

Interventions to improve hand hygiene in community settings: A systematic review of theories, barriers and enablers, behavior change techniques, and hand hygiene station design features

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S5 – Overview of included studies

Supplemental Table 5. Included studies and key characteristics

Study ID	Design	Country	Location	Setting	Participant category	Theory used	Hand hygiene outcome(s)	Quality Appraisal	Effective?
Abbot 2012	Non-randomized quantitative	United States	Unspecified	Universities	Adults (Women and Men)	Theory of Planned Behavior; Theory of reasoned action	Handwashing with soap and water	2	Yes
Aboud 2011	Randomized controlled trial	Bangladesh	Rural	Households	Mother-child dyads	Social-cognitive learning theory	Handwashing - unspecified	4	Yes
Advaita 2021	Non-randomized quantitative	India	Urban	Households	Children (Boys only)	No theory reported	Handwashing - unspecified	3	Yes
Aibana 2013	Non-randomized quantitative	Haiti	Rural	Households	General populations	No theory reported	Handwashing with soap and water	4	Yes
Aiello 2012	Randomized controlled trial	United States	Unspecified	Universities	Adults (Women and Men)	No theory reported	Handrubbing with alcohol-based rub	4	Yes
Akina 2020	Randomized controlled trial	Nepal	Unspecified	Schools	Children (Girls and Boys)	No theory reported	Handwashing - unspecified	3	Yes
Akuokoasibey 1994	Non-randomized quantitative	Ghana	Rural	Households	General populations	No theory reported	Handwashing with water; Handwashing with soap and water	3	Yes
Alam 1989	Non-randomized quantitative	Bangladesh	Rural	Households	Mother-child dyads	No theory reported	Handwashing with water; Handwashing with soap alternatives	4	Yes
Alexander 2012	Non-randomized quantitative	India	Rural	Households; Schools	General populations; Children (Girls and Boys)	No theory reported	Handwashing - unspecified	4	Yes
Ali 2020	Non-randomized quantitative	Liberia	Urban	Households	General populations	No theory reported	Handwashing with soap alternatives	3	Yes

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Alkon 2009	Randomized controlled trial	United States	Rural; Urban	Childcare centers	Non-food occupational workers	No theory reported	Handwashing - unspecified	4	Yes
Almazan 2014	Non-randomized quantitative	The Philippines	Rural	Households	Adults (Women and Men)	No theory reported	Handwashing with water; Handwashing with soap and water	3	Yes
Amon-Tanoh 2021	Randomized controlled trial	Côte d'Ivoire	Urban	Households	General populations	Theory of normative social behaviour	Handwashing with soap and water	5	Yes
Andrade 2019	Non-randomized quantitative	El Salvador	Rural	Households; Schools	General populations	No theory reported	Handwashing with soap and water	4	Yes
Anu 2018	Mixed methods	Malawi	Rural	Households	Adults (Women and Men)	No theory reported	Handwashing with soap and water	3	Yes
Appiah-Brempong 2020	Randomized controlled trial	Ghana	Unspecified	Schools	Children (Girls and Boys)	Bloom's Taxonomy of Learning Theory Social Cognitive Theory; Health Belief Model; Theory of Planned Behavior	Handwashing with soap and water	5	Yes
Ar 2008	Non-randomized quantitative	Turkey	Unspecified	Schools	Adults (Women and Men); Children (Girls and Boys)	No theory reported	Handwashing - unspecified	3	Yes
Ara 2022	Randomized controlled trial	Bangladesh	Rural	Households	Mother-child dyads	No theory reported	Handwashing with soap and water	4	Yes
Aragie 2021	Randomized controlled trial	Ethiopia	Rural	Households; Schools	Children (Girls and Boys)	No theory reported	Handwashing with soap and water	4	Yes
Arbianingsih 2018	Non-randomized quantitative	Indonesia	Unspecified	Schools	General populations; Children	No theory reported	Handwashing with soap and water	2	Yes

