

2023 Hand Hygiene Research Summary



Photo credit: Water Aid

Executive Summary

For over 10 years, the Global Handwashing Partnership has synthesized the latest hand hygiene research through annual research summaries. These summaries provide the latest research, key findings, and guidance on hand hygiene best practices for program implementers, policy actors and researchers. In 2023, studies focused on documenting hand hygiene impacts, addressing hand hygiene access and supplies, and designing, implementing, and monitoring hand hygiene behaviour change.

Hand Hygiene Impact. Hand hygiene has a significant positive impact on public health. It is a key preventative measure against a range of diseases, including diarrhoeal diseases, respiratory infections, malnutrition, and a range of other diseases. Despite the strong evidence supporting its physical health benefits, the impact of hand hygiene on mental health remains under-researched. Additionally, while some studies have evaluated the cost-effectiveness of hand hygiene interventions, more data is needed to fully understand their economic benefits. While one study evaluated the cost-effectiveness of individual protective measures (including hand hygiene), further evidence is needed on relative costs and return on investment of hand hygiene interventions.

Handwashing Access and Supplies. Access to hand hygiene services, supplies, and facilities is crucial for promoting proper hand hygiene behaviour. Factors such as water supply and affordability significantly influence hand hygiene practice. In healthcare settings, the visibility and strategic placement of handwashing facilities are vital for ensuring compliance.

More research is needed to understand the attributes of handwashing facilities that are important to end-users to ensure they are usable for all. Studies also focused on the efficacy of other hand hygiene supplies. Alcohol-based hand rub (ABHR) is widely used and considered a suitable alternative to soap in healthcare settings. Use of these alternatives still leaves the question around whether international guidelines should recommend affordable options for handwashing when soap or ABHR is unavailable.

Determinants of Hand Hygiene Behaviour. Hand hygiene behaviour is influenced by various sociodemographic and behavioural factors. Studies found that factors such as knowledge, educational status, occupation, and wealth influenced hand hygiene behaviour in most settings. Motivational factors like perceived susceptibility of illness, collective responsibility, and social norms were also determinants of hand hygiene behaviour.

Interventions for Behaviour Change. Behaviour change theory is commonly used in hand hygiene intervention design. Studies showed that educational and nudging interventions, such as visual and olfactory cues, have shown effectiveness in some settings. However, it is important that hand hygiene interventions are designed and tailored to the specific contexts in which they are implemented.

Monitoring Hand Hygiene. Direct observations remain the gold standard for monitoring hand hygiene compliance, but this method can be labour-intensive and biased. Alternative methods, including electronic and automated systems, are being explored. However, patient confidentiality must be considered with video-based technologies.

Overall, research continues to highlight the essential role of hand hygiene in preventing health issues such as diarrhoeal illnesses, respiratory infections, and malnutrition, as well as the need to gear hand hygiene interventions to the appropriate conditions of the target group addressing enabling factors such as hand hygiene access and the key determinants for hand hygiene behaviour.

Acknowledgements

This research summary was prepared by Katherine Davies (London School of Hygiene and Tropical Medicine). Technical reviews were conducted by Robert Dreibelbis (London School of Hygiene and Tropical Medicine), Ron Clemmer (Global Handwashing Partnership), and Aarin Palomares (Global Handwashing Partnership).

About the Research Summary

For over 10 years, the Global Handwashing Partnership has synthesized the latest hand hygiene research through annual research summaries. These summaries provide the latest research, key findings, and guidance on hand hygiene best practices for program implementers, policy actors and researchers. This summary covers peer-reviewed publications from 2023 and complements lessons learned from previous years to promote hand hygiene. Methodology for the summary is included in [Annex 1](#) while the full reference list is included in [Annex 2](#).

Research Highlights

Research highlights for 2023 are summarized with key findings categorised by the following themes:

- [Impact of Hand Hygiene](#)
- [Handwashing Access and Supplies](#)
- [Determinants of Hand Hygiene Behaviour](#)
- [Interventions for Hand Hygiene Behaviour Change](#)
- [Monitoring Hand Hygiene Behaviour](#)

Impact of Hand Hygiene

Respiratory Infections

Newly published systematic reviews demonstrated the impact of hand hygiene on respiratory infection. A systematic review and meta-analysis on the effectiveness of interventions promoting handwashing with soap on acute respiratory infection (ARI) morbidity in low- and middle-income settings found interventions reduced ARI morbidity by 17% (RR 0.83, 95%CI 0.76-0.90) (Ross et al., 2023). These findings are consistent with a previous [meta-analysis](#) that concluded improvements in hand hygiene reduced respiratory illness by 21%. Similarly, a systematic review and meta-analysis of individual and cluster-randomized trials showed a 14% relative reduction in the number of people with ARIs associated with hand hygiene interventions (RR 0.86, 95%CI 0.81-0.90) (Jefferson et al., 2023). However, in both studies, hand hygiene interventions made little or no difference to influenza-like illness and laboratory-confirmed influenza. A systematic review and meta-analysis of school-based hand hygiene interventions showed interventions delivered in high-income countries reduced respiratory tract and gastro-intestinal infection-related absence by 25% (relative rate ratio 0.75, 95% CI 0.60, 0.94) (Hoyle et al., 2023). The authors also found evidence that using more behaviour change techniques, utilising both 'risk perception' and 'instruction' in intervention design and targeting both children and adults was associated with increased impact.

The provision of alcohol-based hand rub (ABHR) had limited effect on ARI rates among adult pilgrims in a pilot randomised controlled trial (RCT) in Saudi Arabia (Albutti et al., 2023). However, multiple observational studies found associations between reported respiratory

infections or symptoms and self-reported hand hygiene and/or hand hygiene resources (Kifle et al., 2023, Girma et al., 2023, Meierhofer et al., 2023, Matsuda et al., 2023, Sepadi and Nkosi, 2023). A cost-effectiveness assessment of public health measures against influenza in Italy showed individual preventative measures such as handwashing were a cost-effective option against human influenza pandemics (253.67 million euros for achieving a mortality reduction >40%), particularly in severe epidemic scenarios when the cost of other public health alternatives are more expensive (Beresniak et al., 2023).

COVID-19

A scoping review and two literature summaries identified hand hygiene as a core measure recommended for the prevention of SARS-CoV-2 transmission (Donskey, 2023, Voidarou et al., 2023, Saulnier et al., 2023). A scoping review of non-pharmaceutical interventions (NPIs) for COVID-19 found behavioural NPIs (including handwashing) positively influenced COVID-19 outcomes and the use of behavioural NPIs in combination were more effective than individual interventions (Silubonde-Moyana et al., 2023). However, authors note that few studies focussed on hand sanitisation.

Using spatial modelling, research in Zimbabwe estimated that improvements to handwashing access could lead to reductions in the risk of severe COVID-19 of up to 16% (Joseph et al., 2023). A case-control study in Chile found regular handwashing both within (OR 0.61, 95% CI 0.39-0.95) and outside the home (OR 0.40, 95% CI 0.24-0.66) was associated with reduced ICU admissions due to COVID-19 (Urquidi et al., 2023). Multiple cross-sectional studies found handwashing or hand sanitiser use reduced the risk of COVID-19 (Francis et al., 2023, Hoffmann et al., 2023). However, several studies found no protective effect of handwashing on SARS-CoV-2 infection (Huguet-Torres et al., 2023, Kettlitz et al., 2023). A study investigating global convergence patterns of COVID-19 found the provision of handwashing facilities reduced the likelihood of belonging to a group with higher COVID-19 death intensity (Awaworyi Churchill et al., 2023). A global ecological study found significant positive correlations between COVID-19 deaths per million population with handwashing facility availability (Dhamnetiya et al., 2023). However, this relation is likely driven by higher COVID-19 mortality in high-income countries where handwashing facility availability is high.

Diarrhoeal Disease, Enteric Infections, and Helminth Infections

A new systematic review and meta-analysis showed no significant association between handwashing after toilet use and intestinal parasite infection among pregnant women in East Africa (OR 1.29, 95% CI 0.77-2.18) (Mosisa et al., 2023). A systematic review and meta-analysis identified handwashing using water only as a risk factor for STH infection among the paediatric population in India (OR 2.49, 95%CI 1.51-4.12) (Chopra et al., 2023). A systematic review and meta-analysis of case-control studies found access to basic hygiene services (handwashing facility with soap and water available at home) was associated with lower odds of contracting typhoid (OR 0.60, 95%CI 0.38-0.97) and access to limited hygiene (handwashing facility without soap and/or water) was associated with higher odds of contracting typhoid (OR 2.26, 95%CI 1.38-3.64) (Kim et al., 2023).

Among primary research studies, a study nested within a RCT of the CHoBI7 mHealth program in Bangladesh showed households responding correctly to the CHoBI7 mHealth intervention interactive voice response (IVR) quiz responses had reduced diarrhoea prevalence and improvements in observed handwashing with soap behaviour, highlighting that greater handwashing awareness is associated with reduced diarrhoeal disease prevalence (Bhuyian et al., 2023). Children receiving the CHoBI7 handwashing intervention also had significant reductions in harmful gut bacteria belonging to Proteobacteria, and an increase in beneficial Firmicutes (Monira et al., 2023).

Multiple observational studies explored the impact of handwashing on diarrhoeal disease and intestinal parasite infection. A case-control study conducted during a cholera outbreak in Ethiopia found that participants reporting handwashing after defecation were more likely to be controls than cases (OR 0.4 95% CI 0.2-0.8) (Davis et al., 2023). Cross-sectional, cohort and ecological studies explored hand hygiene behaviour or hand hygiene resource availability as a preventative factor for diarrhoeal disease (Ali et al., 2023, Chatterjee et al., 2023, Asgedom et al., 2023, Geteneh et al., 2023, Inaida et al., 2023, Islam et al., 2023, Taranum et al., 2023). A multi-country, cross-sectional study identified hand hygiene as an effect modifier on the association between flood exposure and diarrhoea risk in children under five in low- and middle-income countries, with a significantly higher chance of contracting diarrhoea observed among children living in households with no water available at the handwashing site (OR 1.80, 95%CI 1.34-2.41) compared with children living in households with water available at handwashing sites (OR 1.17, 95%CI 0.92-1.48) (Wang et al., 2023b).

A hospital-based case-control study among diarrhoeal patients in Ethiopia showed handwashing after toilet use and before eating was protective against infection with *Giardia lamblia*, *Entamoeba Histolytica* and *Cryptosporidium Spp.* (Firdu and Mulatu, 2023). Many cross-sectional studies identified handwashing as a protective factor against intestinal parasite infections, particularly amongst children under five, school-aged children and food handlers (Hussein et al., 2023, Duguma et al., 2023, Hakizimana et al., 2023, Bisetegn et al., 2023, Dejen et al., 2023, Feleke et al., 2023a, Mraz et al., 2023, Abate et al., 2023, Che et al., 2023, Chen et al., 2023, Khattak et al., 2023, Mubarak et al., 2023, Nguyen et al., 2023, Hassanen et al., 2023, Friesema et al., 2023, Melese et al., 2023, Athiyah et al., 2023). One cross-sectional study among produce vendors in Ethiopia identified handwashing with soap after toilet use as protective against contamination of fruits and vegetables with intestinal parasites (Gemechu et al., 2023). Several cross-sectional studies identified handwashing after defecation and before eating as a protective factor against STH infection. Most studies focussed on school-aged children (Bokicho et al., 2023, Imalele et al., 2023, Masaku et al., 2023, Rahimi et al., 2023, Zeynudin et al., 2023, Meleko et al., 2023, Zacharia et al., 2023). However, others focussed on adult populations including urban slum-dwelling women and pregnant women (Mukutmoni et al., 2023, Ulaganeethi et al., 2023). Cross-sectional studies in Ethiopia found a protective association between handwashing and enteric bacterial pathogen infection (Solomon et al., 2023). For example, handwashing at less than three critical timepoints was associated with an increase in lactulose-to-mannitol ratio in

Ethiopian children (OR 4.37 95%CI 1.41-13.52), which is indicative of environmental enteropathy (Regassa et al., 2023).

Nutrition and Development

A narrative literature review described how handwashing was a protective factor of child linear growth determined by the height-for-age anthropometric index (Veiga et al., 2023). Several observational studies found an association between inadequate hand hygiene practices or limited hand hygiene resource availability and being stunted or underweight in children and adolescents (Meierhofer et al., 2023, Hasan et al., 2023, Som et al., 2023, Jolly et al., 2023, Shama et al., 2023, Woldesenbet et al., 2023, Shiferaw et al., 2023, Habimana et al., 2023, Feleke et al., 2023b). One cross-sectional study conducted in Ethiopia, Sudan and Tanzania found a lack of school handwashing stations was associated with an increased risk (RR 1.26, 95% CI 1.20-1.32) of anaemia among in-school young adolescents (Partap et al., 2023). Cross-sectional studies in the Asia-Pacific region and Ecuador found a protective association between hand hygiene and cognitive, language and socio-emotional development (Petermann-Rocha et al., 2023, Weigel and Armijos, 2023).

Bacterial Contamination

A cross-sectional study investigated the effect of handwashing on the concentration of *Escherichia coli* (*E. coli*) among children in an urban slum in Indonesia (Rifqi et al., 2023). The mean *E. coli* concentration on the hands decreased after handwashing, with a higher reduction in *E. coli* count among students who used soap and had soap for more than 10 seconds during handwashing. Cleaning in-between fingers, using soap, soap contact with the hand for more than 10 seconds and drying hands with a single-use towel were effective factors for reducing *E. coli* concentration after handwashing. Several studies explored the impact of handwashing on food hygiene. For example, one study in the United States (US) showed increased handwashing attempts, completion of more handwashing steps and average scrub times greater than 5 seconds decreased the risk of cross-contamination of kitchen surfaces and foods during meal preparation (Kirchner et al., 2023). Inadequate hand hygiene practices, such as not using hand sanitizer or not using a clean towel to dry hands, were associated with contamination of chicken meat in markets in El Salvador (Lopez et al., 2023). Several studies demonstrated the importance of hand hygiene to prevent milk contamination on dairy farms (Alembo and Tonjo Torka, 2023, Ágredo-Campos Á et al., 2023, Mesele et al., 2023).

Healthcare-associated Infections

A systematic review aimed to determine the effectiveness of different hand hygiene agents for preventing neonatal infection in both community and health facilities (Kuti et al., 2023). The authors insufficient data to allow them to reach meaningful conclusions about the superiority of one form of antiseptic hand hygiene agent over another for the prevention of neonatal infection, with the available data being of moderate-to very low-certainty. The findings from this review, drawing primarily on trials conducted mostly in high-income countries, highlight the need for further RCTs in different settings to assess the impact of hand hygiene practices on neonatal infection. Long-term follow-up studies in European inpatient nephrology departments showed hospital-acquired bloodstream infections

decreased during electronic hand hygiene monitoring interventions (Rosenfeldt Knudsen et al., 2023, Mareckova et al., 2023). Improving hand hygiene compliance remains a recommended strategy to prevent healthcare-associated infections (Glowicz et al., 2023) and has been successfully used in local Quality Improvement projects to decrease health-care associated Carbapenem-resistant *Enterobacteriaceae* infections (Ragonese et al., 2023).

Other Impacts

A cross-sectional study in Uganda found infrequent handwashing before changing menstrual materials was associated with self-reported urogenital symptoms indicative of infection (Borg et al., 2023) and a cross-sectional study in Ethiopia found using only water for handwashing was associated with scabies (Ararsa et al., 2023). A cross-sectional study in China showed poor handwashing habits were associated with a higher risk of poor overall health status in women of child bearing age (He et al., 2023a). Finally, a longitudinal study in China found university students who reported complying with recommended handwashing technique (WHO) during COVID-19 were less likely to report depression over time (Li et al., 2023).

What does this mean? Overall, studies published in 2023 build on and reinforce existing evidence demonstrating the positive impact of hand hygiene. Handwashing continues to be an important preventative factor for diarrhoeal disease, respiratory infection, malnutrition and a range of other diseases. The evidence for the impacts of hand hygiene on mental health and non-physical health remains limited. While one study evaluated the cost-effectiveness of individual protective measures (including hand hygiene), further evidence is needed on relative costs and return on investment of hand hygiene interventions.

Review authors note the high diversity in measures of hand hygiene, and we found a similar variety in the ways in which researchers measure or estimate hand hygiene behaviour. For example, some studies measured access to handwashing facilities while others asked respondents to self-report handwashing behaviour. Few studies measured handwashing using observations, the current “gold standard” for measuring hand hygiene.

Handwashing Access & Supplies

Several studies the critical role of access and supplies as a key driver of handwashing behaviour in different settings, including the availability, operation and design of handwashing facilities (e.g., soap, sanitiser, water access). The efficacy of different handwashing methods and resources was also explored, and novel handwashing technologies were highlighted.

Community Settings

A systematic review identified several barriers to community handwashing with soap globally, including: resource availability, cost and affordability, ineffective handwashing

facility design, and inadequate water supply (Ezezika et al., 2023). A systematic review of studies in African countries identified the main barrier to hand hygiene among low-income urban and slum dwellers was the lack of safe and clean water (Kawuki et al., 2023). A scoping review of strategies implemented by governments for the homeless population during COVID-19 revealed implementation of mobile handwashing facilities was well-received (Ahillan et al., 2023). However, a lack of public facilities due to public services closing was a barrier to maintaining hand hygiene for people experiencing homelessness.

