially funded by *a* grant from GAMA Healthcare Ltd and they provided the hand hygiene wipes. GAMA Healthcare Ltd had no involvement in the study design, implementation, data collection, analysis or reporting.

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