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					(Girls and Boys)				
Arnold 2009	Non-randomized quantitative	Guatemala	Rural	Households	Children (Girls and Boys)	No theory reported	Handwashing with soap and water	4	No
Ankan 2018	Randomized controlled trial	Turkey	Unspecified	Schools	Children (Girls and Boys)	No theory reported	Handwashing with soap and water	1	Yes
Ashtarian 2020	Randomized controlled trial	Iran	Urban	Schools	Children (Girls and Boys)	No theory reported	Handwashing with soap and water	3	Yes
Ashutosh 2015	Non-randomized quantitative	India	Urban	Schools	Children (Girls and Boys)	No theory reported	Handwashing with soap and water	3	Yes
Au 2010	Non-randomized quantitative	China	Urban	Schools	Children (Girls and Boys)	No theory reported	Handwashing - unspecified	3	No
Äzyazıcıoğlu 2011	Non-randomized quantitative	Turkey	Rural	Schools	Children (Girls and Boys)	No theory reported	Handwashing with soap and water	3	Yes
Bai 2022	Non-randomized quantitative	China	Unspecified	Schools	Children (Boys only)	Behavior Place Theory	Handwashing - unspecified	3	Yes
Bajracharya 2003	Non-randomized quantitative	Myanmar	Unspecified	Households	General populations	No theory reported	Handwashing with soap and water; Handwashing with soap alternatives	2	Yes
Bickford 2017	Non-randomized quantitative	Bangladesh; India	Rural; Urban	Households	Children (Girls and Boys)	No theory reported	Handwashing with soap and water	4	Yes
Bieri 2013	Randomized controlled trial	China	Rural	Schools	Children (Girls and Boys)	No theory reported	Handwashing with soap and water	3	Yes
Biran 2009	Randomized controlled trial	India	Rural	Households	Adults (Women and Men); Children (Girls and Boys)	No theory reported	Handwashing with soap and water	4	No
Biran 2014	Randomized controlled trial	India	Rural	Households	General populations	Behavior-centered	Handwashing with soap and water	4	Yes

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						Design/Evo-Eco Model			
Biran 2020	Randomized controlled trial	Nigeria	Rural	Households	Adults (Women only)	Behavior-centered Design/Evo-Eco Model	Handwashing with soap and water	4	No
Biswas 2019	Randomized controlled trial	Bangladesh	Urban	Schools	Children (Girls and Boys)	No theory reported	Handwashing with water; Handwashing with soap and water; Handrubbing with alcohol-based rub	2	Yes
Blanton 2010	Non-randomized quantitative	Kenya	Rural	Schools	Children (Girls and Boys)	No theory reported	Handwashing with soap and water	3	Yes
Bosomprah 2016	Non-randomized quantitative	Zambia	Unspecified	Households	Mother-child dyads	No theory reported	Handwashing with soap and water	3	Yes
Bowen 2013	Randomized controlled trial	Pakistan	Urban	Households	General populations	No theory reported	Handwashing with soap and water	2	Yes
Briceño 2017	Randomized controlled trial	Tanzania	Rural	Households	Mother-child dyads	No theory reported	Handwashing with soap and water	3	Yes
Briere 2012	Non-randomized quantitative	Kenya	Rural; Urban	Households	Children (Girls and Boys)	No theory reported	Handwashing - unspecified	4	Yes
Bulled 2017	Non-randomized quantitative	South Africa	Unspecified	Schools	Children (Girls and Boys)	RANAS	Handwashing with water	2	Yes
Burke 2016	Non-randomized quantitative	United States	Unspecified	Schools	Children (Girls and Boys)	No theory reported	Handwashing - unspecified	4	Yes
Burns 2018	Randomized controlled trial	South Africa	Unspecified	Households	Children (Girls and Boys)	No theory reported	Handwashing with soap and water	3	Yes
Cairncross 2005	Non-randomized quantitative	India	Rural	Households	General populations	No theory reported	Handwashing - unspecified	2	Yes
Capps 2022	Non-randomized quantitative	United States	Urban	Universities	Adults (Women and Men)	Theory of Planned Behavior	Handrubbing with alcohol-based rub	3	No