Several cross-sectional studies identified a lack of access to hand hygiene resources, including handwashing facilities and water supply, as key barriers to self-reported handwashing in community settings (Abebe et al., 2023, Birhanu et al., 2023, Tamene et al., 2023, Aydamo et al., 2023, Gizaw et al., 2023). The availability of handwashing facilities with water and soap also predicted other WASH behaviours in Ethiopia, including proper latrine utilisation (Yirdaw et al., 2023). A cross-sectional study in a drought-prone region of Southern Niger found as water depth increased at the nearest water point (more groundwater nearby), households were more likely to have water and soap observed at the handwashing station (OR 1.25, 95%CI 1.12-1.49) (Pinchoff et al., 2023). However, a cross-sectional study in vulnerable communities in the Mekong region found the increased need for water to wash hands contributed to water insecure, which in turn made adoption of good practices less likely (Lebel et al., 2023). Qualitative literature supported these quantitative relationships. In Ghana, participants reported that handwashing with soap depended on water availability and the financial position of the household, including their ability to buy soap and pay for water services (Kyei-Arthur et al., 2023, Fielmua et al., 2023). Handwashing facility design was also important, with end-users preferring handwashing facilities with a large water storage capacity (Brial et al., 2023).

Studies examining access to basic hygiene facilities in low- or middle-income settings found access to handwashing facilities was poor (Salam et al., 2023). A cross-sectional study conducted in Bishoftu Town, Ethiopia found only 19% of households used basic hygiene services (handwashing facility with soap and water) and 40% of households lacked a functional handwashing facility (Girmay et al., 2023). Other studies conducted in high-income countries found access to handwashing facilities was poor in specific populations such as mobile workers, unhoused communities, service industry workers and incarcerated individuals (Rutter et al., 2023, Avelar Portillo et al., 2023, Cassarino et al., 2023, Rosemberg et al., 2023).

Humanitarian Settings

An exploratory study conducted in Rohingya refugee camps in Bangladesh found more than 92% of respondents in each camp reported that the availability of soap and handwashing in the latrine was low (Shapna et al., 2023). A study conducted in Goma city, Democratic Republic of Congo (DRC), found the level of action by humanitarian organisations (HOs) to distribute handwashing devices during the COVID-19 pandemic did not meet the expectations of community members, with 32% of participants expecting to see HOs distributing handwashing devices, yet only 13% of participants reported observing this (Hamuli et al., 2023). A microbial assessment conducted two years after the Nepal 2015

earthquake showed target genes of enteric pathogens were detected in significantly higher proportions from hand rinse samples of households in temporary settlements (with limited hand hygiene infrastructure) compared households in more permanent settlements (Uprety et al., 2023). This highlighted the importance of WASH infrastructure to enable hand hygiene and prevent diarrhoeal disease in humanitarian crises.

School Settings

Observational studies exploring access to handwashing facilities in schools in low- and middle-income settings found access could be improved (Sahni et al., 2023, Mwapasa et al., 2023, Melaku and Addis, 2023, Pieters et al., 2023, Dorkenoo et al., 2023). A cross-sectional study in Ethiopia identified the provision of basic hygiene facilities at schools in Addis Ababa was inadequate (36.7% of schools provided basic hygiene services) and that the regions was not on track to meet the Sustainable Development Goal (SDG) targets (Melaku et al., 2023b). Cross-sectional studies in Ethiopia and Indonesia specifically identified a lack of water and soap available for safe menstrual hygiene management practices in schools (Wihdaturrahmah and Chuemchit, 2023, Melaku et al., 2023a). Water supply interruption, financial constraints and a lack of appropriate WASH infrastructure were identified as key barriers to hand hygiene in school settings (Melaku and Addis, 2023, Kirira et al., 2023, Pieters et al., 2023).

Healthcare Settings

A summary of recent hand hygiene literature found there is increased interest in hand sanitiser dispenser function, location and design (Boyce, 2023). Observational studies identified the layout of patient care areas was important for handwashing compliance in healthcare settings, specifically the visibility and accessibility of handwashing facilities or ABHR, with a recognised need to prioritise the accessibility of hand hygiene materials at the point of care (Cai et al., 2023, Pratt et al., 2023). Several qualitative studies identified a lack of hand hygiene resources as a barrier to practicing infection, prevention and control measures, including hand hygiene, in healthcare settings in Malawi, Uganda and Nigeria (Mangochi et al., 2023, Nassolo et al., 2023, Ataiyero et al., 2023). A quality improvement project in long-term care homes in Canada found family members and residents considered accessibility to hygiene infrastructure, including ABHR, important (Yip and Diamond, 2023). To increase provider access to ABHR at smaller healthcare facilities in low- and middle-income settings, a study from Uganda recommended establishing centralised local production of ABHR using a district-wide approach (Tusabe et al., 2023). The importance of product quality management was highlighted in a study in West Africa which identified hand hygiene products, such as liquid soap, could act as reservoirs of Gram-negative bacteria if managed poorly (Lompo et al., 2023).

Efficacy of Hand Hygiene Methods

A scoping review of international guidelines making recommendations for hand hygiene in community settings found handwashing with soap was consistently recommended as the preferred method for hand hygiene across all community settings, with most guidelines specifically recommending handwashing with plain soap and running water for at least 20 seconds (Macleod et al., 2023). However, there were inconsistent recommendations for

affordable and effective alternatives for soap or alcohol-based hand rub (ABHR) and handwashing facility design. A laboratory-based study testing the efficacy of different handwashing methods found that several alternative handwashing methods - such as washing with water only or washing with soapy water - were as effective in a laboratory setting for removal and inactivation of viral surrogates as washing with soap and water for 20 seconds (Anderson et al., 2023a). However, alcohol-based hand rub (ABHR) and washing for a short duration (5 seconds) was only effective for enveloped viruses, whilst using a Supertowel (microfiber towel with antimicrobial coating) was less effective for handwashing than methods using soap and water.

Other studies examined the efficacy of different handwashing techniques in healthcare settings including the 10-Stroke-Scrub (10SS), a 3-step hand hygiene technique and a novel six moments of hand hygiene compliance among hospital cleaning staff (Valim et al., 2023, Aslan et al., 2023, He et al., 2023b). Key handwashing steps for handwashing effectiveness included rubbing the dorsum of fingers, rubbing wrists, rubbing hands during rinsing and rinsing time, and frequently missed areas included wrists, webbing between fingers and skin folds (Shi et al., 2023, Pluta et al., 2023). The impact of gloving practices on infection rates were also explored. A prospective cohort study in Japan found double-gloving with hygienic hand wash was associated with reduced odds of developing postoperative fever during hospitalisation following urological robotic or laparoscopic surgeries compared with single gloving with surgical hand wash (Nagai et al., 2023). Furthermore, a cross-sectional study assessing the microbiological profile of gloves used by food handlers in Singapore demonstrated damaged gloves exhibited higher mean Standard Plate Counts, suggesting damaged gloves promote the transfer of bacteria (Selvaraj et al., 2023).

Efficacy of Hand Hygiene Supplies

Several studies examined the efficacy of alcohol-based hand rub (ABHR), particularly in healthcare settings. A literature review provided an overview of classification, application scenarios and challenges associated with hand sanitiser gels, highlighting the emergence of novel products to advance hand hygiene practices (Ma et al., 2023). A study comparing liquid and gel ABHR formulations in Hungary found the 1.5ml volume commonly applied in healthcare settings provided insufficient hand coverage in both formulations (Voniatis et al., 2023). Liquid ABHR spread better and gel ABHR was easier handled at a larger volume with less spillage. In a US operating suite, waterless alcohol-based dry scrub yielded the lowest amount of particulate formation (which can lead to surgical site infection) during surgical hand preparation) whilst reusable surgical towels produced the highest number of particles (Tholcke et al., 2023). ABHR had a higher antibacterial effect when used by skilled (nursing students) versus unskilled users (other adults), highlighting the importance of education and training on how to use ABHR correctly (Braidablik et al., 2023).

Comparisons of ABHR formulations in laboratory settings showed the addition of a secondary ingredient sped up the antimicrobial mode of action and provided additional anti-biofilm functionality to ABHRs (Lim et al., 2023). Benzalkonium chloride (BAK)-based sanitisers were also shown to be as effective as ethanol-based hand sanitisers at inactivating SARS-CoV-2 and HCoV-229E, supporting previously published [data](#) demonstrating the

effectiveness of BAK-based hand sanitisers (Herdt and Ikner, 2023). One study found that far-UVC radiation in the spectral range of 200-230nm provided a reduction in micro-organisms on the hands (Hessling et al., 2023) while another demonstrated it is possible to formulate a natural, alcohol-free hand sanitiser from fruit peels that has antimicrobial properties against certain pathogens (Verma et al., 2023). A study evaluating virus survival on Supertowels (microfiber towels with antimicrobial coating) found viruses seeded into Supertowels decayed at a similar rate to viruses seeded onto a regular towel indicating the virucidal potential of the Supertowel is minimal (Anderson et al., 2023b).

Novel Hand Hygiene Technologies

Several studies explored novel hand hygiene technologies. For example, one study used Behaviour Centred Design and Human-Centred Design approaches to guide the development of a novel hand cleansing technology, tab soap (Brial et al., 2023). A small-scale proof of concept field test found that all low-income households in rural and peri-urban areas in Tanzania (N=12 households) reported that they would use the product reliably over the medium term. A qualitative study in schools in Kenya assessed the utilisation of water backpacks, a product designed to provide a safer alternative to often-contaminated jerry cans used by children for water transport (Kirira et al., 2023). Feedback from study participants found the backpack was useful and was often hung outside classrooms and toilets at schools for handwashing purposes. These novel technologies offer insights into possible products, services, and interventions that could be used in resource-constrained settings. In the context of COVID-19, a study proposed deploying contactless sanitizer dispensers with integrated temperature monitoring and alert systems as a COVID-19 mitigation strategy (Ashok et al., 2023).

What does this mean? New studies in 2023 further showed how access to hand hygiene services, supplies and facilities is a crucial determinant of hand hygiene behaviour. Inadequate water supply and cost/affordability also play significant roles in determining access and usage.

In healthcare settings, the visibility and placement of handwashing facilities at the point of care is crucial for hand hygiene compliance. To inform future interventions, more research is needed on the attributes of handwashing facilities end-users consider important, to ensure handwashing facilities are accessible and usable for all.

Multiple studies assessed the efficacy of handwashing techniques and supplies. ABHR remains a suitable alternative for handwashing with soap and is widely used in healthcare settings. International hand hygiene guidelines should recommend suitable and affordable options for handwashing when soap or ABHR is not available.

Determinants of Hand Hygiene Behaviour

The literature identified a range of behavioural determinants that influence handwashing behaviour and explored how these differ in various settings.

Community Settings

Knowledge, attitude and practices (KAP) and determinants of hand hygiene behaviours were widely researched in community settings (n = 148 studies). Most of these studies described practices and determinants of hand hygiene in the context of COVID-19 (n = 112 studies). A systematic review found practices related to hand hygiene were frequently evaluated in pandemic-related literature (Seng et al., 2023). Furthermore, a mapping review showed there have been huge volumes of research looking at determinants of COVID-19 protective behaviours, including hand hygiene (Hanratty et al., 2023). However, most studies focussed on demographic determinants such as gender and age, which are difficult to target in interventions. A systematic review and meta-analysis showed there were high levels of handwashing uptake to prevent COVID-19 in East African countries, with pooled handwashing levels of 88% (95%CI 73-97%) in Kenya, Uganda and Tanzania (Muchangi et al., 2023).

Observational literature found hand hygiene was associated with a range of sociodemographic factors and behavioural determinants including knowledge, educational status, occupation, cultural beliefs and wealth (Gizaw et al., 2023, Tamene et al., 2023, Leung et al., 2023, Mihalache et al., 2023, Wana and Mengesha, 2023, Ango et al., 2023b, Lee et al., 2023, Yamakawa et al., 2023). One cross-sectional study in Bangladesh observed a pro-rich socio-economic inequality of handwashing with antimicrobial agents, with a household's wealth index explaining almost half (46%) of the overall inequality of handwashing with antimicrobial agents (Sarker et al., 2023). Further studies identified motivational factors such as perceived susceptibility of illness, self-efficacy, collective responsibility and social norms as predictors of hand hygiene behaviours (Hinssen and Dohle, 2023, Jo et al., 2023).

Key determinants of handwashing during COVID-19 included trust in the government, anxiety, practice of other protective measures and perceived threat of COVID (Obach et al., 2023, Szczuka et al., 2023, Looi, 2023). A cross-sectional study in Nigeria found handwashing with soap as a COVID-19 coping strategy was an important driver of the work performance of nonfarm household enterprises (Obiefuna et al., 2023). A qualitative study exploring perceptions about COVID-19 preventative measures among Ghanaian women found community members did not adhere to handwashing with soap due to perceptions that COVID-19 no longer exists, forgetfulness and difficulty understanding why people must regularly wash hands (Kyei-Arthur et al., 2023).

School Settings

Multiple studies in 2023 explored knowledge and practices of hand hygiene in educational settings, including schools and universities (n=28), with most of these studies exploring hand hygiene in the context of COVID-19 (n=21). Observational studies found hand hygiene in schools was associated with several factors including school ownership (public vs private), having a trained coordinator on hygiene, having a health education programmes at school, and having training on handwashing at school (Melaku and Addis, 2023, Melaku et al., 2023b). Knowledge, attitude towards handwashing with soap, and perception of the

severity of diarrhoea were determinants of primary schoolteachers' reported handwashing with soap behaviours in Ghana (Gbolu et al., 2023).

Humanitarian Settings

Several studies investigated how handwashing behaviour is impacted in protracted conflicts and complex refugee contexts. A scoping review mapped the association between mental health and people's ability to practice hand hygiene behaviours in humanitarian and pandemic crises (Ghassemi et al., 2023). The review found contradictory results, with studies finding both positive and negative correlations between anxiety, depression and post-traumatic stress disorder (PTSD) and handwashing with soap. The authors conclude that the association between mental health and handwashing should be explored further in a wider range of crises. A cross-sectional study on the Thai-Myanmar border reported that fewer than half of the caregivers interviewed reported routinely washing their hands before preparing meals or after using the latrine (Poosesod et al., 2023). Furthermore, conflict-affected populations in eastern Ukraine reported difficulty in complying with COVID-19 preventative measures, including handwashing, due to losses of housing, partners, and access to food resources (Cha et al., 2023).

Healthcare Facilities

Hand hygiene compliance among healthcare workers is critical for preventing healthcare-associated infections and limiting the spread of disease and several studies published in 2023 explored determinants of hand hygiene compliance in healthcare settings (n=53). A systematic review identified overcrowding and high patient complexity as barriers to hand hygiene compliance in emergency departments (Issa et al., 2023). Evidence-based strategies are crucial to help healthcare professionals integrate hand hygiene practices into their workflow. A cluster randomised clinical trial showed a policy endorsing a direct-gloving strategy (compared with the current strategy requiring hand hygiene before glove use) led to improved hand hygiene adherence in US hospital units, with no increase in bacterial contamination in most clinical areas (Thom et al., 2023). The authors argue that strategies to improve the efficiency of hand hygiene will likely improve adherence.

Another randomised controlled trial showed that activating an empathic focus during COVID-19 promoted perceived importance and motivation of healthcare workers of a German hospital to comply with hand hygiene to protect vulnerable individuals from contamination and infection (Sassenrath et al., 2023). The wider literature found motivational factors such as fear or professional identity associated with the adoption of good hand hygiene practices among healthcare workers (Douno et al., 2023, Sands and Aunger, 2023, van Dijk et al., 2023). Cross-sectional literature also identified sociodemographic factors, work experience, hand hygiene resource availability, occupation and workload as determinants of hand hygiene compliance in healthcare settings (Harun et al., 2023, Liu et al., 2023).

A systematic literature search identified mobile phones are often contaminated with SARS-CoV-2 virus and are an important fomite vector of viral transmission (Olsen et al., 2023). Observations in healthcare settings identified "touching phones" as common institution-

wide reasons for hand hygiene misses (Wilson et al., 2023). Furthermore, cross-sectional research highlighted the importance of hand hygiene to prevent hand contamination from phones (Correa et al., 2023, Albastaki et al., 2023). Whilst handheld electronic devices are valued for improving work efficiency, they can reduce hand hygiene compliance in healthcare settings (Suliman et al., 2023).

What does this mean? Hand hygiene behaviour is predicted by a range of sociodemographic and behavioural determinants which vary in different settings. Factors such as knowledge, educational status, occupation, and wealth determined hand hygiene behaviour in most settings. Motivational factors such as perceived susceptibility of illness, collective responsibility and social norms were also determinants of hand hygiene. In healthcare facilities, overcrowding and patient complexity were key determinants of hand hygiene behaviours.

Interventions for Hand Hygiene Behaviour Change

Behaviour change interventions must address the range of behavioural determinants, individual motives and barriers to practicing hand hygiene. As determinants vary by setting, interventions should be designed and adapted to suit different contexts.

