**Supplementary material**

Table S1 MEDLINE search

|  |  |
| --- | --- |
| 1. | (MH "Hand Hygiene+") |
| 2. | TI "hand hygiene" OR AB "hand hygiene" |
| 3. | TI "hand disinfection" OR AB "hand disinfection" |
| 4. | TI handwashing OR AB handwashing |
| 5. | TI "hand washing" OR AB "hand washing" |
| 6. | TI (handrub\* OR "hand rub\*") OR AB (handrub\* OR "hand rub\*") |
| 7. | TI "hand sanit\*" OR AB "hand sanit\*" |
| 8. | TI "hand clean\*" OR AB "hand clean\*" |
| 9. | TI "hand decontamination" OR AB "hand decontamination" |
| 10. | TI "5 moments" OR AB "5 moments" |
| 11. | TI "five moments" OR AB "five moments" |
| 12. | TI "6 step\*" OR AB "6 step\*" |
| 13. | TI "six step\*" OR AB "six step\*" |
| 14. | TI ("alcohol based handrub" OR AB "alcohol based hand rub") OR AB ("alcohol based handrub" OR AB "alcohol based hand rub") |
| 15. | TI "alcohol based hand sanit\*" OR AB "alcohol based hand sanit\*" |
| 16. | TI "hand gel" OR AB "hand gel" |
| 17. | TI (ABHR OR ABHS) OR AB (ABHR OR ABHS) |
| 18. | OR/1-18 |
| 19. | (MH "Meta-Analysis as Topic") |
| 20. | TI ("meta-analy\*" OR metaanaly\*) OR AB ("meta-analy\*" OR metaanaly\*) |
| 21. | (MH "Meta-Analysis") |
| 22. | TI (systematic W1 review\*) OR AB (systematic W1 review\*) |
| 23. | TI (systematic W1 overview\*) OR AB (systematic W1 overview\*) |
| 24. | (MH "Review Literature as Topic+") |
| 25. | OR/19-24 |
| 26. | AB (cochrane OR medline) |
| 27. | AB embase |
| 28. | AB (psychlit OR psyclit OR psychinfo OR psycinfo) |
| 29. | AB (cinahl OR cinhal) |
| 30. | OR/26-29 |
| 31. | AB "reference list\*" |
| 32. | AB bibliograph\* |
| 33. | AB "hand search\*" |
| 34. | AB "relevant journal\*" |
| 35. | AB "manual search\*" |
| 36. | OR/31-35 |
| 37. | AB "selection criteria" |
| 38. | AB "data extraction" |
| 39. | OR/37-38 |
| 40. | (MH "Review") |
| 41. | AND/39,40 |
| 42. | OR/25,30,36,41 |
| 43. | AND/18,42 |

Table S2 Standardised data extraction tool

|  |  |  |
| --- | --- | --- |
| FIRST REVIEWER: | | |
| SECOND REVIEWER: | | |
| **BIBLIOGRAPHIC DETAILS** | Study ID |  |
| First author, year of publication |  |
| Country |  |
| Type of review |  |
| Comments regarding type of review |  |
| **PURPOSE AND DATE RANGE OF REVIEW** | Aim and objectives of review |  |
| Dates covered (from/to) |  |
| **PICOS ELIGIBILITY CRITERIA** | Context eligibility criteria |  |
| Population eligibility criteria |  |
| Intervention eligibility criteria |  |
| Comparator eligibility criteria |  |
| Outcome eligibility criteria, including timeframe |  |
| Outcome: technique, opportunity, both |  |
| Comments regarding outcome |  |
| Study design eligibility criteria |  |
| **ANALYSIS OF INTERVENTIONS** | Intervention content |  |
| Form of delivery |  |
| Use of theory in intervention development |  |
| Treatment fidelity |  |
| Intervention groupings |  |
| Review criteria for effectiveness |  |
| **RESULTS** | Population |  |
| Comments regarding population |  |
| Total number of included studies |  |
| Number of studies per study type |  |
| Number of included studies per population |  |
| Total number of participants |  |
| Number of participants per population |  |
| Countries of included studies |  |
| Number of studies per healthcare setting |  |
| Number of studies per measure of hand hygiene |  |
| Effectiveness of interventions in terms of hand hygiene compliance |  |
| Effectiveness of interventions in terms of bacterial load, HAI rates, psychological variables, and/or organisational culture |  |
| Relationship between effectiveness and form of delivery |  |
| Relationship between effectiveness and intervention content |  |
| Relationship between effectiveness and use of theory in intervention development |  |
| Relationship between effectiveness and treatment fidelity |  |
| Other results |  |
| **DISCUSSION/CONCLUSIONS** | Limitations |  |
| Key messages |  |
| Recommendations for practice |  |
| Future research |  |
| **REVIEWER COMMENTS** | Any other comments relating to the review |  |

Table S3 ROBIS[23]