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Carabin 1999	Randomized controlled trial	Canada	Unspecified	Schools	Children (Girls and Boys)	No theory reported	Handwashing - unspecified	3	Yes
CardinaleLagomarsino 2017	Randomized controlled trial	Argentina	Urban	Universities	Adults (Men only)	No theory reported	Handwashing with soap and water	3	Yes
Chard 2018	Randomized controlled trial	Laos	Unspecified	Schools	Children (Girls and Boys)	No theory reported	Handwashing with soap and water	4	Yes
Contzen 2013	Non-randomized quantitative	Ethiopia	Rural	Households	Adults (Women only)	RANAS	Handwashing with soap and water	3	Yes
Costa 2019	Non-randomized quantitative	Brazil	Unspecified	Schools	Children (Girls and Boys)	No theory reported	Handwashing with soap and water	3	Yes
Cowling 2009	Randomized controlled trial	China	Urban	Households	General populations	No theory reported	Handwashing with soap and water; Handrubbing with alcohol-based rub	3	No
Croghan 2008	Non-randomized quantitative	United Kingdom	Unspecified	Schools	Children (Girls and Boys)	No theory reported	Handwashing with soap and water	2	Yes
Curtis 2001	Non-randomized quantitative	Burkina Faso	Urban	Households; Schools	Adults (Women only)	No theory reported	Handwashing with soap and water	3	Yes
Davis 2011	Randomized controlled trial	Tanzania	Peri-urban	Households	Children (Girls and Boys)	No theory reported	Handwashing with soap and water	3	Yes
Davis 2013	Non-randomized quantitative	United States	Unspecified	Universities	General populations	No theory reported	Handwashing - unspecified	4	Yes
Ditai 2019	Randomized controlled trial	Uganda	Rural	Households	Adults (Women and Men)	No theory reported	Handrubbing with alcohol-based rub	4	Yes
Dreibelbis 2016	Randomized controlled trial	Bangladesh	Rural	Schools	Children (Girls and Boys)	No theory reported	Handwashing with soap and water	3	Yes
Duijster 2020	Randomized controlled trial	The Philippines	Peri-urban	Schools	Mother-child dyads	No theory reported	Handwashing with soap and water	2	No
Early 1998	Non-randomized quantitative	United States	Urban	Schools	Children (Girls and Boys)	No theory reported	Handwashing - unspecified	3	Yes

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Ebuehi 2010	Non-randomized quantitative	Nigeria	Rural; Urban	Households	Children (Girls and Boys)	No theory reported	Handwashing with soap and water; Handwashing with soap alternatives	3	Yes
Edward 2019	Non-randomized quantitative	Kenya; Zambia; Cambodia; Guatemala	Rural	Households	Adults (Women and Men); Children (Girls and Boys)	No theory reported	Handwashing with soap alternatives; Handwashing with soap and water	5	Yes
ErcanOruc 2020	Non-randomized quantitative	Ukraine	Unspecified	Universities	Mother-child dyads	No theory reported	Handwashing - unspecified	3	Yes
Ercumen 2018	Randomized controlled trial	Bangladesh	Rural	Households	Adults (Women and Men)	No theory reported	Handwashing - unspecified	3	No
Eun-Joo 2012	Non-randomized quantitative	South Korea	Unspecified	Schools	Children (Girls and Boys)	Stages of change model	Handwashing with soap and water	4	Yes
EvansJr 2009	Non-randomized quantitative	United States	Unspecified	Universities	Children (Girls and Boys)	Ecological theory of health promotion	Handrubbing with alcohol-based rub	3	Yes
Farhana 2022	Mixed methods	Bangladesh	Rural	Schools	Adults (Women and Men)	IBM-WASH	Handwashing with soap and water	3	Yes
Ford 2014	Non-randomized quantitative	United States	Urban	Universities	Children (Girls and Boys)	No theory reported	Hand drying; Handwashing with soap and water	2	Yes
Freeman 2020	Randomized controlled trial	Kenya	Unspecified	Households	Adults (Women and Men)	COM-B	Handwashing with soap and water	3	Yes
Freeman 2022	Randomized controlled trial	Ethiopia	Unspecified	Households	General populations; Mother-child dyads	COM-B; RANAS	Handwashing with soap and water	4	No
Friedrich 2018	Randomized controlled trial	Zimbabwe	Peri-urban; Rural	Households	General populations	RANAS	Handwashing with soap and water	3	Yes
Galiani 2016	Randomized controlled trial	Peru	Urban	Households; Schools	Adults (Women and Men)	No theory reported	Handwashing with soap and water	4	Yes