Community Settings

A systematic review assessing the global application of behavioural change theory and models on COVID-19 preventative behaviours, such as handwashing, found the health belief model (HBM) and theory of planned behaviour (TPB) were most used (Anagaw et al., 2023). A review found that nudging interventions (messages, images, posters, visual cues, olfactory cues, directional arrows, footprints, handprints) had a positive effect on hand hygiene as a COVID-19 preventative measure (Tzikas and Koulirakis, 2023). However, a scoping review of international guidelines for hand hygiene in community settings found there were gaps in recommendations on behaviour change approaches (Macleod et al., 2023).

The community-based literature mainly focussed on educational interventions. To develop and test a smartphone-based hand hygiene intervention (*Soapp*) during the COVID-19 pandemic in Switzerland, an intervention optimisation randomised trial was conducted to identify the most effective combination and sequence of three theory- and evidence-based intervention modules (habit, motivation and social norms), to be included in a subsequent evaluation phase (Baretta et al., 2023). Results showed significant increases in hand hygiene over time across all conditions, with no interaction effect between time and intervention condition. Further intervention and observational studies showed educational interventions improved knowledge and self-reported hand hygiene practices (Vagha et al., 2023, Dearden et al., 2023, Matsungu et al., 2023, Negussie et al., 2023, Blanco et al., 2023). For example, a process evaluation of the [‘Safe Start’](#) trial in Kenya found caregivers in the intervention arm demonstrated a good understanding of intervention messages and were more likely to practice handwashing before food preparation than caregivers in the control arm (OR 1.39,

95%CI 1.02-1.87) (Simiyu et al., 2023). A cross-sectional study in rural Ethiopia showed being exposed to WASH health education by health extension workers was associated with improved household access to handwashing facilities (AOR 5.14, 95%CI 4.11-6.42) (Alemu et al., 2023). Qualitative assessments showed educational interventions were well-received and demonstrated improvements to knowledge and practices of hand hygiene behaviours following educational interventions (Yan et al., 2023, Calderon-Villarreal et al., 2023).

An evaluation of meal-kit recipes in the UK found handwashing during food preparation was featured in 52% of relevant recipe cards (Melville et al., 2023). Furthermore, a methodological study described the development and validation of a telephone messaging intervention targeting hand hygiene behaviour in Brazil (Souza Neto et al., 2023). A study in Sierra Leone highlighted the importance of considering power dynamics affecting handwashing interventions, and found the strategic inclusion of community leaders in local participatory community projects is essential to enhance the value of projects, mobilise creative action, and empower lower-ranking individuals to practice handwashing (Luetke Lanfer et al., 2023).

School Settings

Intervention studies in educational settings primarily focussed on increasing children's knowledge and practice of hand hygiene through educational approaches such as games or playful activities (Costa et al., 2023, Caplan et al., 2023, Bricchi et al., 2023). For example, a quasi-experimental study evaluated a hand hygiene intervention delivered at a kindergarten school in Malawi with the following components: (1) hand hygiene protocol integrated into school health curriculum; (2) health talks; (3) construction of handwashing facilities; (4) training of schoolteachers and (5) development of reminders and posters of simplified 5-step handwashing technique (Mbakaya et al., 2023). The intervention was effective at increasing hand hygiene knowledge and technique among kindergarten children, with knowledge being retained three months after the programme stopped. A mixed-methods study in India described an innovative approach to handwashing behaviour change using a minimalistic social robot which was co-designed with children (Pasupuleti et al., 2023). Findings showed that children liked and trusted anthropomorphised caricatured designs of everyday objects for the robot's morphology, and most children wanted to robot to be highly interactive and response.

Infrastructural interventions improved hand hygiene accessibility. For example, an impact assessment of a soil-transmitted helminth prevention programme in Angola found schools that received support from the provincial or municipality health department and operational partners to implement WASH interventions were more likely to have improved handwashing facilities and a hygiene club than schools that did not receive any support (Bartlett et al., 2023). Other interventions targeted school employees' behaviour. For example, an intervention study showed improvements to US school nutrition employee's handwashing behaviours did not differ between groups receiving food safety training interventions with a realistic-event video and groups receiving training interventions without a video (Roberts et al., 2023).

Humanitarian Settings

Surprise soaps are a novel soap product with an embedded toy designed for humanitarian settings. Two cluster-randomised controlled equivalence trials evaluated the “Surprise Soap” intervention, where surprise soap was delivered to children in humanitarian settings in a short, participatory household session that included a glitter game and handwashing with soap (HWWS) practice. Results from the first study conducted with children aged 5-12 in Somalia showed that HWWS increased in both the intervention and active comparator group (plain soap delivered in a short household session with standard health-based messaging). However, there was no evidence of a difference in HWWS between intervention and control groups (Watson et al., 2023a). These findings were replicated in the second study conducted with older children living in a refugee settlement in Sudan (Watson et al., 2023c). These findings indicate the Surprise Soap intervention offers no marginal benefit over a standard intervention that would justify the additional costs.

A mixed-methods study evaluated a Case-Area Targeted Intervention (CATI) approach during a cholera outbreak in DRC (Endres et al., 2023). The study showed a higher percentage of CATI area households had handwashing stations present compared to control households. However, handwashing with soap was very low among both groups, and few CATI recipients reported receiving soap in their hygiene kit. As CATIs are part of cholera control plans in many endemic countries, it is important to develop evidence-based delivery approaches to improve hand hygiene behaviours.

A qualitative study explored NGO practitioners’ perspective on the challenges and solutions to handwashing with soap interventions targeting older children in development and humanitarian settings (Watson et al., 2023b). The study found that funding for interventions targeting older children is insufficient and inconsistent, with a lack of coordination within and between sectors creating major challenges for implementation. The study recommends NGOs should foster better intra- and intersectional coordination to overcome challenges related to the integration of interventions within education institutions, the standardisation of implementation tools and sustainability of interventions.

Healthcare Settings

A systematic review and meta-analysis found that intelligent technology interventions to monitor hand hygiene in healthcare settings were associated with improvements in healthcare workers’ hand hygiene compliance (RR 1.56, 95%CI 1.47-1.66) and reduced healthcare associated infection rates (RR 0.25, 95%CI 0.19-0.33)(Zhang et al., 2023). A stepped-wedge cluster-randomised controlled trial in the Netherlands found a multimodal improvement strategy consisting of education, training reminders, observation sessions (including feedback) and team meetings (including feedback) was successful at improving hand hygiene compliance (Haenen et al., 2023). An interventional study evaluating the provision of ABHR with visual cues (using yellow curing tape or signage) in Japanese day care centres found elderly users did not react to these nudges, with no differences in hand sanitiser use observed between intervention and control groups (Takebayashi et al., 2023).

A scoping review of interventions to improve hand hygiene compliance in nursing students showed education and training were core elements of these interventions (Meza Sierra et al., 2023). The literature widely evaluated interventions with hand hygiene training (Mlouki et al., 2023, Farizon et al., 2023, Kouhi et al., 2023, Dhamdhere et al., 2023, Garnier et al., 2023, Chitamanni et al., 2023). Interventions using automated reminders, data-driven feedback and compliance monitoring to boost hand hygiene compliance were also widely evaluated (Rosenfeldt Knudsen et al., 2023, Arbogast et al., 2023, Bolcato et al., 2023, Zwicker et al., 2023, Iversen et al., 2023a, Seferi et al., 2023, Kathirvel et al., 2023). A quasi-experimental study found a multi-modal intervention (SafeHANDS) involving staff training, provision of ABHR bottles, educational leaflets, performance feedback and setting of compliance performance targets, had no impact on hand hygiene compliance rates in a resource-limited neonatal unit in South Africa (Dramowski et al., 2023). The authors suggested this could have been due to the lack of daily reminders and designated hand hygiene champions for each shift. Another quasi-experimental study found hand hygiene compliance improved among nurses with an infection control link nurse nominated, as they acted as role models and influenced hand hygiene practices of other nurses in their wards (Ghorbanmovahhed et al., 2023).

A design-research project in The Netherlands developed the “Island-based nursing” concept based on nudge theory, where a patient room is divided into geographical areas (island and general zone) and the primary hand hygiene indication is upon entering and exiting the island zone (Jansen et al., 2023). The study found the demarcation facilitated and economised hand hygiene in an innovative and user-friendly manner. Furthermore, several studies highlighted the importance of conducting operational research and delivering interventions that are underpinned by theories from organisational learning and culture (Kamara et al., 2023, Moiwo et al., 2023, Frodin et al., 2023). Strategies to improve hand hygiene compliance in healthcare settings need to acknowledge and cater for the unpredictable and busy environment. Local capacity building through training, and availability of hand hygiene materials is crucial to enhance hand hygiene culture in healthcare settings.

What does this mean? Many studies published in 2023 focused on educational interventions. Behaviour change theory was also applied to intervention design. Nudging interventions (such as messages, images, posters, visual cues, olfactory cues, directional arrows, footprints, handprints) were shown to be effective in some settings.

Interventions targeting hand hygiene behaviour change must be designed and adapted to suit the contexts they will be delivered in. For example, strategies to improve hand hygiene compliance in healthcare settings must acknowledge the unpredictable and busy environment.

Monitoring Hand Hygiene Behaviour

A systematic review of WASH assessment tools in healthcare facilities found a lack of uniformity in definitions and methodology adopted for assessments (Trivedi et al., 2023). Furthermore, a summary of recent hand hygiene literature highlighted an increased interest in alternative hand hygiene monitoring options (Boyce, 2023). A randomised feasibility study of eye-tracking glasses showed they provided helpful insights during the recording of hand hygiene compliance in an intensive care unit in Switzerland (Valek et al., 2023). The accuracy, cost-effectiveness, and user-satisfaction of other electronic/automated hand hygiene monitoring systems (such as automated count dispensers to measure ABHR consumption) were widely explored in the literature, particularly in healthcare settings (Iversen et al., 2023b, Salinas-Escudero et al., 2023, Figueroa et al., 2023, Lintz, 2023, Haghpanah et al., 2023a, Haghpanah et al., 2023b). Patient and healthcare worker feedback of video-based monitoring raised concerns over confidentiality and feedback delays (McKay and Shaban, 2023, McKay et al., 2023). Other monitoring technology explored in the literature included Bluetooth low energy-based beacons for in-room positioning and thermal imaging to measure hand hygiene quality (Hadian et al., 2023, Wang et al., 2023a).

Direct observations are the ‘gold standard’ of monitoring handwashing compliance. A study testing the validity of self-reported compliance tools in Dutch hospitals showed no association between self-reported and observed hand hygiene compliance, indicating it is not a valid substitute for direct hand hygiene observations in healthcare settings (van Dijk et al., 2023). This builds on existing literature highlighting that self-report surveys commonly used to assess behavioural changes can substantially overestimate levels of adherence. However, direct observations are labour intensive and can be subject to biases. Whilst tools to reduce the time burden of observations such as smartphone applications have been tested (Liberio et al., 2023), the use of electronic monitoring tools is being more widely explored. One study in France explored the use of patients as observers of healthcare workers’ hand hygiene compliance in clinical settings, and proposed new indicators considering patients’ observations could provide interesting insights (Velardo et al., 2023).

The literature also explored the use of hand swabs to monitor hand contamination as a proxy for hand hygiene. Two studies measured hand hygiene status of housemaids in Jimmy City, Ethiopia, using hand swab samples to test for bacterial contaminants (Ango et al., 2023b, Ango et al., 2023a). Furthermore, a comparative pilot study on Gram-negative bacterial contamination of the hands of children revealed faecal contaminants were more common on the hands of children who live in rural areas with low hygiene conditions (Sibertu, Indonesia) than in urban areas with better hygiene conditions (Göttingen, Germany) (Simanjuntak et al., 2023). Therefore, investigating the hands of children for the prevalence of Gram-negative bacteria are helpful to monitor hygienic conditions.

What does this mean? Direct observations are the gold standard of monitoring hand hygiene compliance. However, they can be labour intensive and subject to bias. Therefore, the accuracy of alternative monitoring methods is being more widely explored. Electronic/automated hand hygiene monitoring systems have been implemented widely in healthcare settings. However, considerations for patient confidentiality must be considered with video-based technologies.

ANNEX 1. Methodology

Searches for handwashing studies published in 2023 were completed on two databases: PubMed and Embase (see search criteria below).

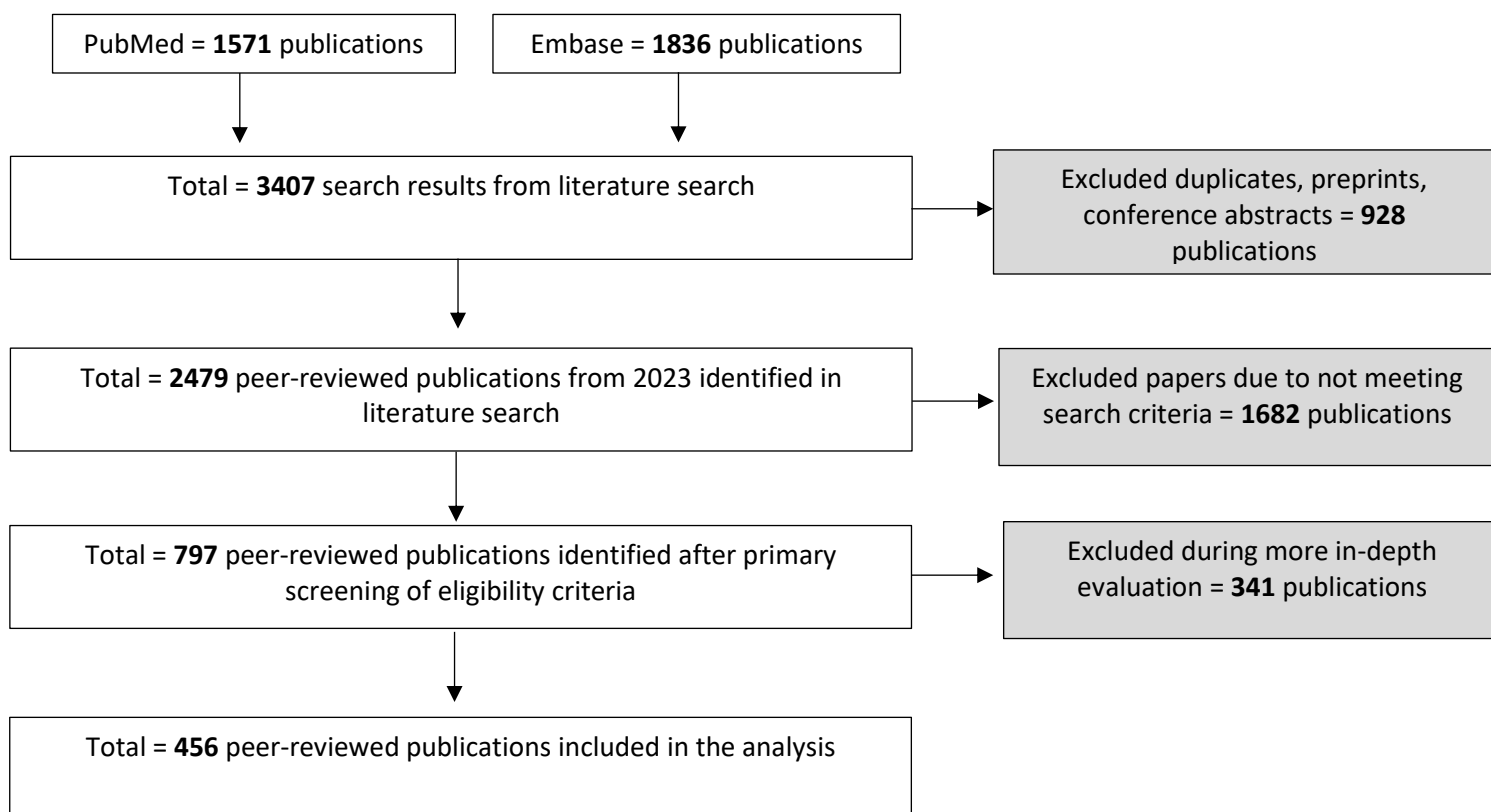
Heading	n°	Keyword
Hand Hygiene	1	(handwash* or hand wash* or hand-wash* or hand hygien*).ti,ab
	2	((Hand or hands) adj3 (wash* or clean* or disinfect* or sterili* or saniti* or decontaminat* or rub* or scrub* or soap or hygien*)).ti,ab
	3	(surgical or surger*) adj2 (scrub*).ti,ab
	4	hand washing/
	5	1 OR 2 OR 3 OR 4
Year	6	Limit 5 to yr="2023"

ti,ab – title & abstract

* – truncation

adj – adjacent to

Below is a visual representation of the literature review process that was conducted to identify and assess the publications included in this research summary.