|  |  |  |
| --- | --- | --- |
| STUDY ID: | | |
| FIRST AUTHOR, YEAR OF PUBLICATION: | | |
| FIRST REVIEWER: | |  |
| SECOND REVIEWER: | |  |
| **DOMAIN 1: Eligibility criteria** | **Rating** | **Support for judgement** |
| Q1.1 Did the review adhere to pre-defined objectives and eligibility criteria? |  |  |
| Q1.2 Were the eligibility criteria appropriate for the review question? |  |  |
| Q1.3 Were eligibility criteria unambiguous? |  |  |
| Q1.4 Were all restrictions in eligibility criteria based on study characteristics appropriate? |  |  |
| Q1.5 Were any restrictions in eligibility criteria based on sources of information appropriate? |  |  |
| **JUDGEMENT DOMAIN 1: Concerns regarding specification of eligibility criteria** |  |  |
| **DOMAIN 2: Identification and selection of studies** | **Rating** | **Support for judgement** |
| Q2.1 Did the search include an appropriate range of databases/electronic sources for published and unpublished reports? |  |  |
| Q2.2 Were methods additional to database searching used to identify relevant reports? |  |  |
| Q2.3 Were the terms and structure of the search strategy likely to retrieve as many eligible studies as possible? |  |  |
| Q2.4 Were restrictions based on date, publication format, or language appropriate? |  |  |
| Q2.5 Were efforts made to minimise errors in selection of studies? |  |  |
| **JUDGEMENT DOMAIN 2: Concerns regarding methods used to identify and/or select studies** |  |  |
| **DOMAIN 3: Data collection and study appraisal** | **Rating** | **Support for judgement** |
| Q3.1 Were efforts made to minimise error in data collection? |  |  |
| Q3.2 Were sufficient study characteristics available for both review authors and readers to be able to interpret the results? |  |  |
| Q3.3 Were all relevant study results collected for use in the synthesis? |  |  |
| Q3.4 Was risk of bias (or methodological quality) formally assessed using appropriate criteria? |  |  |
| Q3.5 Were efforts made to minimise error in risk of bias assessment? |  |  |
| **JUDGEMENT DOMAIN 3: Concerns regarding methods used to collect data and appraise studies** |  |  |
| **DOMAIN 4: Synthesis and findings** | **Rating** | **Support for judgement** |
| Q4.1 Did the synthesis include all studies that it should? |  |  |
| Q4.2 Were all predefined analyses followed or departures explained? |  |  |
| Q4.3 Was the synthesis appropriate given the nature and similarity in the research questions, study designs and outcomes across included studies? |  |  |
| Q4.4 Was between-studies variation (heterogeneity) minimal or addressed in the synthesis? |  |  |
| Q4.5 Were the findings robust, e.g. as demonstrated through funnel plot or sensitivity analyses? |  |  |
| Q4.6 Were biases in primary studies minimal or addressed in the synthesis? |  |  |
| **JUDGEMENT DOMAIN 4: Concerns regarding methods used to synthesise results** |  |  |
| **Risk of bias in the review** | **Rating** | **Support for judgement** |
| A. Did the interpretation of findings address all of the concerns identified in domains 1 to 4? |  |  |
| B. Was the relevance of identified studies to the review's research question appropriately considered? |  |  |
| C. Did the reviewers avoid emphasising results on the basis of their statistical significance? |  |  |
| **OVERALL JUDGEMENT OF RISK OF BIAS IN THE REVIEW** |  |  |
| GUIDANCE - DOMAIN JUDGEMENTS | | |
| If the answers to all questions for a domain are ‘yes’ or ‘probably yes’, then level of concern can be judged as low. If any signalling question is answered ‘no’ or ‘probably no’, potential for concern about bias exists.  Low risk of bias: The findings of the review are likely to be reliable. The assessment of risk of bias in the review did not raise any concerns with the review process or concerns were appropriately considered in the review conclusions. The conclusions were supported by the evidence and included consideration of the relevance of included studies.  High risk of bias: One or more of the concerns raised during the assessment of risk of bias in the review was not addressed in the review conclusions, the review conclusions were not supported by the evidence, or the conclusions did not consider the relevance of the included studies to the review question.  Unclear risk of bias: There is insufficient information reported to make a judgement on risk of bias. | | |