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Gautam 2017	Randomized controlled trial	Nepal	Rural	Households	Adults (Women only)	Behavior-centered Design/Evo-Eco Model	Handwashing with soap and water	5	Yes
Gedamu 2022	Non-randomized quantitative	Ethiopia	Rural	Households	Mother-child dyads	No theory reported	Handwashing - unspecified	4	Yes
Geller 1980	Non-randomized quantitative	United States	Rural	Universities	General populations	No theory reported	Handwashing with soap and water	3	Yes
George 2017	Randomized controlled trial	Bangladesh	Urban	Households	Food workers	RANAS	Handwashing with soap and water	5	Yes
Gimaiyo 2019	Randomized controlled trial	Kenya	Urban	Household	General populations	No theory reported	Handwashing - unspecified	5	Yes
Goel 2019	Non-randomized quantitative	India	Rural	Households	General populations	No theory reported	Handwashing with soap and water	3	Yes
Goel 2020	Non-randomized quantitative	India	Unspecified	Schools	Mother-child dyads	No theory reported	Handwashing - unspecified	4	No
Grace 2012	Non-randomized quantitative	Nigeria	Unspecified	Markets	Children (Girls and Boys)	No theory reported	Handwashing - unspecified	4	Yes
Greene 2012	Randomized controlled trial	Kenya	Unspecified	Schools	Food workers	No theory reported	Handwashing - unspecified	3	No
Greenland 2016	Randomized controlled trial	Zambia	Unspecified	Households	Children (Girls and Boys)	Behavior-centered Design/Evo-Eco Model	Handwashing with soap and water	4	No
Grover 2018	Randomized controlled trial	Bangladesh	Peri-urban; Rural	Schools	Mother-child dyads	Nudge Theory	Handwashing with soap and water	2	Yes
Guo 2018	Randomized controlled trial	China	Rural	Households	Children (Girls and Boys)	No theory reported	Handwashing with soap and water	2	Yes
Hanson 2020	Non-randomized quantitative	Indonesia	Rural	Households	Children (Girls and Boys)	No theory reported	Handwashing - unspecified	2	Yes
Her 2019	Non-randomized quantitative	United States	Rural	Universities	Mother-child dyads	No theory reported	Handwashing with soap and water	2	Yes

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Hetherington 2017	Mixed methods	Tanzania	Unspecified	Schools	Food workers	IBM-WASH; Social Ecological Model	Handwashing with soap alternatives; Handwashing with soap and water	4	Yes
Huang 2021	Mixed methods	Philippines	Rural	Schools	Children (Girls and Boys)	IBM-WASH; Choice-architecture approach	Handwashing with soap and water; Handwashing with water	4	Yes
Hurley 2021	Non-randomized quantitative	Malawi	Unspecified	Households	Children (Girls and Boys)	No theory reported	Handwashing - unspecified	2	Yes
Hussam 2022	Randomized controlled trial	India	Rural	Households	Children (Girls and Boys); Mother-child dyads	No theory reported	Handwashing with soap and water	3	Yes
Jafree 2023	Non-randomized quantitative	Pakistan	Peri-urban; Rural	Households	Adults (Women and Men)	No theory reported	Handwashing - unspecified	3	Yes
Jagals 2004	Non-randomized quantitative	South Africa	Rural	Households	Adults (Women only)	No theory reported	Handwashing - unspecified	2	No
Jetha 2021	Randomized controlled trial	The Philippines	Urban	Schools	General populations	Behavior-centered Design/Evo-Eco Model	Handwashing - unspecified	4	Yes
Jinadu 2007	Non-randomized quantitative	Nigeria	Unspecified	Households	Children (Girls and Boys)	No theory reported	Handwashing with soap and water	3	Yes
Johnson 2003	Non-randomized quantitative	United States	Rural	Universities	Mother-child dyads	No theory reported	Handwashing with water; Handwashing with soap and water	3	Yes
Judah 2009	Non-randomized quantitative	United Kingdom	Unspecified	Public transportation hubs	Adults (Women and Men)	No theory reported	Handwashing with soap and water	4	Yes
Kaewchana 2012	Randomized controlled trial	Thailand	Unspecified	Households	General populations	No theory reported	Handwashing with soap and water	5	Yes
Kajjura 2019	Non-randomized quantitative	Uganda	Urban	Households	General populations	Health Belief Model	Handwashing with soap and water	3	Yes