From the initial search 3407 publications were identified. After deleting duplicates, preprints and conferences and confirming articles were published in 2023, a total of 2479 studies were identified for primary analysis against eligibility criteria. Initial eligibility criteria included:

- 1) Article is published between January 1, 2023, through December 31, 2023
- 2) Article includes relevant hand hygiene terms in its title and/or abstract and is relevant to the hand hygiene literature
- 3) Article is free to access
- 4) Article is written in the English language

After excluding papers that did not meet the eligibility criteria a total of 797 studies were identified for a more in-depth assessment and evaluation of the publication. Papers not specifically focussing on hand hygiene (for example focussing on more general infection prevention) were excluded, leaving a total of 456 peer-reviewed publications included in the analysis.

ANNEX 2. Reference List

- ABATE, M., ERISO, F., KALYANKAR, V. B., PADWAL, N. D., SINGH, S. C., UPADHYE, V., HUMBE, A. S., JADHAV, S. D. & HAJARE, S. T. 2023. Prevalence of *Entamoeba histolytica* among schoolchildren in Dilla town, Gedeo zone, Ethiopia. *Infectious Diseases Now*, 53, 104621.
- ABEBE, A., DEBELA, B. G., SISAY, W. T. D., ASSEFA ZENEBE, G., ENDASHAW HARERU, H. & ASHURO, Z. 2023. Mothers' hand washing practices and associated factors among model and non-model households in the rural community of Bibugn district, north west Ethiopia: The context of the Ethiopian health extension package. *Heliyon*, 9, e17503.
- ÁGREDO-CAMPOS Á, S., FERNÁNDEZ-SILVA, J. A. & RAMÍREZ-VÁSQUEZ, N. F. 2023. *Staphylococcus aureus*, *Escherichia coli*, and *Klebsiella* spp. prevalence in bulk tank milk of Colombian herds and associated milking practices. *Vet World*, 16, 869-881.
- AHILLAN, T., EMMERSON, M., SWIFT, B., GOLAMGOUSE, H., SONG, K., ROXAS, A., MENDHA, S. B., AVRAMOVIC, E., RASTOGI, J. & SULTAN, B. 2023. COVID-19 in the homeless population: a scoping review and meta-analysis examining differences in prevalence, presentation, vaccine hesitancy and government response in the first year of the pandemic. *BMC Infectious Diseases*, 23, 155.
- ALBASTAKI, A., OLSEN, M., ALMULLA, H., NASSAR, R., BOUCHERABINE, S., MOHAMED, L., ALMHEIRI, R., KACHIGUNDA, B., MCKIRDY, S., ALGHAFRI, R., TAJOURI, L. & SENOK, A. 2023. Mobile phones as fomites for pathogenic microbes: A cross-sectional survey of perceptions and sanitization habits of health care workers in Dubai, United Arab Emirates. *Infection, Disease and Health*, 28, 19-26.
- ALBUTTI, A., MAHDI, H. A., ALWASHMI, A. S., ALFELALI, M., BARASHEED, O., BARNES, E. H., SHABAN, R. Z., BOOY, R. & RASHID, H. 2023. The relationship between hand hygiene and rates of acute respiratory infections among Umrah pilgrims: A pilot randomised controlled trial. *Journal of Infection and Public Health*.
- ALEMBO, E. A. & TONJO TORKA, T. 2023. Prevalence, Contamination Level, and Associated Factors of Methicillin-Resistant *Staphylococcus aureus* in Raw Cow Milk at Selected Districts of Gamo Zone, Southern Ethiopia. *Veterinary Medicine International*, 2023, 6238754.
- ALEMU, F., EBA, K., BONGER, Z. T., YOUYA, A., GERBABA, M. J., TEKLU, A. M. & MEDHIN, G. 2023. The effect of a health extension program on improving water, sanitation, and hygiene practices in rural Ethiopia. *BMC health services research*, 23, 836.
- ALI, A. S., GARI, S. R., GOODSON, M. L., WALSH, C. L., DESSIE, B. K. & AMBELU, A. 2023. Prevalence and risk factors of childhood diarrhea among wastewater irrigating urban farming households in Addis Ababa. *PLoS ONE*, 18, e0288425.
- ANAGAW, T. F., TIRUNEH, M. G. & FENTA, E. T. 2023. Application of behavioral change theory and models on COVID-19 preventive behaviors, worldwide: A systematic review. *SAGE Open Medicine*, 11.
- ANDERSON, C. E., TONG, J., ZAMBRANA, W., BOEHM, A. B. & WOLFE, M. K. 2023a. Investigating the Efficacy of Various Handwashing Methods against Enveloped and Non-Enveloped Viruses. *American Journal of Tropical Medicine and Hygiene*, 108, 820-828.
- ANDERSON, C. E., WOLFE, M. K. & BOEHM, A. B. 2023b. Enveloped and non-enveloped virus survival on microfiber towels. *PeerJ*, 11, e15202.
- ANGO, T. S., GELAW, N. B., ZEGENE, G. M., TESHOME, T. & GETAHUN, T. 2023a. Prevalence and antimicrobial susceptibility profile of bacteria isolated from the hands of housemaids in Jimma City, Ethiopia. *Frontiers in public health*, 11, 1301685.

- ANGO, T. S., TESHOME, T. & GETAHUN, T. 2023b. Hand hygiene status and its associated factors among housemaids working in communal living residences in Jimma city, southwest Ethiopia. *Heliyon*, 9, e22651.
- ARARSA, G., MERDASSA, E., SHIBIRU, T. & ETAFA, W. 2023. Prevalence of scabies and associated factors among children aged 5-14 years in Meta Robi District, Ethiopia. *PLoS ONE*, 18, e0277912.
- ARBOGAST, J. W., MOORE, L. D., DIGIORGIO, M., ROBBINS, G., CLARK, T. L., THOMPSON, M. F., WAGNER, P. T., BOYCE, J. M. & PARKER, A. E. 2023. The impact of automated hand hygiene monitoring with and without complementary improvement strategies on performance rates. *Infection Control and Hospital Epidemiology*, 44, 638-642.
- ASGEDOM, A. A., ABIRHA, B. T., TESFAY, A. G., GEBREYOWHANNES, K. K., ABRAHA, H. B., HAILU, G. B., ABRHA, M. B., TSADIK, M., GEBREHIWET, T. G., GEBREYESUS, A., DESALEW, T., ALEMAYEHU, Y. & MULUGETA, A. 2023. Unimproved water and sanitation contributes to childhood diarrhoea during the war in Tigray, Ethiopia: a community based assessment. *Scientific reports*, 13, 7800.
- ASHOK, G., JOHN PAUL, J., THUSNAVIS MARY BELLA, I., PACKIAVATHY, S. V. & GAUTAM, S. 2023. Internet of Things (IoT) based automated sanitizer dispenser and COVID-19 statistics reporter in a post-pandemic world. *Health and Technology*, 13, 327-341.
- ASLAN, L., SUBASI, O., MIZIKOGLU, D., BIRSEL, O., KIRISCI, S. T., BAS, A., ARSHAD, M., LAZOGLU, I. & SEYAHİ, A. 2023. A new checklist surgical hand scrub to replace time-based methods - A pixel intensity analysis. *The surgeon : journal of the Royal Colleges of Surgeons of Edinburgh and Ireland*, 21, 344-350.
- ATAIYERO, Y., DYSON, J. & GRAHAM, M. 2023. The barriers and facilitators to hand hygiene practices in Nigeria: A qualitative study: "There are so many barriers the barriers are limitless.". *American Journal of Infection Control*, 51, 295-303.
- ATHIYYAH, A. F., SURONO, I. S., RANUH, R. G., DARMA, A., BASUKI, S., ROSSYANTI, L., SUDARMO, S. M. & VENEMA, K. 2023. Mono-Parasitic and Poly-Parasitic Intestinal Infections among Children Aged 36-45 Months in East Nusa Tenggara, Indonesia. *Tropical Medicine and Infectious Disease*, 8, 45.
- AVELAR PORTILLO, L. J., KAYSER, G. L., KO, C., VASQUEZ, A., GONZALEZ, J., AVELAR, D. J., ALVARENGA, N., FRANKLIN, M. & CHIANG, Y. Y. 2023. Water, Sanitation, and Hygiene (WaSH) insecurity in unhoused communities of Los Angeles, California. *International Journal for Equity in Health*, 22, 108.
- AWAWORYI CHURCHILL, S., INEKWE, J. & IVANOVSKI, K. 2023. Has the COVID-19 pandemic converged across countries? *Empir Econ*, 64, 2027-2052.
- AYDAMO, A. A., GARI, S. R. & MERETA, S. T. 2023. Access to Drinking Water, Sanitation, and Hand Hygiene Facilities in the Peri-Urban and Informal Settlements of Hosanna Town, Southern Ethiopia. *Environ Health Insights*, 17, 11786302231193604.
- BARETTA, D., AMREIN, M. A., BADER, C., RUSCHETTI, G. G., RUTTIMANN, C., DEL RIO CARRAL, M., FABIAN, C. & INAUEN, J. 2023. Promoting Hand Hygiene During the COVID-19 Pandemic: Parallel Randomized Trial for the Optimization of the Soapp App. *JMIR mHealth and uHealth*, 11, e43241.
- BARTLETT, A. W., MENDES, E. P., DAHMASH, L., PALMEIRIM, M. S., DE ALMEIDA, M. C., PELIGANGA, L. B., LUFUNDA, L. M. M., DIREITO, A., RAMIREZ, J., MWINZI, P. N., LOPES, S. & NERY, S. V. 2023. School-based preventive chemotherapy program for schistosomiasis and soil-transmitted helminth control in Angola: 6-year impact assessment. *PLoS Neglected Tropical Diseases*, 17, e0010849.
- BERESNIAK, A., NAPOLI, C., OXFORD, J., DARUICH, A., NIDDAM, L., DURU, G., TOZZI, A. E., ATTI, M. C., DUPONT, D., RIZZO, C. & BREMOND-GIGNAC, D. 2023. The FLURESP European commission project:

cost-effectiveness assessment of ten public health measures against influenza in Italy: is there an interest in COVID-19 pandemic? *Cost Effectiveness and Resource Allocation*, 21, 30.

BHUYIAN, M. S. I., PERIN, J., ENDRES, K., ZOHURA, F., MASUD, J., PARVIN, T., UDDIN, I. M., HASAN, T., MONIRA, S., SACK, D. A., FARUQUE, A. S. G., ALAM, M. & GEORGE, C. M. 2023. Reduced Diarrhea Prevalence and Improvements in Handwashing with Soap and Stored Drinking Water Quality Associated with Diarrheal Disease Awareness Measured by Interactive Voice Response Messages in the CHoBI7 Mobile Health Program. *American Journal of Tropical Medicine and Hygiene*, 108, 530-535.

BIRHANU, M. T., LIGA, A. D. & JABIR, Y. N. 2023. Practices of hygiene during complementary food feeding and associated factors among women with children aged 6-24 months in Dedo district, Southwest Ethiopia: A cross-sectional study. *Health Science Reports*, 6, e1771.

BISETEGN, H., DEBASH, H., EBRAHIM, H., ERKIHUN, Y., TILAHUN, M. & FELEKE, D. G. 2023. Prevalence and Determinant Factors of Intestinal Parasitic Infections and Undernutrition among Primary School Children in North-Central Ethiopia: A School-Based Cross-Sectional Study. *Journal of Parasitology Research*, 2023, 2256910.

BLANCO, S., VALDEZ, M., STOLLAK, I., WESTGATE, C. C., HERRERA, A. & PERRY, H. B. 2023. Reducing inequities in maternal and child health in rural Guatemala through the CBIO+ Approach of Curamericas: 3. Expansion of population coverage of key interventions. *International Journal for Equity in Health*, 21, 196.

BOKICHO, B., HAILU, D., ESHETU, B., MATIE, M. & TADELE, T. 2023. Soil-transmitted helminthiases among school-age children and their association with water, sanitation, and hygiene, Hawassa City, Southern Ethiopia. *PLoS Neglected Tropical Diseases*, 17, e0011484.

BOLCATO, V., ROBUSTELLI DELLA CUNA, F. S., FASSINA, G., ODOE, A., GERVASIO, L., BOSONE, D. & BLANDI, L. 2023. Preventing Healthcare-Associated Infections: Hand Disinfection Monitoring Using an Automated System in an Italian Neurological Hospital. *Healthcare (Basel)*, 11.

BORG, S. A., BUKENYA, J. N., KIBIRA, S. P. S., NAKAMYA, P., MAKUMBI, F. E., EXUM, N. G., SCHWAB, K. J. & HENNEGAN, J. 2023. The association between menstrual hygiene, workplace sanitation practices and self-reported urogenital symptoms in a cross-sectional survey of women working in Mukono District, Uganda. *PLoS ONE*, 18, e0288942.

BOYCE, J. M. 2023. Current issues in hand hygiene. *American Journal of Infection Control*, 51, A35-A43.

BREIDABLIK, H. J., JOHANNESSEN, L., ANDERSEN, J. R., SØREIDE, H. & KLEIVEN, O. T. 2023. Effect of Optimal Alcohol-Based Hand Rub among Nurse Students Compared with Everyday Practice among Random Adults; Can Water-Based Hand Rub Combined with a Hand Dryer Machine Be an Alternative to Remove E. coli Contamination from Hands? *Microorganisms*, 11.

BRIAL, E., AUNGER, R., MUANGI, W. C. & BAXTER, W. 2023. Development of a novel hand cleansing product for low-income contexts: The case of tab soap. *PLoS ONE*, 18, e0283741.

BRICCHI, L., CEREDA, D., BISCEGLIA, L., LOPALCO, P. L., ODOE, A. & SIGNORELLI, C. 2023. Impact of the educational program "Igiene Insieme" in 1,991 Italian primary schools: student behavior and incidence of SARS-CoV-2. *Acta Biomedica*, 94, e2023184.

CAI, H., GARCIA, A., POLIVKA, B., SPRECKELMEYER, K. & YANG, F. M. 2023. Visibility and Accessibility of Hand Hygiene Stations and Fatigue Among Nurses Working in Long-Term Care (LTC) During the COVID-19 Pandemic. *HERD*, 16, 24-37.

- CALDERON-VILLARREAL, A., ALAMO-HERNANDEZ, U., TERRY, B. & SALGADO-DE-SNYDER, N. 2023. Popular education to improve water quality and hygiene in a Mexican indigenous community. *Global health promotion*, 30, 39-48.
- CAPLAN, N., SANKA, B. C., MULAT, A., BRENER, D. T., BAUM, S., SEIFU, A., KESETE, N. Z., BRUCK, M., WOHLGEMUTH, L. G., DEBELA, M. M., WEEKES, R. B., SABAR, G., BENTWICH, Z. & GOLAN, R. 2023. Motivating school communities towards behavior change and local ownership: a gamification intervention to prevent trachoma at primary schools in southern Ethiopia. *International Health*, 15, ii38-ii43.
- CASSARINO, N., DABBARA, H., MONTEIRO, C. B., BEMBURY, A., CREDLE, L., GRANDHI, U., PATIL, A., WHITE, S. & JIMÉNEZ, M. C. 2023. Conditions of Confinement in U.S. Carceral Facilities During COVID-19: Individuals Speak-Incarcerated During the COVID-19 Epidemic. *Health Equity*, 7, 261-270.
- CHA, J., NOH, J. W., ROBINSON, C., KWON, Y. D. & KIM, J. 2023. Challenges of COVID-19 prevention during protracted conflicts: differential adherence to preventive measures in "contact line" regions in eastern Ukraine. *Frontiers in public health*, 11, 1151452.
- CHATTERJEE, S., MAJUMDER, D. & ROY, M. N. 2023. Assessing water, sanitation and hygiene (WASH) practices and their association with diarrhoea in under-five children in urban Chandernagore: Community-based evidence from a small municipal corporation in Hooghly District of West Bengal, India. *Journal of Water and Health*, 21, 1530-1549.
- CHE, T. H., NGUYEN, T. C., VU, V. N. T., NGUYEN, H. T., HOANG, D. T. P., NGO, X. M., TRUONG, D. Q., BONTEMS, P., ROBERT, A. & NGUYEN, P. N. V. 2023. Factors Associated With Helicobacter Pylori Infection Among School-Aged Children From a High Prevalence Area in Vietnam. *International journal of public health*, 68, 1605908.
- CHEN, R. X., ZHANG, D. Y., ZHANG, X., CHEN, S., HUANG, S., CHEN, C., LI, D., ZENG, F., CHEN, J., MO, C., GAO, L., ZENG, J., XIONG, J., CHEN, Z. & BAI, F. 2023. A survey on Helicobacter pylori infection rate in Hainan Province and analysis of related risk factors. *BMC Gastroenterology*, 23, 338.
- CHITAMANNI, P., ALLANA, A. & HAND, I. 2023. Quality Improvement Project to Improve Hand Hygiene Compliance in a Level III Neonatal Intensive Care Unit. *Children*, 10, 1484.
- CHOPRA, P., SHEKHAR, S., DAGAR, V. K. & PANDEY, S. 2023. Prevalence and Risk Factors of Soil-Transmitted Helminthic Infections in the Pediatric Population in India: A Systematic Review and Meta-Analysis. *J Lab Physicians*, 15, 4-19.
- CORREA, G. H., FORMIGONI, C. D. S., SASAGAWA, S. M., ARNONI, M. V., MATHIAS, L. A. D. S. T. & MIMICA, M. J. 2023. Mobile phones of anesthesiologists as reservoirs of nosocomial bacteria in a quaternary teaching hospital: an observational study. *Brazilian Journal of Anesthesiology (English Edition)*, 73, 276-282.
- COSTA, M. G., ROCHA JUNIOR, P. R., SPADELLA, M. A., PINHO, M. V. X., CHAGAS, E. F. B. & PINHEIRO, O. L. 2023. Playful activity with robot for hand hygiene of elementary school students: quasi-experimental study. *Revista gaucha de enfermagem*, 44, e20220344.
- DAVIS, W. W., MOHAMMED, Y., ABDILAH, I., KIM, S., SALAH, A. A., MCATEER, J., ABAYNEH, A., MOGES, B., GALLAGHER, K. & MINTZ, E. 2023. Food as a Driver of a Cholera Epidemic in Jijiga, Ethiopia-June 2017. *American Journal of Tropical Medicine and Hygiene*, 108, 963-967.
- DEARDEN, K., MULOKOZI, G., LINEHAN, M., CHERIAN, D., TORRES, S., WEST, J., CROOKSTON, B. & HALL, C. 2023. The Impact of a Large-Scale Social and Behavior Change Communication Intervention in the Lake Zone Region of Tanzania on Knowledge, Attitudes, and Practices Related to Stunting Prevention. *International Journal of Environmental Research and Public Health*, 20, 1214.