Table S4 Characteristics of included reviews

| **First author (year) and title** | **Aim(s) of review** | **Review type and dates covered by the search** | **Inclusion criteria** | **Number, study design, countries, population and sample size, and healthcare settings of primary studies** | **Key outcomes, with operationalisations and measures for HHC, where discernible\*** |
| --- | --- | --- | --- | --- | --- |
| **Cherry et al. (2012)**[25]  Features of educational interventions that lead to compliance with HH in healthcare professionals within a hospital care setting. A BEME systematic review: BEME  Guide No. 22 | To determine the features of structured educational interventions that impact on compliance with HH in healthcare professionals within a hospital care setting | Narrative synthesis  1995 to March 2011 | *Context*:Hospital settings  *Population*: Healthcare professionals  *Interventions*: Structured educational interventions designed to change staff behaviour with regards to compliance of one or more facet of HH, documentable and repeatable content, run over defined time period  *Comparators*: Any, including but not limited to use of a control group, a differing educational intervention and use of differing healthcare groups    *Outcomes*: At least one outcome measure of aseptic HH, pre- and post-intervention data relating to either patient outcomes or staff behavioural change, reports adequate descriptive statistics to evaluate the effectiveness of an intervention, and at least six months follow-up period  *Study designs*: All study designs | 30 studies (designs NR)  USA (n=12), China (n=3), Thailand (n=2), Brazil (n=2), Germany (n=2), Australia (n=2), Philippines (n=1), Netherlands (n=1), Switzerland (n=1), Spain (n=1), Argentina (n=1), UK (n=1), Taiwan (n=1)  Nurses and doctors, including postgraduate trainees (n=25), doctors only (n=2), nursing staff only (n=2), unspecified healthcare professional group (n=1)  Sample sizes NR  PICU (n=7), NICU (n=5), hospital(s) (n=14), wound care centre (n=1), acute care facilities (n=1), adult cardiac surgical unit (n=1), paediatric nephrology unit (n=1) | HHC (n=25\*\*):  *Unable to determine whether opportunity and/or technique*   * Variation in HHC outcome measures (no further details given)   HAI rates (n=21\*\*) |
| **Doronina et al. (2017)**[26]  A systematic review on the effectiveness of interventions improve HHC of nurses in the hospital setting | To determine the short- and long-term effects of interventions to improve HHC among nurses in the hospital setting | Narrative synthesis  Searched reference list of review by Luangasanatip et al. (2015) and database searches from February 2014 (end date not given) | *Context*: Acute care hospital setting (no simulated environments)  *Population*: Nurses (no students)  *Interventions*: Interventions consisting of any strategy targeting promotion of hand washing  *Comparators*: Not specified  *Outcomes*: Direct or unobtrusive observation, electronic monitoring, or video recording to measure HHC rates, and proxy indicators, such as the amount of hand sanitiser used  *Study designs*: RCT, ITS, and CBA studies meeting Cochrane EPOC methodological critiera | 6 studies (3 RCT, 2 ITS, 1 CBA)  Countries NR  277 nurses (n=4)  Nursing wards (n=1), surgical wards (n=1), ICU (n=2) | HHC (n=6):  *Opportunity*   * Direct observation (n=4) * Unobtrusive observation (n=1)   *Usage of hand sanitiser*   * Volume of liquid in mL (n=1) |
| **Gould et al. (2017)**[27]  Interventions to improve HHC in patient care | To assess the short- and long-term success of strategies to improve HHC in patient care  To determine whether an increase in HHC can reduce rates of HAI | Narrative synthesis  1980 to October 2016 | *Context*:Hospitals, nursing homes, LTCF, or community healthcare settings in any country  *Population*: Nurses, doctors, and other healthcare workers whose role does not involve in surgical hand disinfection and surgical scrubbing  *Interventions*: Any intervention intended to improve compliance with HH using soap and water and/ or alcohol-based products  *Comparators*: Not specified  *Outcomes*: HHC measured through observation or a proxy indicator of HHC (primary outcome), HAI, and colonisation rates by clinically significant nosocomial pathogens (secondary outcomes)  *Study designs*: RCT, NRT, ITS, and CBA studies meeting Cochrane EPOC methodological criteria | 26 studies (2 RCT, 9 CRT, 2 stepped-wedge CRT, 1 randomised trial with crossover, 2 NRT, 10 ITS)  Southeast Asia (n=4), Spain (n=1), Canada (n=1), England and Wales (n=1), Southern Ireland (n=1), Switzerland (n=2), Australia (n=1), Lebanon (n=1), Netherlands (n=1), Argentina (n=1), USA (n=10), multinational involving multiple European countries (n=1) as well as Israeli centres (n=1)  Staff in the anaesthetic room (n=1), nurses (n=2) including student nurses (n=1) or nursing assistants and physiotherapists (n=1), all clinical staff present in the clinical areas during data collection (n=21)  Sample sizes NR  LTCF (n=2), primary care (n=1), acute care hospitals on general wards and/or critical care units (n=22), anaesthetic room (n=1) | HHC (n=26):  *Opportunity*   * Direct observation (n=19) * Video camera (n=1) * Electronic monitoring device (n=1)   *Proportion of nurses who performed HH*   * Direct observation (n=1)     *HH events per hour*   * Direct observation (n=1)   *Product usage*   * ABHR use in ounces per adjusted patient-day (n=1) * Litres of HH product per 100 patient-days (n=1) * Electronic count of soap/ABHR dispensers (n=1) * Procurement of ABHR (n=1)   HAI rates (n=7) |
| **Huis et al. (2012)**[28]  A systematic review of HH improvement strategies: A behavioral approach | To offer sufficient conceptual clarity on the nature of HH improvement strategies by classifying their improvement activities on the basis of their determinants of behaviour change  To explore the effectiveness of targeting different determinants of behaviour change (using controlled studies) | Narrative synthesis  January 2000 to November 2009 | *Context:* Hospital settings  *Population*: HCW  *Interventions*: Strategies aimed at improving HH behaviour  *Comparators*: HH behaviour before the introduction of the programme or strategy, or HH behaviour in a comparison group where another programme or no programme (usual care) was implemented  *Outcomes*: All operationalisations of HH behaviour  *Study designs*: Studies with at least one outcome comparison with a randomised or nonrandomized comparison group, or a comparison with baseline data in the case of a single group before-after design | 41 studies (28 before-after, 7 CBA, 3 RCT, 3 cross-over)  Asia (n=7), Australia (n=3), Canada (n=1), Central America (n=1), Europe (n=5), Russia (n=1), South America (n=2), USA (n=21)  Nurses, physicians, and other HCW (n=28, although n=1 also included family/visitors), nurses only (n=6), HCW not further defined (n=7)  76,197 opportunities (n=32)  ICU (n=25), medical or surgical wards (n=10), emergency wards (n=4), all hospital wards (n=2) | HHC (n=41):   * Unobtrusive observations (n=30) * Obtrusive observations (n=9)   *HH episodes*   * Electronic counting device (n=1)   *Volume of soap or hand alcohol used*   * Number of dispenser activations/patient-days (n=1) |
| **Kingston et al. (2016)**[29]  HH-related clinical trials reported since 2010: A systematic review | To report the outcomes of a systematic search for peer-reviewed,  published studies – especially clinical trials – that focused on HHC among healthcare professionals | Narrative synthesis  December 2009 to February 2014 | *Context*: Acute, non-acute, long-term care of the elderly and primary care settings  *Population*: Healthcare professionals  *Interventions*: Interventions focused on HH  *Comparators*: Not specified  *Outcomes*: HHC measured either by observation or electronic counters, results of HHC rates published  *Study designs*: Empirical studies/ clinical trials | 16 studies (all described as clinical trials, but ITS and before-after were included[46])  Netherlands (n=2), France (n=2), Spain (n=1), UK (n=1), USA (n=5), Australia (n=1), Hong Kong (n=2), Brazil (n=1) and across 19 resource- limited countries in Latin America, South America, Asia, the Middle East and Europe (n=1)  HCW n=8,174, range 32 to 4,221 (from 6 studies)  5,166 nurses, 688 physicians, 1,620 healthcare assistants, 526 other HCW (from 5 studies)  Adult ICU (n=113), step-down ICU (n=2), NICU (n=11), PICU (n=9), care of the elderly (n=93), wards (n=59), primary healthcare centres (n=11), whole organisation (n=1) | HHC (n=8 with pre- and post-intervention data):  *Opportunity*   * Observation (n=7)   *Amount of ABHR dispensed*   * Electronic recording device (n=1) |