- DEJEN, T., YITAYEW, F. M., AMLAK, B. T., BIRHANIE, S. A., TESHALE, M. M., ALEMINEH, T. L. & WUBISHET, T. 2023. Intestinal parasite infection and associated factors among food handlers in Feres Bet town, North West Amhara, Ethiopia, 2021. *Heliyon*, 9, e14075.
- DHAMDHARE, N., VISHNANI, R., RECHE, A., PAUL, P., RATHI, S. & BOLENWAR, A. 2023. Hand Scrubbing and Donning of Sterile Surgical Gloves: An Observational Clinical Audit of Novice Dental Surgeons. *Cureus*, 15, e43504.
- DHAMNETIYA, D., SHALINI, S., MEHRA, A. & JHA, R. P. 2023. Correlation Between COVID 19 and Selected Risk Factors: An Ecological Study. *Eastern Journal of Medicine*, 28, 87-93.
- DONSKEY, C. J. 2023. High technology and low technology measures to reduce risk of SARS-CoV-2 transmission. *American Journal of Infection Control*, 51, A126-A133.
- DORKENOO, A. M., PHILLIPS, A. E., KLEIN, L., LACK, F., ATABA, E., YAKPA, K., TAGBA, A. E., ASSOTI, B. E., SOSSOU, E., TCHALIM, M., DATAGNI, G., SEIM, A., MILORD, M. D. & KASSANKOGNO, Y. 2023. Progress from morbidity control to elimination as a public health problem of schistosomiasis and the status of soil-transmitted helminth infection in Togo: a second impact assessment after ten rounds of mass drug administration. *Parasites and Vectors*, 16, 314.
- DOUNO, M., ROCHA, C., BORCHERT, M., NABE, I. & MÜLLER, S. A. 2023. Qualitative assessment of hand hygiene knowledge, attitudes and practices among healthcare workers prior to the implementation of the WHO Hand Hygiene Improvement Strategy at Faranah Regional Hospital, Guinea. *PLOS Glob Public Health*, 3, e0001581.
- DRAMOWSKI, A., ERASMUS, L. M., AUCAMP, M., FATAAR, A., COTTON, M. F., COFFIN, S. E., BEKKER, A. & WHITELAW, A. C. 2023. SafeHANDS: A Multimodal Hand Hygiene Intervention in a Resource-Limited Neonatal Unit. *Tropical Medicine and Infectious Disease*, 8, 27.
- DUGUMA, T., WORKU, T., SAHILE, S. & ASMELASH, D. 2023. Prevalence and Associated Risk Factors of Intestinal Parasites among Children under Five Years of Age Attended at Bachuma Primary Hospital, West Omo Zone, Southwest Ethiopia: A Cross-Sectional Study. *Journal of Tropical Medicine*, 2023, 2268554.
- ENDRES, K., MWISHINGO, A., THOMAS, E., BOROTO, R., NTUMBA NYARUKANYI, W., BISIMWA, J. C., SANVURA, P., PERIN, J., BENGHEHYA, J., MAHESHE, G., CIKOMOLA, C. & GEORGE, C. M. 2023. A Quantitative and Qualitative Program Evaluation of a Case-Area Targeted Intervention to Reduce Cholera in Eastern Democratic Republic of the Congo. *Int J Environ Res Public Health*, 21.
- EZEZIKA, O., HENG, J., FATIMA, K., MOHAMED, A. & BARRETT, K. 2023. What are the barriers and facilitators to community handwashing with water and soap? A systematic review. *PLOS Glob Public Health*, 3, e0001720.
- FARIZON, M., DOS SANTOS, S., RICHARD, L., PETITEAU, A., VALENTIN, A. S. & VAN DER MEE-MARQUET, N. 2023. Impact of a training strategy on improving compliance of hand hygiene and gloving during the placement of a short peripheral venous catheter: the multicentre study CleanHand4. *BMC medical education*, 23, 731.
- FELEKE, D. G., BISETEGN, H., ZEWUDU, G., ALEMU, Y. & FELEKE, S. T. 2023a. Intestinal Parasitic Infections and Associated Risk Factors among Food Handlers of Food and Drinking Establishments in Woldia Town, North-East Ethiopia: A Cross-Sectional Study. *Journal of Tropical Medicine*, 2023, 2831175.
- FELEKE, D. G., CHANIE, E. S., WUBET, G. M., AMARE, A. T., DEMELASH, A. T., DESALE, A. T., YIMER, R. D. & TESEMA, A. A. 2023b. Magnitude of stunting and its determinant factors among children age 6-

59 months at Debre Tabor comprehensive specialized hospital, South Gondar zone, North central Ethiopia, 2020. *African Health Sciences*, 23, 508-523.

FIELMUA, N., MENGBA, J. D. & KOSOE, E. K. 2023. Rural and peri-urban households' handwashing behaviour before the COVID-19 pandemic: Implications for managing it in North-western Ghana. *Cogent Public Health*, 10, 2212852.

FIGUEROA, D., NISHIO, S., YAMAZAKI, R., OHTA, E., HAMAGUCHI, S. & UTSUMI, M. 2023. Recognition of hand disinfection by an alcohol-containing gel using two-dimensional imaging in a clinical setting. *Journal of Hospital Infection*, 135, 157-162.

FIRDU, Z. & MULATU, K. 2023. Prevalence of Intestinal Parasites and Associated Risk Factors among Diarrheal Patients Attending Negelle Borena General Hospital: A Case-Control Study. *Journal of Parasitology Research*, 2023, 1990468.

FRANCIS, N. A., BECQUE, T., WILLCOX, M., HAY, A. D., LOWN, M., CLARKE, R., STUART, B., YARDLEY, L., MOORE, M., HOURIET, J. & LITTLE, P. 2023. Non-pharmaceutical interventions and risk of COVID-19 infection: survey of U.K. public from November 2020 - May 2021. *BMC public health*, 23, 389.

FRIESEMA, I. H. M., HOFHUIS, A., HOEK-VAN DEURSEN, D., JANSZ, A. R., OTT, A., VAN HELLEMOND, J. J., VAN DER GIESSEN, J., KORTBEEK, L. M. & OPSTEEGH, M. 2023. Risk factors for acute toxoplasmosis in the Netherlands. *Epidemiology and Infection*, 151, e95.

FRODIN, M., ROGMARK, C., NELLGARD, B., GILLESPIE, B. M., WIKSTROM, E. & ANDERSSON, A. E. 2023. Interactive Interventions Can Improve Hand Hygiene and Aseptic Techniques During Perioperative Care-Experience From the "Safe Hands" Project. *Journal of perianesthesia nursing : official journal of the American Society of PeriAnesthesia Nurses*, 38, 284-290.

GARNIER, A., DUBS, C., HAERDER, C., BONNABRY, P. & BOUCHOUD, L. 2023. Game-based training to promote handwashing, handrub and gloving for hospital pharmacy operators. *European Journal of Hospital Pharmacy*, ejhpharm-2022-003648.

GBOLU, S., APPIAH-BREMPPONG, E., OKYERE, P., VAMPERE, H., OBENG NYARKO, G. & MENSAH, K. A. 2023. Determinants of handwashing behaviour among primary school teachers in a district of Ghana. *Health Psychol Behav Med*, 11, 2185620.

GEMECHU, T., BONA, J., ALIYO, A., DEDECHA, W. & ASHENAFI, G. 2023. Assessment of Intestinal Parasites and Its Associated Factors among Fruits and Vegetables Collected from Local Markets of Bule Hora Town, Southeast Ethiopia. *Journal of Tropical Medicine*, 2023, 1861919.

GETENEH, A., TADESSE, S., BISET, S., GIRMA, L. & FISSIHA, P. 2023. Rapid stool antigenic test for typhoid fever among suspected cases, Northeast, Ethiopia. *Scientific reports*, 13, 649.

GHASSEMI, E. Y., THORSETH, A. H., ROCH, K. L., HEATH, T. & WHITE, S. 2023. Mapping the association between mental health and people's perceived and actual ability to practice hygiene-related behaviours in humanitarian and pandemic crises: A scoping review. *PLoS ONE*, 18, e0286494.

GHORBANMOVAHHED, S., SHAHBAZI, S., GILANI, N., OSTADI, A., SHABANLOEI, R. & GHOLIZADEH, L. 2023. Effectiveness of implementing of an infection control link nurse program to improve compliance with standard precautions and hand hygiene among nurses: a quasi-experimental study. *BMC medical education*, 23, 265.

GIRMA, F., AYANA, M., ABDISSA, B., ABOMA, M., KETEMA, D., KOLOLA, T. & WAKE, S. K. 2023. Determinants of under-five pneumonia among children visited in nine public health Hospitals in Ethiopia. *Clinical Epidemiology and Global Health*, 24, 101441.

GIRMAY, A. M., MENGESHA, S. D., DINSSA, D. A., ALEMU, Z. A., WAGARI, B., WELDEGEBRIEL, M. G., SERTE, M. G., ALEMAYEHU, T. A., KENEA, M. A., WELDETINSAE, A., TEKLU, K. T., ADUGNA, E. A., AWOKE, K. S., BEDADA, T. L., GOBENA, W., FIKRESLASSIE, G., WUBE, W., HOFFMANN, V., TESSEMA, M. & TOLLERA, G. 2023. Access to water, sanitation and hygiene (WASH) services and drinking water contamination risk levels in households of Bishoftu Town, Ethiopia: A cross-sectional study. *Health Science Reports*, 6, e1662.

GIZAW, Z., DEMISSIE, N. G., GEBREHIWOT, M., DESTAW, B. & NIGUSIE, A. 2023. Hand hygiene practice and associated factors among rural communities in northwest Ethiopia. *Scientific reports*, 13, 4287.

GLOWICZ, J. B., LANDON, E., SICKBERT-BENNETT, E. E., AIELLO, A. E., DEKAY, K., HOFFMANN, K. K., MARAGAKIS, L., OLMSTED, R. N., POLGREEN, P. M., TREXLER, P. A., VANAMRINGE, M. A., WOOD, A. R., YOKOE, D. & ELLINGSON, K. D. 2023. SHEA/IDSA/APIC Practice Recommendation: Strategies to prevent healthcare-associated infections through hand hygiene: 2022 Update. *Infection Control and Hospital Epidemiology*, 44, 355-376.

HABIMANA, J. D. D., UWASE, A., KORUKIRE, N., JEWETT, S., UMUGWANEZA, M., RUGEMA, L. & MUNYANSHONGORE, C. 2023. Prevalence and Correlates of Stunting among Children Aged 6-23 Months from Poor Households in Rwanda. *International Journal of Environmental Research and Public Health*, 20, 4068.

HADIAN, K., FERNIE, G. & ROSHAN FEKR, A. 2023. Development and Evaluation of BLE-Based Room-Level Localization to Improve Hand Hygiene Performance Estimation. *Journal of Healthcare Engineering*, 2023, 4258362.

HAENEN, A., HUIS, A., TEERENSTRA, S., LIEFERS, J., BOS, N., VOSS, A., DE GREEFF, S. & HULSCHER, M. 2023. Effect and Process Evaluation of an Intervention to Improve Hand Hygiene Compliance in Long-Term Care Facilities. *Journal of the American Medical Directors Association*.

HAGHPANAH, M. A., TALE MASOULEH, M., KALHOR, A. & AKHAVAN SARRAF, E. 2023a. A hand rubbing classification model based on image sequence enhanced by feature-based confidence metric. *Signal Image Video Process*, 17, 2499-2509.

HAGHPANAH, M. A., VALI, S., MOUSAVI TORKAMANI, A., TALE MASOULEH, M., KALHOR, A. & AKHAVAN SARRAF, E. 2023b. Real-time hand rubbing quality estimation using deep learning enhanced by separation index and feature-based confidence metric. *Expert Syst Appl*, 218, 119588.

HAKIZIMANA, E., KIM, J. Y., OH, S., YOON, M. & YONG, T. S. 2023. Intestinal parasitic infections among children aged 12-59 months in Nyamasheke District, Rwanda. *Parasites, hosts and diseases*, 61, 304-309.

HAMULI, R. P., MAYHEW, S. H. & SAHANI, M. K. 2023. Humanitarian sector (international non-governmental organisations) support to the community in Goma city/DRC during the COVID-19 pandemic period: Expectations and reality. *PLOS Glob Public Health*, 3, e0002086.

HANRATTY, J., KEENAN, C., O'CONNOR, S. R., LEONARD, R., CHI, Y., FERGUSON, J., AXIAQ, A., MILLER, S., BRADLEY, D. & DEMPSTER, M. 2023. Psychological and psychosocial determinants of COVID Health Related Behaviours (COHeRe): An evidence and gap map. *Campbell Syst Rev*, 19, e1336.

HARUN, M. G. D., ANWAR, M. M. U., SUMON, S. A., MOHONA, T. M., HASSAN, M. Z., RAHMAN, A., ABDULLAH, S. A. H. M., ISLAM, M. S., OAKLEY, L. P., MALPIEDI, P., KAYDOS-DANIELS, S. C. & STYCZYNSKI, A. R. 2023. Hand hygiene compliance and associated factors among healthcare workers in selected tertiary-care hospitals in Bangladesh. *Journal of Hospital Infection*, 139, 220-227.

- HASAN, M. M., ASIF, C. A. A., BARUA, A., BANERJEE, A., KALAM, M. A., KADER, A., WAHED, T., NOMAN, M. W. & TALUKDER, A. 2023. Association of access to water, sanitation and handwashing facilities with undernutrition of children below 5 years of age in Bangladesh: Evidence from two population-based, nationally representative surveys. *BMJ Open*, 13, e065330.
- HASSANEN, E. A. A., MAKAU, D. N., AFIFI, M., AL-JABR, O. A., ABDULRAHMAN ALSHAHRANI, M., SAIF, A., ANTER, R. G. A., EL-NESHWY, W. M., IBRAHIM, D. & ABOU ELEZ, R. M. M. 2023. Interplay between cross sectional analysis of risk factors associated with *Toxoplasma gondii* infection in pregnant women and their domestic cats. *Frontiers in Veterinary Science*, 10, 1147614.
- HE, L., LI, S. T., QIN, M. X., YAN, Y., LA, Y. Y., CAO, X., CAI, Y. T., WANG, Y. X., LIU, J., WU, D. H. & FENG, Q. 2023a. Unsupervised clustering analysis of comprehensive health status and its influencing factors on women of childbearing age: a cross-sectional study from a province in central China. *BMC public health*, 23, 2206.
- HE, W., CHEN, X., CHENG, X., LI, Y., FENG, B. & WANG, Y. 2023b. Exploring the effect of novel six moments on hand hygiene compliance among hospital cleaning staff members: a quasi-experimental study. *Epidemiology and Infection*, 151, e73.
- HERDT, B. L. & IKNER, L. A. 2023. Inactivation kinetics of benzalkonium chloride and ethanol-based hand sanitizers against a betacoronavirus and an alphacoronavirus. *Infection Prevention in Practice*, 5, 100293.
- HESSLING, M., SICKS, B. & LAU, B. 2023. Far-UVC Radiation for Disinfecting Hands or Gloves? *Pathogens*, 12, 213.
- HINSSEN, M. & DOHLE, S. 2023. Personal protective behaviors in response to COVID-19: a longitudinal application of protection motivation theory. *Front Psychol*, 14, 1195607.
- HOFFMANN, K., MICHALAK, M., BOŃKA, A., BRYL, W., MYŚLIŃSKI, W., KOSTRZEWSKA, M., KOPCIUCH, D., ZAPRUTKO, T., RATAJCZAK, P., NOWAKOWSKA, E., KUS, K. & PACZKOWSKA, A. 2023. Association between Compliance with COVID-19 Restrictions and the Risk of SARS-CoV-2 Infection in Poland. *Healthcare (Basel)*, 11.
- HOYLE, E., DAVIES, H., BOURHILL, J., ROBERTS, N., LEE, J. J. & ALBURY, C. 2023. Effectiveness of hand-hygiene interventions in reducing illness-related absence in educational settings in high income countries: systematic review and behavioural analysis. *Journal of Public Health (Germany)*.
- HUGUET-TORRES, A., CASTRO-SANCHEZ, E., CAPITAN-MOYANO, L., SANCHEZ-RODRIGUEZ, C., BENNASAR-VENY, M. & YANEZ, A. M. 2023. Personal protective measures and settings on the risk of SARS-COV-2 community transmission: a case-control study. *Frontiers in public health*, 11, 1327082.
- HUSSEIN, K., MEKONNEN, T. C., ABEBE, M. S., HUSSINI, F. M. & ALENE, T. D. 2023. School Feeding and Nutritional Status of Students in Dubti District, Afar, Northeast Ethiopia: Comparative Cross-Sectional Study. *Pediatric Health, Medicine and Therapeutics*, 14, 217-230.
- IMALELE, E. E., BRAIDE, E. I., EMANGHE, U. E., EFFANGA, E. O. & USANG, A. U. 2023. Soil-transmitted helminth infection among school-age children in Ogoja, Nigeria: implication for control. *Parasitology Research*, 122, 1015-1026.
- INAIDA, S., MIZUKOSHI, A., AZUMA, K. & OKUMURA, J. 2023. Reduced norovirus epidemic follows increased sales of hand hygiene products in Japan, 2020-2021. *Environmental Health and Preventive Medicine*, 28, 18.
- ISLAM, M. T., IM, J., AHMMED, F., KIM, D. R., TADESSE, B. T., KANG, S., KHANAM, F., CHOWDHURY, F., AHMED, T., FIROJ, M. G., AZIZ, A. B., HOQUE, M., PARK, J., JEON, H. J., KANUNGO, S., DUTTA, S., ZAMAN, K., KHAN, A. I., MARKS, F., KIM, J. H., QADRI, F. & CLEMENS, J. D. 2023. Better Existing

Water, Sanitation, and Hygiene Can Reduce the Risk of Cholera in an Endemic Setting: Results From a Prospective Cohort Study From Kolkata, India. *Open Forum Infectious Diseases*, 10, ofad535.