| **Luangasanatip et al. (2015)**[30]  Comparative efficacy of interventions to promote HH in hospital: Systematic review and network meta-analysis | To evaluate the relative efficacy of the WHO campaign and other interventions to promote HH among HCW in hospital settings and to summarise associated information on use of resources | Network meta-analysis  1980 to February 2014 | *Context*: Hospital settings  *Population*: HCW  *Interventions*: Interventions to improve HHC  *Comparators*: No restrictions on promotion of HH in the comparison group  *Outcomes*: HHC using opportunities with pre-specified indications or using proxies linked to HHC (such as consumption of soap and ABHR)  *Study designs*: RCT, NRT, ITS, and CBA studies meeting Cochrane EPOC methodological criteria | 41 studies (6 RCT, 1 NRT, 32 ITS, 2 CBA)  Low- or middle-income countries (n=5)  All HCW with patient contact (n=34, but n=1 also included relatives), only nurses and/or nursing assistants (n=6), nursing students (n=1)  Sample sizes NR  Whole hospital (n=17), hospital wards (n=21) (n=3 allocated interventions to specific HCW) | HHC (n=41):  *Opportunity*   * Direct observation (n=28) * Video recorders and external observers (n=2)   *Soap or ABHR consumption, HH events, or HH checklist score*   * (n=19)   HAI and/or resistance rates (n=19) |
| **Mitchell et al. (2014)**[31]  Automated HH monitoring systems | To identify and summarise evidence on the effectiveness of devices that automatically monitor compliance of hospital staff with proper HH procedures | Narrative synthesis  2003 to November 2013 | *Context*: Implied hospitals  *Populations*: Hospital staff  *Interventions*: Automated devices that record HHC, store quantitative information for subsequent download and analysis by infection control staff, work for any or all hand disinfection methods including soap and water and use of waterless products, and measure compliance by individuals or by groups of users  *Comparators*: All comparisons  *Outcomes*: Prevalence estimates of hand disinfection, administrator satisfaction with product and data analytics capabilities, HAI rates  *Study designs*: Guidelines, systematic reviews, RCT or NRT | 14 studies (1 RCT, 1 NRT, 11 pre-post), but 1 with no quantitative results  Countries NR  HCW not further defined  Sample sizes NR  Healthcare settings not consistently reported, but included ICU (n=2), hematology unit (n=1), step-down unit (n=1) | HHC (n=12):  *Opportunity*   * Automated devices (n=12)   *Product usage*   * Use of hand sanitizer (n=1) * Solution dispenses (n=1)   HAI rates (n=3) |
| **Naikoba & Hayward (2001)**[18]  The effectiveness of interventions aimed at increasing handwashing in healthcare  workers – A systematic review | To summarise and assess the effectiveness of interventions aimed at increasing compliance with handwashing in HCW | Narrative synthesis  Search dates NR | *Context*: Healthcare settings  *Population*: HCW  *Interventions*: Interventions to promote handwashing  *Comparators*: Not specified  *Outcomes*: Compliance with handwashing  *Study designs*: Not specified | 21 studies (17 uncontrolled trials, 2 RCT, 1 observational) \*\*\*  Countries NR  HCW (occasionally further defined) ranged from 12 nurses to 426 staff  ICU (n=15), general hospital (n=4), care homes for people with disabilities (n=1)\*\*\* | HHC (n=21):  *Opportunity*   * Observation (n=7)   *Technique*   * Observation (n=1)   *Technique and hand washing frequency*   * Observation (n=1)   *Handwashing frequency*   * Observation (n=8) * Soap use per day (n=1)   *Handwashing behaviour*   * Observation (n=3) |
| **Neo et al. (2016)**[32]  Evidence-based practices to increase HHC in  healthcare facilities: An integrated review | To provide a comprehensive summary of recently published evidence-based HH interventions designed to improve HHC that will enable healthcare providers to make informed choices when allocating limited resources to improve HHC and patient safety | Narrative synthesis  January 1,2002 to September 30,2015 | *Context*: Healthcare environments in developed countries  *Population*: HCW, physicians, registered nurses, nursing students, families and visitors, and patients  *Interventions*: Various forms of HH interventions  *Comparators*: Not specified  *Outcomes*: Measurements of improvement in HHC  *Study designs*: RCT, NRT, and pre- and post-intervention designs with or without a control group | 73 studies (37 pre- and post-intervention studies without a control group, 21 pre- and post-intervention studies with a control group, 9 NRT, and 6 RCT)  Developed countries  HCW not further defined (n=51), registered nurses, nursing assistants, and students (n=17), families and visitors (n=5), physicians (n=3), patients (n=1)  Sample sizes NR  Entire facility (n=16), ICU (n=28), non-ICU inpatient units (n=27), LTCF (n=5), other locations (n=4) | HHC (n=73):  *Unable to determine whether opportunity and/or technique*   * A mixture of HHC measures, including self-report, electronic monitoring, and direct observation |
| **Ofek Shlomai et al. (2015)**[33]  Efficacy of interventions to improve HHC in neonatal units: A systematic review and meta-analysis | To evaluate the efficacy of strategies for improving HHC in NICU | Meta-analysis  Database inception to October 2013 | *Context*: NICU  *Populations*: Implied HCW  *Interventions*: Interventions aimed to improve HHC  *Comparators*: Not specified  *Outcomes*: HHC  *Study designs*: Randomised and before-after studies | 16 studies (all non-randomised)  Canada (n=1), Saudi Arabia (n=1), Netherlands (n=3), Philippines (n=1), Thailand (n=2), Switzerland (n=1), USA (n=3), Brazil (n=1), Taiwan (n=1), Hong Kong (n=1), and Russia (n=1)  HCW not further defined  HH opportunities (n=27,155)  NICU (n=16) | HHC (n=16):  *Opportunity*   * Observation (n=15) * Observation and electronic dispensers (n=1)   Blood culture positive HAI rates (n=9) |
| **Picheansathian (2004)**[34]  A systematic review on the effectiveness of alcohol-based solutions for HH | To evaluate the clinical evidence supporting the use of alcohol-based solutions in hospitals as an alternative for ensuring HH | Meta-analysis  January 1992 to April 2002 | *Context*: Hospitals  *Population*: HCW  *Interventions*: Introduction of alcohol-based solutions  *Comparators*: Not specified  *Outcomes*: HHC  *Study designs*: Not specified | 6 studies (designs NR)  Countries NR  Nurses, physicians, and other HCW (n=4)  Sample sizes NR  ICU and other wards, including gynaecology/obstetrics and paediatric | HHC (n=6):  *Unable to determine whether opportunity and/or technique*   * HHC measures NR |
| **Ranji et al. (2007)**[35]  Closing the quality gap:  A critical analysis of quality improvement strategies | To determine the effects of quality improvement strategies on promoting adherence to interventions for prevention of selected HAI and on HAI rates | Narrative synthesis  Database inception to December 2005 / January 2006 | *Context*: Acute care hospitals  *Populations*: Implied HCW  *Interventions*: Quality improvement strategies  *Comparators*: Not specified  *Outcomes*: Incidence of HAI or adherence to evidence-based preventive interventions, including HH (where HAI also reported)  *Study designs*: Experimental design with a control group (RCT or quasi-RCT, CBA study) or a quasi-experimental design (ITS or before-after study) | 11/64 studies of HH intervention with HHC and/or infection rate(s) outcome and 4/64 studies of bundle with HH component and HHC outcome (all before-after)  Taiwan (n=1), Guatemala (n=1), Sri Lanka (n=1), USA (n=5), Mexico (n=1), Hong Kong (n=1), Netherlands (n=1), UK (n=1), Argentina (n=3)  All clinical staff (n=5), nurses and physicians (n=7), nurses only (n=1), HCW not further defined (n=2)  Sample sizes NR  NICU (n=2), ICU (n=5), surgical ICU (n=2), medical-surgical ICU (n=2) multiple areas of hospital (n=1), community hospital with residents (n=1), unit/hospital type not specified (n=2) | HHC (n=9):  *Unable to determine whether opportunity and/or technique*   * HHC measures NR   HAI rates (n=15) |