ISSA, M., DUNNE, S. & DUNNE, C. 2023. Hand hygiene practices for prevention of health care-associated infections associated with admitted infectious patients in the emergency department: a systematic review. *Irish Journal of Medical Science*, 192, 871-899.

IVERSEN, A. M., HANSEN, M. B. & ELLERMANN-ERIKSEN, S. 2023a. Effects of data-driven feedback on nurses' and physicians' hand hygiene in hospitals - a non-resource-intensive intervention in real-life clinical practice. *Infection Prevention in Practice*, 5, 100321.

IVERSEN, A. M., HANSEN, M. B., KRISTENSEN, B. & ELLERMANN-ERIKSEN, S. 2023b. Clinical evaluation of an electronic hand hygiene monitoring system. *American Journal of Infection Control*, 51, 376-379.

JANSEN, S. J., MULLER, B. J., CRAMER, S. J. E., TE PAS, A. B., LOPRIORE, E. & BEKKER, V. 2023. Developing a design-based concept to improve hand hygiene in the neonatal intensive care unit. *Pediatric Research*, 94, 450-457.

JEFFERSON, T., DOOLEY, L., FERRONI, E., AL-ANSARY, L. A., VAN DRIEL, M. L., BAWAZEER, G. A., JONES, M. A., HOFFMANN, T. C., CLARK, J., BELLER, E. M., GLASZIOU, P. P. & CONLY, J. M. 2023. Physical interventions to interrupt or reduce the spread of respiratory viruses. *Cochrane Database of Systematic Reviews*, 2023, CD006207.

JO, S., HAN, S. Y. & HOWE, N. 2023. Factors Associated with Handwashing Behaviors During the COVID-19 Pandemic: An Analysis of the Community Health Survey in Korea. *SAGE Open Nurs*, 9, 23779608231172364.

JOLLY, S. P., ROY CHOWDHURY, T., SARKER, T. T. & AFSANA, K. 2023. Water, sanitation and hygiene (WASH) practices and deworming improve nutritional status and anemia of unmarried adolescent girls in rural Bangladesh. *Journal of health, population, and nutrition*, 42, 127.

JOSEPH, G., MILUSHEVA, S., STURROCK, H., MAPAKO, T., AYLING, S. & HOO, Y. R. 2023. Estimating spatially disaggregated probability of severe COVID-19 and the impact of handwashing interventions: The case of Zimbabwe. *PLoS ONE*, 18, e0292644.

KAMARA, M. N., LAKOH, S., KALLON, C., KANU, J. S., KAMARA, R. Z., KAMARA, I. F., MOIWO, M. M., KPAGOI, S. S. T. K., ADEKANMBI, O., MANZI, M., FOFANAH, B. D. & SHEWADE, H. D. 2023. Hand Hygiene Practices and Promotion in Public Hospitals in Western Sierra Leone: Changes Following Operational Research in 2021. *Tropical Medicine and Infectious Disease*, 8, 486.

KATHIRVEL, M., MURUGESAN, A., SASTRY, A. & ADHISIVAM, B. 2023. Effect of Electronic Infrared Tap With Voice Reinforcement on Hand Hygiene Compliance of Healthcare Personnel. *Indian Pediatrics*, 60, 744-747.

KAWUKI, J., CHAN, P. S. F., FANG, Y., CHEN, S., MO, P. K. H. & WANG, Z. 2023. Knowledge and Practice of Personal Protective Measures Against COVID-19 in Africa: Systematic Review. *JMIR public health and surveillance*, 9, e44051.

KETTLITZ, R., HARRIES, M., ORTMANN, J., KRAUSE, G., AIGNER, A. & LANGE, B. 2023. Association of known SARS-CoV-2 serostatus and adherence to personal protection measures and the impact of personal protective measures on seropositivity in a population-based cross-sectional study (MuSPAD) in Germany. *BMC public health*, 23, 2281.

KHATTAK, I., YEN, W. L., USMAN, T., NASREEN, N., KHAN, A., AHMAD, S., REHMAN, G., KHAN, K., SAID, M. B. & CHEN, C. C. 2023. Individual and Community-Level Risk Factors for Giardiasis in Children under Five Years of Age in Pakistan: A Prospective Multi-Regional Study. *Children*, 10, 1087.

- KIFLE, M., YADETA, T. A., DEBELLA, A. & MUSSA, I. 2023. Determinants of pneumonia among under-five children at Hiwot Fana specialized hospital, Eastern Ethiopia: unmatched case-control study. *BMC Pulmonary Medicine*, 23, 293.
- KIM, C., GOUCHER, G. R., TADESSE, B. T., LEE, W., ABBAS, K. & KIM, J. H. 2023. Associations of water, sanitation, and hygiene with typhoid fever in case-control studies: a systematic review and meta-analysis. *BMC Infectious Diseases*, 23, 562.
- KIRCHNER, M., GOULTER, R. M., BERNSTEIN, C., LAVALLEE, A., SCHAFFNER, D., CHAPMAN, B. & JAYKUS, L. A. 2023. The role of hands in cross-contamination of kitchen surfaces during meal preparation. *American Journal of Infection Control*, 51, A44-A57.
- KIRIRA, P., OYATSI, F., WAUDO, A. & MBUGUA, S. 2023. Improving Access to Safe Water in Rural Schools of Kenya: Qualitative Multisectoral Insights. *Cureus*, 15, e49174.
- KOUHI, R., PANAHI, R., RAMEZANKHANI, A., AMIN SOBHANI, M., KHODAKARIM, S. & AMJADIAN, M. 2023. The effect of education based on health belief model on hand hygiene behavior in the staff of Tehran dentistry centers: A quasi-experimental intervention study. *Health Science Reports*, 6, e1408.
- KUTI, B. P., OGUNLESI, T. A., ODUWOLE, O., ORINGANJE, C. C. M. O., UDOH, E. E., BELLO, S., HORN, D. & MEREMIKWU, M. M. 2023. Hand hygiene for the prevention of infections in neonates. *Cochrane Database of Systematic Reviews*, 2023, CD013326.
- KYEI-ARTHUR, F., AGYEKUM, M. W., AFRIFA-ANANE, G. F., LARBI, R. T. & KISAAKYE, P. 2023. Perceptions about COVID-19 preventive measures among Ghanaian women. *PLoS ONE*, 18, e0284362.
- LEBEL, L., NAVY, H., SIHARATH, P., LONG, C. T. M., AUNG, N., LEBEL, P., HOANH, C. T. & LEBEL, B. 2023. COVID-19 and household water insecurities in vulnerable communities in the Mekong Region. *Environ Dev Sustain*, 25, 3503-3522.
- LEE, P., KURSCHEID, J. M., LAKSONO, B., PARK, M. J., CLEMENTS, A. C. A., LOWE, C., STEWART, D. E. & GRAY, D. J. 2023. Model validation for a knowledge and practices survey towards prevention of soil-transmitted helminth infections in rural villages in Indonesia. *Scientific reports*, 13, 1444.
- LEUNG, M. W., O'DONOGHUE, M. & SUEN, L. K. P. 2023. Personal and Household Hygiene Measures for Preventing Upper Respiratory Tract Infections among Children: A Cross-Sectional Survey of Parental Knowledge, Attitudes, and Practices. *International Journal of Environmental Research and Public Health*, 20, 229.
- LI, H., ZHAO, J., CHEN, R., LIU, H., XU, X., XU, J., JIANG, X., PANG, M., WANG, J., LI, S., HOU, J. & KONG, F. 2023. The relationships of preventive behaviors and psychological resilience with depression, anxiety, and stress among university students during the COVID-19 pandemic: A two-wave longitudinal study in Shandong Province, China. *Frontiers in public health*, 11, 1078744.
- LIBERO, G., BORDINO, V., GARLASCO, J., VICENTINI, C. & MARIA ZOTTI, C. 2023. Hand hygiene monitoring: Comparison between app and paper forms for direct observation. *Public Health Nursing*, 40, 313-316.
- LIM, K., LI, W. Y., DINATA, A. & HO, E. T. 2023. Comparing the antibacterial efficacy and functionality of different commercial alcohol-based sanitizers. *PLoS ONE*, 18, e0282005.
- LINTZ, J. 2023. Provider Satisfaction With Artificial Intelligence-Based Hand Hygiene Monitoring System During the COVID-19 Pandemic: Study of a Rural Medical Center. *J Chiropr Med*, 22, 197-203.

- LIU, Y., YUAN, S., WANG, L. Y., CHEN, S., LI, Y. & MA, W. 2023. Factors Affecting the Qualification Rate of Hand Disinfection Among Physicians: A Cross-Sectional Survey. *Journal of Multidisciplinary Healthcare*, 16, 4091-4097.
- LOMPO, P., HEROES, A. S., AGBOBLI, E., KAZIENGA, A., PEETERS, M., TINTO, H., LAGROU, K., SANGARE, L., AFFOLABI, D. & JACOBS, J. 2023. Growth of Gram-Negative Bacteria in Antiseptics, Disinfectants and Hand Hygiene Products in Two Tertiary Care Hospitals in West Africa-A Cross-Sectional Survey. *Pathogens*, 12, 917.
- LOOI, K. H. 2023. Correlations of demographic factors and hygiene factors with face mask wearing during the COVID-19 pandemic and suggestion for future research: A cross-sectional study of adults in Malaysia. *Journal of Public Health Research*, 12.
- LOPEZ, A., BURGOS, T., VANEGAS, M., ALVAREZ, Z., MENDEZ, Y. & QUINTEROS, E. 2023. FACTORS ASSOCIATED WITH MICROBIOLOGICAL CONTAMINATION OF CHICKEN MEAT MARKETED IN EL SALVADOR. *Revista Peruana de Medicina Experimental y Salud Publica*, 40, 25-33.
- LUETKE LANFER, H., BREW-SAM, N. & ROSSMANN, C. 2023. An Analysis of Power Dynamics Affecting Handwashing Interventions in Sierra Leone: Findings From a Qualitative Participatory Study. *JMIR Form Res*, 7, e39226.
- MA, Y., YI, J., MA, J., YU, H., LUO, L., WU, W., JIN, L., YANG, Q., LOU, T., SUN, D. & CAO, M. 2023. Hand Sanitizer Gels: Classification, Challenges, and the Future of Multipurpose Hand Hygiene Products. *Toxics*, 11, 687.
- MACLEOD, C., BRAUN, L., CARUSO, B. A., CHASE, C., CHIDZIWISANO, K., CHIPUNGU, J., DREIBELBIS, R., EJEMOT-NWADIARO, R., GORDON, B., ESTEVES MILLS, J. & CUMMING, O. 2023. Recommendations for hand hygiene in community settings: A scoping review of current international guidelines. *BMJ Open*, 13, e068887.
- MANGOCHI, H., TOLHURST, R., SIMPSON, V., KAWAZA, K., CHIDZIWISANO, K., FEASEY, N. A., MORSE, T. & MACPHERSON, E. 2023. A qualitative study exploring hand hygiene practices in a neonatal unit in Blantyre, Malawi: implications for controlling healthcare-associated infections. *Wellcome Open Res*, 7, 146.
- MARECKOVA, M., KNUDSEN, A. R., HANSEN, M. B. & MOLLER, J. K. 2023. Investigating Individual Hand Hygiene Improvements and Effect on Hospital-acquired Infections Using an Electronic Hand Hygiene Monitoring System: A Long-term Follow-up Study. *American Journal of Infection Control*, 51, S56.
- MASAKU, J., OKOYO, C., ARAKA, S., MUSUVA, R., NJAMBI, E., NJOMO, D. W., MWANDAWIRO, C. & NJENGA, S. M. 2023. Understanding factors responsible for the slow decline of soil-transmitted helminthiasis following seven rounds of annual mass drug administration (2012-2018) among school children in endemic counties of Kenya: A mixed method study. *PLoS Neglected Tropical Diseases*, 17, e0011310.
- MATSUDA, A., ASAYAMA, K., OBARA, T., YAGI, N. & OHKUBO, T. 2023. Behavioral changes of preventive activities of influenza among children in satellite cities of a metropolitan area of Tokyo, Japan, by the COVID-19 pandemic. *BMC public health*, 23, 727.
- MATSUNGO, T. M., KAMAZIWA, F., MAVHUDZI, T., MAKOTA, S., KAMUNDA, B., MATSINDE, C., CHAGWENA, D., MUKUDOKA, K. & CHOPERA, P. 2023. Influence of care group participation on infant and young child feeding, dietary diversity, WASH behaviours and nutrition outcomes in rural Zimbabwe. *BMJ Nutrition, Prevention and Health*, 6, 164-172.

- MBAKAYA, B. C., ZGAMBO, M. & KALEMBO, F. W. 2023. Hand hygiene knowledge and demonstrated technique among Malawian kindergarten children: A quasi-experimental study. *Nursing open*, 10, 5388-5395.
- MCKAY, K. J., LI, C., SOTOMAYOR-CASTILLO, C., FERGUSON, P. E., WYER, M. & SHABAN, R. Z. 2023. Health care workers' experiences of video-based monitoring of hand hygiene behaviors: a qualitative study. *American Journal of Infection Control*, 51, 83-88.
- MCKAY, K. J. & SHABAN, R. Z. 2023. Video based monitoring systems for hand hygiene compliance auditing: What do patients think? *PLoS ONE*, 18, e0281895.
- MEIERHOFER, R., KUNWAR, B. M. & SHRESTHA, A. 2023. Changes in water treatment, hygiene practices, household floors, and child health in times of Covid-19: A longitudinal cross-sectional survey in Surkhet District, Nepal. *International journal of hygiene and environmental health*, 249, 114138.
- MELAKU, A. & ADDIS, T. 2023. Handwashing Practices and Associated Factors Among School Children in Kirkos and Akaki Kality Sub-Cities, Addis Ababa, Ethiopia. *Environ Health Insights*, 17, 11786302231156299.
- MELAKU, A., ADDIS, T., MENGISTIE, B., KANNO, G. G., ADANE, M., KELLY-QUINN, M., KETEMA, S., HAILU, T., BEDADA, D. & AMBELU, A. 2023a. Menstrual hygiene management practices and determinants among schoolgirls in Addis Ababa, Ethiopia: The urgency of tackling bottlenecks - Water and sanitation services. *Heliyon*, 9, e15893.
- MELAKU, A., MENGISTIE, B. & ADDIS, T. 2023b. The Status of School Water, Sanitation, and Hygiene Services in Addis Ababa, Ethiopia: Progress Towards Achieving the SDG 6. *Environ Health Insights*, 17, 11786302231199003.
- MELEKO, A., TURGEMAN, D. B., CAPLAN, N., BAUM, S., ZERAI, N. K., ZAADNOORDIJK, W., BRUCK, M., SABAR, G., BENTWICH, Z. & GOLAN, R. 2023. High prevalence of soil-transmitted helminths and schistosomiasis among primary schoolchildren in Southwest Ethiopia: the need for health strategies alongside mass drug administration. *International health*.
- MELESE, M., BIRHAN, T. A., SIMEGN, W., ADUGNA, D. G., DIRESS, M., GETAWA, S. & AZANAW, J. 2023. Prevalence of Diarrhea, Intestinal Parasites, and Associated Factors Among Under-Five Children in Dabat District, Northwest Ethiopia: Multicenter Cross-sectional Study. *Environ Health Insights*, 17, 11786302231174744.
- MELVILLE, N., REDMOND, E. C., BALDWIN, J. E. B. & EVANS, E. W. 2023. Inclusion of Food Safety Information in Home-delivered U.K. Meal-kit Recipes. *Journal of food protection*, 86, 100162.
- MESELE, F., LETA, S., AMENU, K. & ABUNNA, F. 2023. Occurrence of Escherichia Coli O157:H7 in lactating cows and dairy farm environment and the antimicrobial susceptibility pattern at Adami Tulu Jido Kombolcha District, Ethiopia. *BMC Veterinary Research*, 19, 6.
- MEZA SIERRA, C. U., PEREZ JAIMES, G. A. & RUEDA DÍAZ, L. J. 2023. Interventions to improve knowledge or compliance to hand hygiene in nursing students: A scoping review. *J Infect Prev*, 24, 30-44.
- MIHALACHE, O. A., TEIXEIRA, P., LANGSRUD, S. & NICOLAU, A. I. 2023. Hand hygiene practices during meal preparation-a ranking among ten European countries. *BMC public health*, 23, 1315.
- MLOUKI, I., AYED, S. B., CHEBBI, F., REZG, N., KHOULDI, A., SASSI, A. H. & EL MHAMDI, S. 2023. Hand hygiene and biomedical waste management among medical students: a quasi-experimental study evaluating two training methods. *BMC medical education*, 23, 634.