| **Ritchie et al. (2005)**[36]**/Stout et al. (2007)**[37]  The provision of alcohol-based products to improve compliance with HH / Clinical effectiveness of alcohol-based products in increasing HHC and reducing infection rates: A systematic review | To determine the  effectiveness of alcohol-based HH products in improving HHC and in reducing the incidence of HAI | Narrative synthesis  Searches conducted May to November 2004 (no early cut-off date indicated) | *Context*: Hospitals  *Populations*: Implied HCW  *Interventions*: Interventions designed to improve HHC and interventions including a HH component designed to reduce nosocomial infection rates  *Comparators*: Not specified  *Outcomes*: HHC (not solely technique or handwashing duration), incidence of nosocomial infections  *Study designs*: Primary studies with a pre-intervention measure of HHC or infection rate | For studies reporting HHC†  41 studies (30 uncontrolled prospective, 8 prospective with non-randomised parallel control groups, 3 cross-over)  USA (n=17), Australia (n=4), Switzerland (n=3), France (n=3), UK (3), Costa Rico (n=1), Guatemala (n=1), Russia (n=1), Canada (n=1), Argentina (n=1), Taiwan (n=1), NR (n=5)  Nurses only (n=5), nurses and healthcare assistants (n=3), medical staff only (n=2) nurses (including nursing assistants) and medical staff (n=3), mixed HCW (n=11), all HCW (15), not stated (n=2)  Sample sizes NR  ICU (n=25), other settings included paediatric outpatient clinic, paediatric hospital, emergency department, general hospital(s), surgical wards, community hospitals,  rehab unit, LTCF, renal unit, intermediate care unit  For studies reporting HAI‡  27 studies (majority prospective design)  Countries NR  HCW not further defined and sample sizes NR  ICU (n=10), NICU (n=5), hospital-wide (n=5), LTCF (n=3), one or several departments (n=4) | HHC (n=41†):  *Opportunity*   * Direct observation (n=32) * Self-report (n=1)   *Product usage*   * (n=8)   HAI rates (n=27‡) |
| **Schweizer et al. (2014)**[38]  Searching for an optimal HH bundle: A meta-analysis | To systematically review all studies on interventions to improve HHC in order to evaluate existing compliance improvement bundles and identify areas of promise to target high quality intervention studies  To evaluate the association between number of interventions in a HH bundle and improvement in compliance to determine whether bundle size has an effect on compliance | Meta-analysis  January 2000 to April 2012 | *Context*: Healthcare settings  *Populations*: Healthcare professionals  *Interventions*: Interventions to improve HHC  *Comparators*: Any control group  *Outcomes*: Numerator and denominator data on changes in HHC (not self-report or ABHR use only)  *Study designs*: RCT and quasi-experimental studies, including before-after studies with historical control groups | 45 studies (39 quasi-experimental, 4 CRT, 2 RCT) reported in 46 articles  Europe (35.6%) and USA (34.1%)  HCW not further defined    Sample sizes NR  ICU (n=23), acute care units (n=14) entire hospital (n=7), LTCF (n=2), outpatient clinics (n=1), dialysis units (n=2), infectious disease unit (n=1), hematopoietic stem cell transplant/haematology unit (n=1) | HHC (n=45):  *Opportunity*   * Direct observation (n=28) * Direct observation and electronic surveillance (n=2) * Direct observation and product usage (n=3) * Undercover observers and product usage (n=1) * Electronic surveillance (n=1) * Video surveillance (n=2) * Nurse investigators (n=1) * NICU medical staff (n=1) * Unknown (n=1)   *Activation/use of dispenser*   * Electronic surveillance (n=1) * Electronic surveillance and product usage (n=1)   *Unknown/not stated*   * Direct observation and product usage (n=1) * Direct observation (n=2) |
| **Srigley et al. (2015)**[39]  Applying psychological frameworks of behaviour  change to improve HCW HH: A systematic review | To determine the effectiveness of interventions based on psychological frameworks to improve HCW HHC | Narrative synthesis  Database inception to  June 5,2014 | *Context*: Any healthcare setting, including acute care and long-term care  *Populations*: Any HCW group  *Interventions*: Interventions based on psychological theory to improve HCW HH  *Comparators*: Not specified  *Outcomes*: HHC (not self-report)  *Study designs*: RCT NRT, ITS, CBA studies, and quasi-experimental studies (including before-after) | 4/7 intervention studies (1 stepped-wedge CRT, 1 CBA, 1 CBA and ITS, 1 before-after)  UK (n=1), USA (n=2), and Australia (n=1)  1,203 nurses and personal care assistants (n=1), nurses, medical staff, and allied health practitioners (n=1)  44,730 HH opportunities (n=2)  Acute general and teaching hospitals (n=1), tertiary care teaching hospital (n=1), tertiary care hospital (n=1), teaching hospitals (n=1) | HHC (n=4):  *Unable to determine whether opportunity and/or technique*   * Direct observation (n=4)   *ABHR and soap procurement*   * (n=1)   HAI rates (n=3) |
| **Srigley et al. (2015)**[40]  HH monitoring technology: A systematic  review of efficacy | To determine whether HH monitoring technology increases directly observed HHC among HCW compared to usual care  To determine whether HH monitoring technology reduces HAI incidence or improves other measures of HH, including HH frequency, volume of soap and ABHR use, or compliance as defined by the individual HH monitoring technology | Narrative synthesis  Database inception to December 31st 2013 | *Context*: Acute or long-term care settings  *Populations*: HCW  *Interventions*: HH monitoring technology  *Comparators*: Usual care  *Outcomes*: HHC (not at ward/ hospital entrances or in the operating room) and/or HAI incidence  *Study designs*: Experimental and quasi-experimental studies | 7 studies (1 RCT, 1 NRT, 2 ITS, 3 pre-test post-test)  Countries NR  All HCW (n=2), all HCW and visitors (n=3), and 245 nurses (n=2)  Median (range) number of HH opportunities 194,150 (8,235-1,017,600)  Intermediate care unit (n=1), haematology ward (n=1), medical ICU (n=1), surgical ICU (n=1), step-down units (n=1), chronic care ward (n=1), wards and surgical ICU (n=1) | HHC (n=7):  *Opportunity*   * System defined (n=5) * System defined and HH event rate (n=1)   *HH frequency*   * (n=1)   *ABHR usage*   * (n=2)   HAI rates: (n=2) |
| **Stiller et al. (2016)**[41]  Relationship between hospital ward design and HAI infection rates: A systematic review | To analyse whether healthcare facility design is a contributing factor to multifaceted infection control strategies (e.g. the impact of the accessibility of antiseptic handrub dispenser’s location on HHC) | Narrative synthesis  January 1, 1990 to December 31, 2015 | *Context*: Hospitals  *Population*: Implied HCW  *Interventions*: Antiseptic hand rub dispenser inside the patient's room  *Comparators*: Different location of antiseptic hand rub dispenser inside the patient's room  *Outcomes*: HHC rate or antiseptic agent consumption volume  *Study designs*: Any type of study or trial | 3 studies (designs NR)  Countries NR  52 physicians (n=1), HCW not further defined (n=2)  Real-size patient room replica (n=1), internal medical unit (n=1), surgical ICU (n=1) | HHC (n=3):  *Opportunity*   * Anonymous recording (n=1) * Observation (n=1)   *Daily volume of use of antiseptic hand rub*   * (n=1) |
| **Vindigni et al. (2011)**[42]  Systematic review: Handwashing behaviour in low- to middle-income countries: Outcome measures and behaviour  maintenance | To describe global approaches to handwashing research in low- and middle-income communities, schools and healthcare settings using behavioural outcome measurement and temporal  study design | Narrative synthesis  Database inception to August 2009 | *Context*: Healthcare settings in low- or middle-income countries  *Population*: Not specified  *Intervention*: HH interventions  *Comparator*: Not specified  *Outcome*: HH behaviour (self-report, proxy indicator, and/or direct observation)  *Study design*: Not specified | 7/30 studies of interventions in healthcare settings (6 quantitative, 1 mixed methods)  Low- and middle-income countries  HCW not further defined  Sample sizes NR  Outpatient maternal-child health clinic (n=1), hospital (n=1), other settings NR | HHC:  *Unable to determine whether opportunity and/or technique*   * Direct observation (n=6) * Self-report (n=1)   *Soap presence*   * (n=2)   HAI rates (n=3) |
| **Ward et al. (2014)**[43]    Automated and electronically assisted HH monitoring  systems: A systematic review | To assess the existing evidence surrounding the adoption and accuracy of automated systems or electronically enhanced direct observations and review the effectiveness of such systems in healthcare settings | Narrative synthesis  January 1, 2000 to  March 31, 2013 | *Context*: Healthcare settings  *Populations*: Implied HCW  *Interventions*: Automated and electronically assisted HH monitoring systems  *Comparators*: Not specified  *Outcomes*: Implied accuracy of monitoring technology or HHC  *Study designs*: Not specified | 42 studies (designs not consistently reported)  Countries NR  HCW not further defined (in at least 1 study, HHC data was collected for all entrances made by patients and visitors, as well as HCW)  Sample sizes NR  Healthcare settings not consistently reported, but appears to be hospitals only | HHC (n=unclear):  *Unable to determine whether opportunity and/or technique*   * HHC measures included electronic dispenser systems, automated monitoring networks, video camera, and mobile handheld devices   HAI rates (n=unclear) |

*Note*. ABHR = Alcohol-based hand rub. CBA = Controlled before-after. CRT = Cluster randomised trial. EPOC = Effective Practice and Organisation of Care. HAI = Healthcare associated infection. HCW = Healthcare workers. HH = Hand hygiene. HHC= Hand hygiene compliance. ICU = Intensive care unit. ITS = Interrupted time series. LTCF = Long-term care facilities. NICU = Neonatal intensive care units. NR = Not reported. NRT = Non-randomised trials. PICU = Paediatric intensive care units. RCT = Randomised controlled trials. UK = United Kingdom. USA = United States of America. WHO = World Health Organization. \* = Some primary studies within some reviews reported more than one measure of HHC. \*\* =Figures derived from Table 5 in Cherry et al (2012).[25] \*\*\* = Naikoba and Hayward (2001)[18] only reported study designs and healthcare settings for 20/21 primary studies. † = From Ritchie et al. (2005).[36] ‡ = From Stout et al. (2007).[37]

Table S5 Mapping content of interventions included in reviews onto the World Health Organization’s (2009) multimodal strategy for hand hygiene

| **First author (year)** | **System change** | **Training and education** | **Observation and feedback** | **Reminders** | **Safety climate** | **Total** |
| --- | --- | --- | --- | --- | --- | --- |
| **Cherry et al. (2012)**[25] | X | X | X | X | X | 5 |
| **Doronina et al. (2017)**[26 ] | X | X | X | X | X | 5 |
| **Gould et al. (2017)**[27] | X | X | X | X | X | 5 |
| **Huis et al. (2012)**[28] |  | X | X | X | X | 4 |
| **Kingston et al. (2016)**[29] | X | X | X | X | X | 5 |
| **Luangasanatip et al. (2015)**[30] | X | X | X | X | X | 5 |
| **Mitchell et al. (2014)**[31] |  | X | X | X |  | 3 |
| **Naikoba & Hayward (2001)**[18] | X | X | X | X |  | 4 |
| **Neo et al. (2016)**[32] | X | X | X | X | X | 5 |
| **Ofek Shlomai et al. (2015)**[33] | X | X | X | X |  | 4 |
| **Picheansathian (2004)**[34] |  | X | X |  |  | 2 |
| **Ranji et al. (2007)**[35] |  | X | X | X | X | 4 |
| **Ritchie et al. (2005)**[36]**/Stout et al. (2007)**[37] | X | X | X | X |  | 4 |
| **Schweizer et al. (2014)**[38] | X | X | X | X | X | 5 |
| **Srigley et al. (2015)**[39] | X | X | X |  |  | 3 |
| **Srigley et al. (2015)**[40] |  |  | X | X |  | 2 |
| **Stiller et al. (2016)**[41] | X |  |  |  |  | 1 |
| **Vindigni et al. (2011)**[42] | X | X | X |  |  | 3 |
| **Ward et al. (2014)**[43] |  |  | X | X | X | 3 |
| **Total** | 13 | 16 | 18 | 15 | 10 |  |

Table S6 Overall effectiveness of interventions (hand hygiene compliance)