- MOIWO, M. M., KAMARA, G. N., KAMARA, D., KAMARA, I. F., SEVALIE, S., KOROMA, Z., KAMARA, K. N., KAMARA, M. N., KAMARA, R. Z., KPAGOI, S. S. T. K., KONTEH, S. A., MARGAO, S., FOFANAH, B. D., THOMAS, F., KANU, J. S., TWEYA, H. M., SHEWADE, H. D. & HARRIES, A. D. 2023. Have Hand Hygiene Practices in Two Tertiary Care Hospitals, Freetown, Sierra Leone, Improved in 2023 following Operational Research in 2021? *Tropical Medicine and Infectious Disease*, 8, 431.
- MONIRA, S., BARMAN, I., JUBYDA, F. T., ALI, S. I., ISLAM, A., RAHMAN, K. M. Z., RASHID, M. U., JOHURA, F. T., SULTANA, M., ZOHURA, F., BHUYIAN, S. I., PARVIN, T., SACK, D., AHMED, T., SAIF-UR-RAHMAN, K. M., HOSSAIN, M., WATANABE, H., GEORGE, C. M. & ALAM, M. 2023. Gut microbiota shifts favorably with delivery of handwashing with soap and water treatment intervention in a prospective cohort (CHOBI7 trial). *Journal of health, population, and nutrition*, 42, 146.
- MOSISA, G., DIRIBA, D. C., TSEGAYE, R., KEJELA, G., BAYISA, D., OLUMA, A., WAKUMA, B., ABADIGA, M., TURI, E., ABERA, T., BAYISA, L. & TUFA, G. 2023. Burden of intestinal parasitic infections and associated factors among pregnant women in East Africa: a systematic review and meta-analysis. *Maternal Health, Neonatology and Perinatology*, 9, 5.
- MRAZ, A. L., MUTYALA, N., CLEARY, S. & SEALS, B. F. 2023. Is Personal Protective Equipment Worth the Hassle? Annual Risk of Cryptosporidiosis to Dairy Farmers and How Personal Protective Equipment and Handwashing Can Mitigate It. *Microorganisms*, 11.
- MUBARAK, A. G., MOHAMMED, E. S., ELAADLI, H., ALZAYLAEE, H., HAMAD, R. S., ELKHOLY, W. A. & YOUSEEF, A. G. 2023. Prevalence and risk factors associated with *Toxocara canis* in dogs and humans in Egypt: A comparative approach. *Veterinary Medicine and Science*, 9, 2475-2484.
- MUCHANGI, J. M., MTURI, J., MUKASA, H., KITHUKI, K., KOSGEI, S. J., KANYANGI, L. M., MARARO, R. & NANKANJA, M. 2023. Levels of handwashing and vaccine uptake in Kenya, Uganda, and Tanzania to prevent and control COVID-19: a systematic review and meta-analysis. *Frontiers in public health*, 11, 1256007.
- MUKUTMONI, M., LIZA, F. T., PARVIN, R. A. & NATH, T. C. 2023. Perceptions and practices of urban slum-dwelling women concerning soil-transmitted helminths infections in Bangladesh: A cross-sectional study. *Parasite Epidemiology and Control*, 21, e00291.
- MWAPASA, T., CHIDZIWISANO, K., LALLY, D. & MORSE, T. 2023. Hygiene in early childhood development centres in low-income areas of Blantyre, Malawi. *International Journal of Environmental Health Research*, 33, 751-767.
- NAGAI, T., TAGUCHI, K., ISOBE, T., MATSUYAMA, N., HATTORI, T., UNNO, R., KATO, T., ETANI, T., HAMAKAWA, T., FUJII, Y., IKEGAMI, Y., KAMIYA, H., HAMAMOTO, S., NAKANE, A., ANDO, R., MARUYAMA, T., OKADA, A., KAWAI, N. & YASUI, T. 2023. A Multicenter, Prospective, Non-randomized Study Evaluating Surgical hand Preparation between Double-Gloving and Single-Gloving for Preventing Postoperative Infection in Robotic and Laparoscopic Minimally Invasive Surgeries. *Urology journal*, 20, 109-115.
- NASSOLO, N., WALEKHWA, A. W., KIZZA, F. G. & OSURET, J. 2023. COVID-19 unanticipated benefits to hand washing coverage and practices in health care facilities in central Uganda. *African Health Sciences*, 23, 155-167.
- NEGUSSIE, A., LEJORE, E., HAILEMARIAM, A., TEFERA, B., MAZENGLIA, E. M., DEJENE, T., TADESSE, Y., ADANE, Y., GUGSA, K., BANDA, K., SHARMA, R. & GIRMA, E. 2023. BabyWASH and diarrhea prevention practices following multimedia educational intervention in hard-to-reach areas of the Afar and Somali regions of Ethiopia: a mixed-method endline evaluation. *BMC public health*, 23, 1998.

- NGUYEN, T. B., NGUYEN, T. T. H., HUYNH, S. Q., PHU, T. V., TAHA, A. M., NGUYEN, D., LE, H. M., NGUYEN, H. N., NGUYEN, L. T. K. & TRAN, N. T. 2023. Seroprevalence of Toxocara at Tra Vinh University Hospital in Vietnam. *European Review for Medical and Pharmacological Sciences*, 27, 10334-10341.
- OBACH, A., CABIESES, B., VEZZANI, F., ROBLEDO, C., BLUKACZ, A. & VIAL, P. 2023. Perceived barriers and facilitators for adhering to COVID-19 preventive measures in Chile: a qualitative study in three large cities. *BMC Infectious Diseases*, 23, 158.
- OBIEFUNA, E. C., OJONTA, O. I. & OGBUABOR, J. E. 2023. The influence of COVID-19 pandemic and coping strategies on work operation of nonfarm household enterprises in Nigeria. *Environ Dev Sustain*, 1-16.
- OLSEN, M., DEMANEUF, T., SINGH, G., GOLDSWORTHY, A., JONES, P., MORGAN, M., NASSAR, R., SENOK, A., GHEMRAWI, R., ALMHEIRI, R., MARZOOQI, H. A., ALMANSOORI, S., ALBASTAKI, A., ALMANSOORI, R., MCKIRDY, S., ALGHAFRI, R. & TAJOURI, L. 2023. Do mobile phone surfaces carry SARS-CoV-2 virus? A systematic review warranting the inclusion of a "6th" moment of hand hygiene in healthcare. *Journal of Infection and Public Health*, 16, 1750-1760.
- PARTAP, U., TADESSE, A. W., SHINDE, S., SHERFI, H., MANK, I., MWANYIKA-SANDO, M., SHARMA, D., BAERNIGHAUSEN, T., DRYSDALE, R., WORKU, A., TINKASIMILE, A. & FAWZI, W. W. 2023. Burden and determinants of anaemia among in-school young adolescents in Ethiopia, Sudan and Tanzania. *Maternal and Child Nutrition*.
- PASUPULETI, D., SASIDHARAN, S., MANIKUTTY, G., DAS, A. M., PANKAJAKSHAN, P. & STRAUSS, S. 2023. Co-designing the Embodiment of a Minimalist Social Robot to Encourage Hand Hygiene Practises Among Children in India. *Int J Soc Robot*, 15, 345-367.
- PETERMANN-ROCHA, F., RAO, N., BALA, M., PARSHAD-ASNANI, M., SIFUNA, A., YOUSAFZAI, A., HO, F. K. & IP, P. 2023. Hygiene Practices and Early Childhood Development in the East Asia-Pacific Region: A Cross-Sectional Analysis. *International Journal of Environmental Research and Public Health*, 20, 2798.
- PIETERS, M. M., FAHSEN, N., CRAIG, C., QUEZADA, R., PRATT, C. Q., GOMEZ, A., BROWN, T. W., KOSSIK, A., MCDAVID, K., VEGA OCASIO, D., LOZIER, M. J. & CORDON-ROSALES, C. 2023. Assessment of Water, Sanitation, and Hygiene Conditions in Public Elementary Schools in Quetzaltenango, Guatemala, in the Context of the COVID-19 Pandemic. *International Journal of Environmental Research and Public Health*, 20, 6914.
- PINCHOFF, J., DOUGHERTY, L. & DADI, C. 2023. Water and Handwashing in a Drought-Prone Region of Southern Niger: How Environment, Household Infrastructure, and Exposure to Social and Behavior Change Messages Interact. *American Journal of Tropical Medicine and Hygiene*, 108, 536-542.
- PLUTA, P. L., BARTELS, B. D. & CHAIYAPERM, V. 2023. Supplementary Handwashing Techniques to Improve Hand Hygiene. *Pharmaceutical Technology Europe*, 35, 17-23.
- POOSEESOD, K., UMEZAKI, M., PHETRAK, A. & PHUANUKOONNON, S. 2023. Corrigendum: Handwashing among caregivers of young children in a protracted and complex refugee and immigration context: a mixed methods study on the Thai-Myanmar border. *Frontiers in public health*, 11, 1279605.
- PRATT, C., KESANDE, M., TUSABE, F., MEDLEY, A., PRENTICE-MOTT, G., LOZIER, M., TRINIES, V., YAPSWALE, S., NABATYANGA, S., ISABIRYE, H., LAMORDE, M. & BERENDES, D. 2023. Access to and Use of Hand Hygiene Resources during the COVID-19 Pandemic in Two Districts in Uganda, January-April 2021. *American Journal of Tropical Medicine and Hygiene*, 109, 881-889.

RAGONESE, B., MULARONI, A., VALERI, A., CAMPANELLA, M., CORSO, B., FAZZINA, M. L., BARONE, M. A., ARENA, G., LOMBARDO, R. & LUCA, A. 2023. Reducing Carbapenem-Resistant Enterobacteriaceae Using the Targeted Solution Tool: A Quality Improvement Project. *Journal of nursing care quality*, 38, 47-54.

RAHIMI, B. A., RAFIQI, N., TAREEN, Z., KAKAR, K. A., WAFI, M. H., STANIKZAI, M. H., BEG, M. A., DOST, A. K. & TAYLOR, W. R. 2023. Prevalence of soil-transmitted helminths and associated risk factors among primary school children in Kandahar, Afghanistan: A cross-sectional analytical study. *PLoS Neglected Tropical Diseases*, 17, e0011614.

REGASSA, R., TAMIRU, D., DUGUMA, M. & BELACHEW, T. 2023. Environmental enteropathy and its association with water sanitation and hygiene in slum areas of Jimma Town Ethiopia. *PLoS ONE*, 18, e0286866.

RIFQI, M. A., HAMIDAH, U., SINTAWARDANI, N., HARADA, H., NYAMBE, S., SAI, A. & YAMAUCHI, T. 2023. Effect of handwashing on the reduction of *Escherichia coli* on children's hands in an urban slum Indonesia. *Journal of Water and Health*, 21, 1651-1662.

ROBERTS, K. R., PAEZ, P., SAUER, K., ALCORN, M. & JOHNSON, D. E. 2023. Impact of Training on Employees' Handwashing Behaviors in School Nutrition Programs. *Journal of the Academy of Nutrition and Dietetics*, 123, 770-782.

ROSENBERG, M. A. S., ADAMS, M., POLICK, C., RATLIFF, H., LI, W. V. & JUN, J. 2023. Service Workers' Experience and Perceptions of Workplace Protective Measures During the Onset of COVID-19. *Workplace health & safety*, 71, 144-151.

ROSENFELDT KNUDSEN, A., BO HANSEN, M. & KJOLSETH MOLLER, J. 2023. Individual hand hygiene improvements and effects on healthcare-associated infections: a long-term follow-up study using an electronic hand hygiene monitoring system. *Journal of Hospital Infection*, 135, 179-185.

ROSS, I., BICK, S., AYIEKO, P., DREIBELBIS, R., WOLF, J., FREEMAN, M. C., ALLEN, E., BRAUER, M. & CUMMING, O. 2023. Effectiveness of handwashing with soap for preventing acute respiratory infections in low-income and middle-income countries: a systematic review and meta-analysis. *The Lancet*, 401, 1681-1690.

RUTTER, S., MADDEN, A. & WHITE, L. 2023. Challenges of accessing hygiene facilities when on the move: an exploratory interview study with UK mobile workers. *BMC public health*, 23, 2514.

SAHNI, B., KUMAR, D. & BALA, K. 2023. Assessment of Water, Sanitation and Hygiene (WASH) in Schools of Jammu District-A Cross Sectional Study. *Indian Journal of Public Health Research and Development*, 14, 64-71.

SALAM, A. S., QAYUMI, R., MAJEED SIDDIQI, A., NASEEM, M., MANSOOR, M., BUTCHER, R., BAKHTIARI, A., RENNEKER, K., WILLIS, R., JIMENEZ, C., DEJENE, M., SAFI, N., HEGGEN, A., SOLOMON, A. W., HARDING-ESCH, E. M. & ALIZOI, N. 2023. Prevalence of Trachoma in 72 Districts of Afghanistan in 2018-2019: Results of 35 Population-based Prevalence Surveys. *Ophthalmic Epidemiol*, 30, 608-618.

SALINAS-ESCUADERO, G., LA ROSA-ZAMBONI, D., CARRILLO-VEGA, M. F., GAMINO-ARROYO, A. E., TOLEDANO-TOLEDANO, F., ORTEGA-RIOSVELASCO, F., GRANADOS-GARCIA, V., VILLA-GUILLEN, M. & GARDUNO-ESPINOSA, J. 2023. Cost-effectiveness analysis of a hand hygiene monitoring system in a tertiary pediatric hospital in Mexico. *Frontiers in public health*, 11, 1117680.

SANDS, M. & AUNGER, R. 2023. Process Evaluation of an Acute-Care Nurse-Centred Hand Hygiene Intervention in US Hospitals. *Evaluation review*, 193841X231197253.