| **First author**  **(year)** | **Overall intervention effectiveness (HHC)** |
| --- | --- |
| **Cherry et al. (2012)**[25] | 21/25 studies that reported HHC showed a significant improvement (p=.05 to p<.001).\* |
| **Doronina et al. (2017)**[26] | HHC improved in all six studies (p<.05 in two studies). Increases of 4%, 13%, 16%, and 35% in HHC in three studies (p NR) and an increase from 20% to 53% (OR=1.64) in the sixth study. Improvement was maintained at 3 to 6 months in four out of six studies. |
| **Gould et al. (2017)**[27] | Overall, HHC increased in all studies, regardless of the intervention or the outcome measure employed. The level of increase varied, however, as did the level of HHC both at baseline and post-intervention. |
| **Huis et al. (2012)**[28] | The effectiveness of the strategies used in controlled studies (n=13) varied substantially, but most showed positive results. |
| **Kingston et al. (2016)**[29] | Overall, based on mean HHC rates calculated from 8 studies with baseline and post-intervention data, there was an improvement of 22.8%, from 34.1% at baseline to 56.98% after intervention (p NR). |
| **Luangasanatip et al. (2015)**[30] | Of 22 pairwise comparisons from ITS studies, 18 showed both stepwise increases in HHC associated with intervention and increases in mean HHC after intervention compared with that expected in the absence of intervention. The range was wide: the mean change in HHC attributed to intervention varied between a decrease of 14.8% and an increase of 83.3%. |
| **Mitchell et al. (2014)**[31] | 9/12 studies reported an increase in HHC (1 study had no quantitative results). Where only the increase in HHC is given, there were 7%, 34% and 40% increases in HHC rates (p NR). Pre- and post-intervention HHC rates were reported for four studies (p NR) and ranged from 23% to 88% and from 48% to 98%, respectively. |
| **Neo et al. (2016)**[32] | Five HH intervention types were found to be effective. Among studies that reported the p value (n=63/73), 59 produced a significant increase in HHC.\*\* |
| **Ofek Shlomai et al. (2015)**[33] | Meta-analysis (n=14) indicated an improvement in HHC (OR=2.04, 95% CI=1.40-2.97; I2=97%). Two studies that could not be included in the meta-analysis also showed improved HHC (p NR (n=1), p=.001 (n=1)). |
| **Picheansathian (2004)**[34] | The combined result of six studies significantly favoured the introduction of ABHR (Peto OR=1.96, CI=1.56-2.46). |
| **Ranji et al. (2007)**[35] | 6/9 studies reported a significant improvement in HHC (all p<.01) with baseline data ranging from 5% to 62% and post-intervention data ranging from 53% to 85%, 2/9 studies reported an improvement in HHC (17% to 30% p NR and 40% to 58% p NR), and 1/9 studies reported an 11% change in HHC (p NR). |
| **Ritchie et al. (2005)**[36]**/ Stout et al. (2007)**[37] | Most types of interventions employed in infection control generate at least transient improvements in HHC. |
| **Schweizer et al. (2014)**[38] | 37/45 studies reported a significant improvement in HHC (p NR). |
| **Srigley et al. (2015)**[39] | Four studies utilising a theoretical approach reported overall improvement in HHC (p<.001 for n=2; OR=1.44, p<.001 (n=1); increase of 15%, p=.039). |
| **Srigley et al. (2015)**[40] | Insufficient evidence was found to recommend adoption of HH monitoring technology in general as a HHC improvement strategy (3/7 studies reported significant increases). |
| **Stiller et al. (2016)**[41] | There were significant increases in HHC in all 3 studies. |
| **Vindigni et al. (2011)**[42] | The evidence base documents short-term improvement in HHC among HCW in low- to middle-income healthcare facilities. Data provided for 1/7 studies, where there was a 31% to 40% increase in HHC (p NR). |
| **Ward et al. (2014)**[43] | There is very little data as to whether automated and electronically assisted systems monitoring systems can improve HHC. |

*Note*. ABHR = Alcohol-based handrub. CI = Confidence interval. HCW = Healthcare workers. HH = Hand hygiene. HHC = Hand hygiene compliance. ITS = Interrupted time series. NR = Not reported. OR = Odds ratio. \* = Figures derived from Table 5 in Cherry et al (2012).[25] \*\* = From the article text, although Table A2 in Neo et al. (2016)[32] indicates that 62 rather than 63 studies reported a p value and that 58 rather than 59 studies produced a significant increase in HHC.

Table S7 Relationship between intervention content and effectiveness (hand hygiene compliance)

| **First author**  **(year)** | **Intervention content and effectiveness (HHC)** |
| --- | --- |
| **Doronina et al. (2017)**[26] | Single-component interventions were shown to improve HHC, but evidence showed sustainable and greater improvements with multimodal strategies. Education, feedback and support from a team leader, accessibility, and visual reminders of HH are all elements that appear to increase HHC in nurses. It is important to add goal setting, reward incentives, and accountability for further improvements. |
| **Gould et al. (2017)[**27] | *Multimodal interventions that include some but not all components recommended in the WHO multimodal strategy for HH, multimodal interventions that include all the recommended components plus additional strategies, and cues such as signs or scent*: May slightly improve HHC (low certainty evidence).  *Multimodal interventions that contain all components recommended in the WHO multimodal strategy for HH*: Unclear whether improve HHC (very low certainty evidence).  *Performance feedback and education*: May improve HHC (low certainty evidence).  *Placement of ABHR close to point of use*: Probably slightly improves HHC (moderate certainty evidence). |
| **Huis et al. (2012)**[28] | BCT that map on to the theoretical determinates of social influence (e.g. provide information about peer behaviour, provide opportunities for social comparison, mobilise social norm), attitude (e.g. persuasive communication, reinforcement of behavioural progress), self-efficacy (e.g. modelling, verbal persuasion, guided practice, plan coping responses, set graded tasks/goal setting), and intention (e.g. general intention information, agree to behavioural contract) appear to be associated with increased effectiveness of interventions. |
| **Luangasanatip et al. (2015)**[30] | Meta-analysis of two RCT showed that the addition of goal setting to the WHO-5 framework was associated with improved HHC over the WHO-5 framework alone (OR=1.35, 95% CI=1.04-1.76). Twelve pairwise comparisons from ITS met the criteria for network meta-analysis. When single interventions of education or system change (OR=4.30, 95% credible interval (CRI) 0.43-46.57), the WHO-5 framework (OR=6.51, 95% CRI 1.58-31.91),and the WHO-5 framework plus incentives, goal setting, or accountability (OR=11.83, 95% CRI 2.67-53.79) were compared with no intervention, there was evidence that they were all effective. The WHO-5 framework plus incentives, goal setting, or accountability also showed additional improvement compared with single interventions of education or system change (OR NR) and WHO-5 framework alone (OR=1.82, 95% CRI 0.2-12.2). The WHO-5 framework plus incentives, goal setting, or accountability had the highest probability (67%) of being the best strategy in improving HHC. |
| **Mitchell et al. (2014)**[31] | *Real-time reminder systems*: 7/7 studies reported an improvement in HHC.  *Periodic feedback given by managers*: 1/3 studies reported an improvement in HHC. |
| **Naikoba & Hayward (2001)**[18] | *One-off educational interventions (single intervention)*: 3/5 studies showed a short-term effect on handwashing (p<.0001, n=1), with HHC falling to low or baseline levels within a month for 2/3 studies. 1/5 studies reported an improvement in HHC maintained over six months (data and p NR). 1/5 studies found no significant difference in HHC between the intervention and control groups (p NR).  *Reminders (single intervention)*: 1/4 studies found a significant 34% increase in soap use per bed day (p=.021), 1/4 studies found a significant increase in HH frequency (p<.05), and 2/4 studies reported no difference between pre- and post-intervention, but data provided only for one study (31% versus 30%, p=.25).  *Performance feedback (single intervention)*: 2/4 studies reported improvements (p NR), 1/4 studies reported significant improvements for medical officers from 57% to 94% and for physiotherapists from 20% to 77% sustained at six months (p NR), and 1/4 studies reported a significant improvement compared to the control group over a three-week period (p<.05).  *Moisturised soaps/ABHR near patient beds (single intervention)*: 1/3 studies reported a significant improvement from 32% to 45% (p NR), 1/3 studies reported no change (no data), and 1/3 studies reported a decrease from 76% to 24% which was attributed to a change of medical staff during the same period (p NR).  *Adjusting sink facilities (single intervention)*: 1/2 studies reported a significant improvement in quality of handwashing (data and p NR) and 1/2 studies reported that handwashing was performed more frequently on wards with more sinks than on wards with fewer sinks (76% versus 51%, respectively, p NR).  *Multiple interventions*: 4/6 studies reported a significant improvement (p<.01, n =3; p NR, n=1). |
| **Neo et al. (2016)**[32] | *Improving awareness with education (knowledge transfer, evaluation, monitoring, feedback)*: 26/34 studies found a significant % improvement in HHC (range from 4% to 70%\*, p<.05 to p<.001) and 7/34 studies found a % improvement in HHC (range from 6% to 62%, all p NR).  *Facility design and planning*: 7/8 studies found a significant % improvement in HHC (range from 14% to 60%, p=.01 to p<.001).  *Unit-level protocols and procedures*: 6/7 studies found a significant % improvement in HHC (range from 16% to 59%, all p<.001).  *Institution-wide programmes*: 1/3 studies found a significant 20% improvement in HHC (p<.01) and 1/3 studies found a 43% improvement in HHC (p NR).    *Multimodal interventions*: 16/21 studies found a significant % improvement in HHC (range from 8% to 200%, p<.05 to p<.001), 1/21 studies found a significant 48% improvement (p<.001) in HHC in one of three multimodal campaigns evaluated, 1/21 studies found a significant 9% improvement (p=.03) in HHC among nurses, but a significant 14% decline (p=.008) among physicians, and 3/21 studies found a % improvement in HHC (range from 36% to 49%, all p NR). |
| **Ofek Shlomai et al. (2015)**[33] | The provision of performance feedback in addition to other measures improved HHC markedly (OR=2.81, 95% CI=1.32-5.96) whereas studies that did not include the provision of performance feedback resulted in improvement of HHC to a lesser degree (OR=1.55, 95% CI=1.13-2.11). |
| **Ritchie et al. (2005)**[36]**/ Stout et al. (2007)**[37] | Successful interventions were generally multi-component in nature, long-term, and targeted a range of factors that modify HH behaviour. Multi-component strategies were more consistently associated with sustained improvements compared with single component strategies. Multi-component interventions that include ABHR products are equally effective as strategies that do not in effecting sustained change.  *ABHR alone*: 3/4 studies reported a significant improvement in HHC with increases of between 44% and 92% at 5 to 12 weeks (p<.05 to p=.007).  *ABHR and education*: 3/7 studies reported a significant improvement in HHC with increases of between 41% and 139% (p<.01 to p<.001).  *ABHR with multifaceted intervention*: 3/4 studies reported a significant improvement in HHC (p<.001; 1 study NR). Also, a significant increase in HHC was demonstrated in all 2 studies, with adjusted OR of 1.9 and 1.92 at 5.5 months and 3 years respectively. For 1/4 reported that significant improvement was observed; however, it is stated in the summary table that significant improvement was observed only when “relaxed criteria were used i.e. glove use before contact is adequate HH” – thus, this was not considered as a significant improvement to HHC.  *Education alone*: 1/2 studies reported an increase in ABHR consumption (from 5.7 to 9.7 L per capita over an eight-year period, p NR).  *Reminders alone*: 2/5 studies reported a significant increase in product usage (40% increase at three months, p <.001; average 34% increase during intervention period, p=.021).  *Feedback alone*: 1/4 studies significant improvement in HHC across staff groups (p=.001) and 1/4 studies significant improvement in HHC among two of six professional groups (p<.001).  *Multifaceted interventions*: 11/15 studies significant improvement in HHC with increases ranging from 19% to 1160% (p <.05 to p<.0000 (sic)). |
| **Schweizer et al. (2014)**[38] | Studies that assessed a larger number of components to improve HH did not see larger increases in HHC: 1 or 2 components (OR=3.44, 95% CI=1.11-10.68, n=13); 3 or 4 components (OR=2.16, 95% CI=1.82-2.55, n=20); and ≥5 components (OR=2.49, 95% CI=1.74-3.56, n=12).  Three studies of interventions that included feedback, education, and reminders were statistically significant (OR=1.47, 95% CI 1.12-1.94; I2=19%).  Three studies of interventions that included feedback, education, reminders, access to ABHR, and administrative support (i.e. the WHO-5 framework) were statistically significant (OR=1.82, 95% CI=1.69-1.97; I2=11%). |
| **Srigley et al. (2015)**[40] | Insufficient evidence was found to recommend adoption of any specific HH monitoring technology as a HHC improvement strategy.  *Electronic monitoring systems that provided reminders without feedback*: 2/2 studies reported a significant improvement (from 19.1% to 27.3% and from 36.3% to 70.1%) in HHC during the intervention period (p<.05).  *Electronic/video monitoring systems that provided aggregate feedback without reminders*: 2/3 studies reported an improvement in HHC at room entry/exit (from 6.5% to 81.6% and from 30.4 % to 82.3% at 16 weeks of intervention; p NR) and 1/3 studies report no significant difference in HH frequency (p=.63).  *Electronic monitoring systems that provided individual feedback and reminders*: 1/2 studies reported significantly higher (+6.8%) HHC in the intervention versus the control arm (p NR) and 1/2 studies reported an increase from 25% to 65% (p NR). |

*Note*. ABHR = Alcohol-based hand rub. BCT = Behaviour change techniques. CI = Confidence interval. CRI = Credible interval. HH = Hand hygiene. HHC = Hand hygiene compliance. ITS = Interrupted time series. NR = Not reported. OR = Odds ratio. RCT = Randomised controlled trial. WHO = World Health Organization. WHO-5 = World Health Organization’s (2009) multimodal strategy for hand hygiene. \* = From the article text, although Table A2 in Neo et al. (2016)[32] shows that the upper limit of % improvement in HHC is 78% not 70%.