- SARKER, A. R., ZABEEN, I., ALI, N., ASHRAF, A. & HOSSAIN, Z. 2023. Inequality of handwashing practice using antimicrobial agents in Bangladesh: a household level analyses. *Public Health*, 214, 106-115.
- SASSEN RATH, C., DIEFENBACHER, S., KOLBE, V., NIESALLA, H. & KELLER, J. 2023. The impact of activating an empathic focus during COVID19 on healthcare workers motivation for hand hygiene compliance in moments serving the protection of others: a randomized controlled trial study. *Journal of Public Health (Germany)*, 31, 1381-1385.
- SAULNIER, A., WENDLING, J. M., HERMANT, B. & LEPELLETIER, D. 2023. SARS-CoV-2 transmission modes: Why and how contamination occurs around shared meals and drinks? *Food microbiology*, 114, 104297.
- SEFERI, A., PARGINOS, K., JEAN, W., CALERO, C., FOGEL, J., MODESTE, S., SCOTT, B. A., DALY-WALSH, M., YAP, W., KAUR, M., BRADY, T. & MADALINE, T. 2023. Hand hygiene behavior change: a review and pilot study of an automated hand hygiene reminder system implementation in a public hospital. *Antimicrob Steward Healthc Epidemiol*, 3, e122.
- SELVARAJ, R., CHENG, E. J., GAN, P., OH, J. Q. & AUNG, K. T. 2023. Microbiological Profiles of Disposable Gloves Used for Handling Ready-to-Eat Foods. *Journal of food protection*, 86, 100146.
- SENG, J. J. B., YEAM, C. T., HUANG, C. W., TAN, N. C. & LOW, L. L. 2023. Pandemic-related health literacy: a systematic review of literature in COVID-19, SARS and MERS pandemics. *Singapore medical journal*.
- SEPADI, M. M. & NKOSI, V. 2023. Health Risk Assessment of Informal Food Vendors: A Comparative Study in Johannesburg, South Africa. *International Journal of Environmental Research and Public Health*, 20, 2736.
- SHAMA, A. T., WAKUMA, O., DEBELO, S., TEREFA, D. R., CHEME, M. C., LEMA, M., BIRU, B. & GETA, E. T. 2023. Prevalence and associated factors of stunting and thinness among primary school-aged children in Gudeya Bila district, West Ethiopia: A cross-sectional study. *BMJ Open*, 13, e072313.
- SHAPNA, K. J., HASAN, K., KABIR, K. H., LI, J. & HOSSAIN MD, L. 2023. Water, sanitation and hygiene challenges of forcibly displaced Myanmar nationals in Rohingya camps in Bangladesh. *Journal of Water and Health*, 21, 1385-1403.
- SHI, C., O'DONOGHUE, M., YANG, L., TSANG, H., CHEN, J., ZOU, J., QIN, J., MAK, Y. W., PITTET, D., XIE, Y. J., LAI, T., LI, C. & CAO, J. 2023. Factors associated with hand washing effectiveness: an institution-based observational study. *Antimicrobial Resistance and Infection Control*, 12, 85.
- SHIFERAW, Y. F., ASMAMAW, D. B., ENGIDAW, M. T., BELAY, D. G., BIRHAN, H. & NEGASH, W. D. 2023. The prevalence of undernutrition among students attending traditional Ethiopian orthodox Tewahedo church schools in northwest Ethiopia. *Frontiers in public health*, 11, 1124173.
- SILUBONDE-MOYANA, T. M., DRAPER, C. E. & NORRIS, S. A. 2023. Effectiveness of behavioural interventions to influence COVID-19 outcomes: A scoping review. *Preventive Medicine*, 172, 107499.
- SIMANJUNTAK, D. F., KUSUMAWATI, R. L., BADER, O., LUDER, C. G. K., ZIMMERMANN, O. & GROSS, U. 2023. A comparative pilot study on Gram-negative bacteria contaminating the hands of children living in urban and rural areas of Indonesia versus Germany - A suitable monitoring strategy for diarrhea risk assessment? *Frontiers in Microbiology*, 14, 1152411.
- SIMIYU, S., ASEYO, E., ANDERSON, J., CUMMING, O., BAKER, K. K., DREIBELBIS, R. & MUMMA, J. A. O. 2023. A Mixed Methods Process Evaluation of a Food Hygiene Intervention in Low-Income Informal Neighbourhoods of Kisumu, Kenya. *Maternal and child health journal*, 27, 824-836.

- SOLOMON, Z., GIDISA, B., GEBEYHU, K., TEWABE, H., SHENKUTE, D., KASSA, M., GIZE, A. & MITIKU, A. 2023. Prevalence, antibiotic susceptibility pattern, and associated factors of enteric bacterial pathogens among hiv infected patients with diarrhea attending the art clinic of dilla university referral hospital, southern ethiopia. *Infection and Drug Resistance*, 16, 4227-4236.
- SOM, S. V., WIERINGA, F. T., CAMPOS PONCE, M., POLMAN, K., DAKURAH, P., DUNCAN, D., BLOMBERG, J., RASPHONE, S. & HOEVEN, M. V. D. 2023. Association of both Water, Sanitation and Hygiene (WASH) and Infant and Young Child Feeding (IYCF) practices with childhood malnutrition in Lao PDR: A cross-sectional study of the 2017 Lao Social Indicator Survey II. *BMJ Open*, 13, e073974.
- SOUZA NETO, V. L., LOPES, C. T., BARROS, A. L. B. L., TAMINATO, M., SANTOS, V. B. & LOPES, J. L. 2023. Telephone messages regarding preventive measures against COVID-19. *Revista gaucha de enfermagem*, 44, e20220328.
- SULIMAN, S., AKBAR, R., YOUSAF, Z., GHAZOUANI, H., AL-MOHANADI, D., AL-MOHAMMED, A. & ALKHAL, A. 2023. The Pros and Cons of Use of Handheld Electronic Devices During Ward Rounds and the Impact of the COVID-19 Pandemic. *Adv Med Educ Pract*, 14, 245-255.
- SZCZUKA, Z., SIWA, M., ABRAHAM, C., BABAN, A., BROOKS, S., CIPOLLETTA, S., DANSO, E., DOMBROWSKI, S. U., GAN, Y., GASPAR, T., GASPAR DE MATOS, M., GRIVA, K., JONGENELIS, M., KELLER, J., KNOLL, N., MA, J., ABDUL AWAL MIAH, M., MORGAN, K., PERAUD, W., QUINTARD, B., SHAH, V., SCHENKEL, K., SCHOLZ, U., SCHWARZER, R., TAUT, D., TOMAINO, S. C. M., VILCHINSKY, N., WOLF, H. & LUSZCZYNSKA, A. 2023. Handwashing adherence during the COVID-19 pandemic: A longitudinal study based on protection motivation theory. *Social Science and Medicine*, 317, 115569.
- TAKEBAYASHI, M., KANEDA, Y., NAMBA, M., YAMASHIRO, A. & TAKEBAYASHI, K. 2023. Assessing Hand Sanitizer Usage in Japanese Elderly Day Care Centers: An Observational and Interventional Study. *Cureus*, 15, e46834.
- TAMENE, A., HABTE, A., TAGESSE, M., ENDALE, F., MELIS, T., SEWALEM, Z. W. & AFEWORK, A. 2023. Exploring associations between household environmental factors and handwashing with essential agents in sub-Saharan Africa. *PLoS ONE*, 18, e0286735.
- TARANUM, A., SHWETHA, T. M., MUHAMMED MUNTAZEEM, G. & KURRE, B. 2023. Safe Drinking Water Practices among the Households in Rural Field Practice Area of a Medical College: A Cross Sectional Study. *Indian Journal of Public Health Research and Development*, 14, 36-40.
- THOLCKE, L. C., FANG, W. H., GORNICK, B. R. & SCHLECHTER, J. A. 2023. Investigating particulate production in the operating suite following the use of waterless alcohol based dry scrub versus traditional hand washing and drying with commonly used surgical towels: An experimental study. *American Journal of Infection Control*, 51, 551-556.
- THOM, K. A., ROCK, C., ROBINSON, G. L., REISINGER, H. S., BALOH, J., LI, S., DIEKEMA, D. J., HERWALDT, L. A., JOHNSON, J. K., HARRIS, A. D. & PERENCEVICH, E. N. 2023. Direct Gloving vs Hand Hygiene before Donning Gloves in Adherence to Hospital Infection Control Practices: A Cluster Randomized Clinical Trial. *JAMA Network Open*, 6, E2336758.
- TRIVEDI, P., BHAVSAR, P., SAXENA, D., KALPANA, P., PATEL, K., DAS, T. & YASOBANT, S. 2023. Dissecting WASH Assessment Tools and Recommending a Comprehensive Tool for Indian Healthcare Facilities. *Risk Management and Healthcare Policy*, 16, 1593-1610.
- TUSABE, F., LAMORDE, M., MEDLEY, A., KESANDE, M., LOZIER, M. J., YAPSWALE, S., OCITI, F., ISABIRYE, H., NUWAMANYA, E., NANYONDO, J., BOORE, A., VOSBURGH, W., KASULE, J. N., PRATT, C. & BERENDES, D. 2023. Establishment of District-Led Production of WHO-Recommended Alcohol-based Hand Rub (ABHR) during the COVID-19 Pandemic: A Model for Improving Access to ABHR during Health Emergencies. *J Water Sanit Hyg Dev*, 13, 847-856.

- TZIKAS, A. & KOULIERAKIS, G. 2023. A systematic review of nudges on hand hygiene against the spread of COVID-19. *J Behav Exp Econ*, 105, 102046.
- ULAGANEETHI, R., SAYA, G. K., RAJKUMARI, N., KUMAR, S. S., GANAPATHY, K. & DORAIRAJAN, G. 2023. Soil-Transmitted Helminth Infections among Antenatal Women in Primary Care Settings in Southern India: Prevalence, Associated Factors and Effect of Anti-Helminthic Treatment. *Tropical Medicine and Infectious Disease*, 8, 48.
- UPRETY, S., SHERCHAN, S. P., NARAYANAN, P., DANGOL, B., MAGGOS, M., CELMER, A., SHISLER, J., AMARASIRI, M., SANO, D. & NGUYEN, T. H. 2023. Microbial assessment of water, sanitation, and hygiene (WaSH) in temporary and permanent settlements two years after Nepal 2015 earthquake. *Science of the Total Environment*, 877, 162867.
- URQUIDI, C., SANTELICES, E., LAGOMARCINO, A. J., TERESA VALENZUELA, M., LARRANAGA, N., GONZALEZ, E., PAVEZ, A., WOSIACK, A., MATURANA, M., MOLLER, P., PABLO TORRES, J., MUNOZ, S. & O'RYAN, G. M. 2023. The added effect of non-pharmaceutical interventions and lifestyle behaviors on vaccine effectiveness against severe COVID-19 in Chile: A matched case-double control study. *Vaccine*, 41, 2947-2955.
- VAGHA, K., SAWHNEY, S., VARMA, A., VAGHA, J. D. & MISHRA, N. 2023. Assessment of the Impact of a Short-Term Intervention on Menstrual Hygiene Practices of Adolescent Girls in Rural Parts of Central India. *Cureus*, 15, e44933.
- VALEK, R., WENDEL-GARCIA, P. D., SCHUEPBACH, R. A., BUEHLER, P. K. & HOFMAENNER, D. A. 2023. Eye-tracking to observe compliance with hand hygiene in the intensive care unit: a randomized feasibility study. *Journal of Hospital Infection*, 131, 148-155.
- VALIM, M. D., CORREA, E. R., MACHADO, A. P., CORREA, L. V. A., DE MORAIS, R. B., DA SILVA TEIXEIRA, R. F. & LACEY, G. 2023. The impact of an effective 3-step hand hygiene technique in reducing potentially pathogenic microorganisms found on nursing professionals' hands. *Journal of Infection in Developing Countries*, 17, 1088-1098.
- VAN DIJK, M. D., NIEBOER, D., VOS, M. C. & VAN BEECK, E. F. 2023. Validity of self-reported compliance and behavioural determinants of observed compliance: an application of the COM-B hand hygiene questionnaire in nine Dutch hospitals. *Journal of Hospital Infection*, 137, 61-68.
- VEIGA, G. R. S., DA SILVA, G. A. P., PADILHA, B. M. & LIMA, M. D. C. 2023. Determining factors of child linear growth from the viewpoint of Bronfenbrenner's Biocological Theory. *Jornal de Pediatria*, 99, 205-218.
- VELARDO, F., PÉFAU, M., NASSO, R., PARNEIX, P. & VENIER, A. G. 2023. Using patients' observations to evaluate healthcare workers' alcohol-based hand rub with Pulpe'friction audits: a promising approach? *GMS Hyg Infect Control*, 18, Doc29.
- VERMA, J., MISHRA, R., MAZUMDAR, A., SINGH, R. & EL-GENDY, N. S. 2023. Development and Evaluation of an Eco-Friendly Hand Sanitizer Formulation Valorized from Fruit Peels. *International Journal of Biomaterials*, 2023, 2516233.
- VOIDAROU, C., ROZOS, G., STAVROPOULOU, E., GIORGI, E., STEFANIS, C., VAKADARIS, G., VAOU, N., TSIGALOU, C., KOURKOUTAS, Y. & BEZIRTZOGLU, E. 2023. COVID-19 on the spectrum: a scoping review of hygienic standards. *Front Public Health*, 11, 1202216.
- VONIATIS, C., BANSAGHI, S., VERES, D. S., SZEREMY, P., JEDLOVSZKY-HAJDU, A., SZIJARTO, A. & HAIDEGGER, T. 2023. Evidence-based hand hygiene: Liquid or gel handrub, does it matter? *Antimicrobial Resistance and Infection Control*, 12, 12.

- WANA, E. W. & MENGESHA, N. A. 2023. Hand-Washing at Critical Times and Associated Factors Among Mothers/Caregivers of Under-Five Year Children in Nefas Silk Lafto Sub-City, Addis Ababa, Ethiopia. *Health Serv Res Manag Epidemiol*, 10, 23333928231153011.
- WANG, C., JIANG, W., YANG, K., SARSENBAYEVA, Z., TAG, B., DINGLER, T., GONCALVES, J. & KOSTAKOS, V. 2023a. Use of thermal imaging to measure the quality of hand hygiene. *Journal of Hospital Infection*, 139, 113-120.
- WANG, P., ASARE, E. O., PITZER, V. E., DUBROW, R. & CHEN, K. 2023b. Floods and Diarrhea Risk in Young Children in Low- and Middle-Income Countries. *JAMA Pediatrics*, 177, 1206-1214.
- WATSON, J., AMON-TANO, M. A., DEOLA, C., HAJI, M. A., SHEIKH, M. R., MOHAMUD, F. A., ALI, S. Y., MACDOUGALL, A. & CUMMING, O. 2023a. Effect of a novel hygiene intervention on older children's handwashing in a humanitarian setting in Kahda district, Somalia: A cluster-randomised controlled equivalence trial. *International journal of hygiene and environmental health*, 250, 114163.
- WATSON, J., CUMMING, O. & DREIBELBIS, R. 2023b. Nongovernmental Organization Practitioners' Perspectives on the Challenges and Solutions to Changing Handwashing Behavior in Older Children: A Qualitative Study. *Global health, science and practice*, 11.
- WATSON, J., OSMAN, I. M. E., AMON-TANO, M., DEOLA, C., MACDOUGALL, A. & CUMMING, O. 2023c. A cluster-randomised controlled equivalence trial of the Surprise Soap handwashing intervention among older children living in a refugee settlement in Sudan. *BMJ Global Health*, 8, e012633.
- WEIGEL, M. M. & ARMIJOS, R. X. 2023. Association of household food insecurity with developmental delay in preschool children: 2018 Ecuadorian Nutrition and Health National Survey. *Journal of Nutritional Science*, 12, e89.
- WIHDATURRAHMAH & CHUEMCHIT, M. 2023. Determinants of Menstrual Hygiene Among Adolescent School Girls in Indonesia. *International Journal of Women's Health*, 15, 943-954.
- WILSON, K. B., SATCHELL, L., SMATHERS, S. A., GOFF, L. F. L., SAMMONS, J. S. & COFFIN, S. E. 2023. The power of feedback: Implementing a comprehensive hand hygiene observer program. *American Journal of Infection Control*, 51, 142-148.
- WOLDESENBET, B., TOLCHA, A. & TSEGAYE, B. 2023. Water, hygiene and sanitation practices are associated with stunting among children of age 24-59 months in Lemo district, South Ethiopia, in 2021: community based cross sectional study. *BMC Nutrition*, 9, 17.
- YAMAKAWA, M., TANAKA, Y. & TOMOKAWA, S. 2023. Personal characteristics associated with handwashing behaviour among Japanese university students studying abroad: Prospective observational studies. *Travel Medicine and Infectious Disease*, 56, 102651.
- YAN, S. D., S, D. S., DESAI, M., DELANEY, M. M., BOBANSKI, L., RAJKUMAR, N., MURTHY, S. & HENRICH, N. 2023. Qualitative assessment of family caregiver-centered neonatal education program in Karnataka, India. *PLOS Glob Public Health*, 3, e0000524.
- YIP, F. & DIAMOND, L. 2023. Understanding resident, family, and caregiver experiences to inform the development of a multimodal hand hygiene program in long-term care. *Canadian Journal of Infection Control*, 38, 83-90.
- YIRDAW, G., DESSIE, A., AZANAW, J. & BIRHAN, T. A. 2023. Latrine Utilization and its Associated Factors in Urban Slums Dwellers of Gondar City, Northwest Ethiopia: A Community-Based Cross-Sectional Study. *Environ Health Insights*, 17, 11786302231203067.

ZACHARIA, F., SILVESTRI, V., MUSHI, V., OGWENO, G., MAKENE, T. & MHAMILAWA, L. E. 2023. Burden and factors associated with ongoing transmission of soil-transmitted helminths infections among the adult population: A community-based cross-sectional survey in Muleba district, Tanzania. *PLoS ONE*, 18, e0288936.

ZEYNUDIN, A., DEGEFA, T., SULEMAN, S., ABAMECHA, A., HAJIKELIL, Z. & WIESER, A. 2023. Prevalence and Determinants of Geohelminthiasis among School-Age Children in Jimma City, Ethiopia. *Journal of Tropical Medicine*, 2023, 8811795.

ZHANG, Y., CHEN, X., LAO, Y., QIU, X., LIU, K., ZHUANG, Y., GONG, X. & WANG, P. 2023. Effects of the Implementation of Intelligent Technology for Hand Hygiene in Hospitals: Systematic Review and Meta-analysis. *Journal of Medical Internet Research*, 25, e37249.

ZWICKER, P., MENG, M., FRIESECKE, S., STEIN, T., HERZOG, A., HERZER, C., KAMMERLANDER, M., GEBHARDT, T., KUGLER, C. & KRAMER, A. 2023. An interactive feedback system for increasing hand antisepsis adherence in stationary intensive care. *Journal of Hospital Infection*, 133, 73-80.