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Kamm 2016	Randomized controlled trial	Bangladesh	Rural	Households	Mother-child dyads	No theory reported	Handwashing with water; Handwashing with soap and water	4	Yes
Kang 2017	Randomized controlled trial	Ethiopia	Rural	Households	Adults (Women only)	No theory reported	Handwashing - unspecified	2	Yes
Kapadia-Kundu 2014	Randomized controlled trial	India	Rural	Schools	Mother-child dyads	Social Ecological Model	Handwashing with soap and water	4	Yes
Kariuki 2012	Non-randomized quantitative	Kenya	Rural	Households	Children (Girls only)	No theory reported	Handwashing with soap and water	3	Yes
Karon 2017	Non-randomized quantitative	Indonesia	Unspecified	Schools	Mother-child dyads	No theory reported	Handwashing with soap and water	5	Yes
Kitsanapun 2019	Non-randomized quantitative	Thailand	Rural	Universities	Children (Girls and Boys)	Theory of Planned Behavior; Health Belief Model	Handwashing - unspecified	3	Yes
Koehn 2020	Non-randomized quantitative	India	Unspecified	Households	Adults (Women and Men)	No theory reported	Handwashing with soap and water	5	No
Kumar 2018	Mixed methods	India	Rural; Urban	Schools	Mother-child dyads	No theory reported	Handwashing - unspecified	3	Yes
Labović 2023	Non-randomized quantitative	Montenegro	Urban	Workplaces	Children (Girls and Boys)	No theory reported	Handwashing with soap and water	2	No
Lange 2022	Non-randomized quantitative	South Africa	Unspecified	Schools	Food workers	No theory reported	Handwashing - unspecified	3	Yes
Langford 2011	Randomized controlled trial	Nepal	Unspecified	Households	Adults (Women and Men)	Theory of Planned Behavior	Handwashing with soap and water	4	Yes
Langford 2013	Mixed methods	Nepal	Urban	Households	Mother-child dyads	Theory of Planned Behavior	Handwashing with soap and water	5	Yes
Lapinski 2013	Randomized controlled trial	United States	Urban	Universities	Mother-child dyads	Theory of normative social	Handwashing - unspecified	4	Yes

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						behaviour; Focus Theory; Theory of reasoned action			
Lawson 2019	Non- randomized quantitative	United Kingdom	Unspecified	Universities	Adults (Men only)	No theory reported	Handwashing with soap and water	3	No
Lee 2020	Randomized controlled trial	China	Unspecified	Schools	Adults (Women and Men)	No theory reported	Handwashing with soap and water	4	Yes
Leventhal 2016	Randomized controlled trial	India	Unspecified	Schools	Children (Girls and Boys)	COM-B	Handwashing with soap and water	3	Yes
Lhakhang 2015	Randomized controlled trial	India	Rural	Universities	Children (Girls only)	COM-B; Health Action Process Approach	Handwashing with non-alcoholic antiseptics; Handwashing with water; Handwashing with soap and water	3	Yes
Liu 2019	Non- randomized quantitative	China	Urban	Schools	Adults (Women and Men)	Health Belief Model	Handwashing - unspecified	3	Yes
Locks 2019	Non- randomized quantitative	Democratic Republic of Congo	Peri-urban; Urban	Households	Adults (Women and Men)	No theory reported	Handwashing with soap and water	5	No
Lubna 2014	Non- randomized quantitative	Bangladesh	Rural; Urban	Households	Children (Girls and Boys); Mother-child dyads	No theory reported	Handwashing with soap and water	5	Yes
Luby 2001	Non- randomized quantitative	Pakistan	Rural	Households	Adults (Women only)	No theory reported	Handwashing with soap and water	4	Yes
Luby 2010	Randomized controlled trial	Bangladesh	Urban	Households	General populations	Stages of change model	Handwashing with soap and water; Handwashing with non-alcoholic antiseptics	4	Yes
Machado 2018	Randomized controlled trial	United States	Urban	Workplaces	Food workers	No theory reported	Handwashing with soap and water	2	Yes

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Mackert 2013	Non-randomized quantitative	United States	Unspecified	Universities	Adults (Women and Men)	Theory of Planned Behavior	Handwashing with water; Handwashing with soap and water	4	No
Mahfuza 2021	Non-randomized quantitative	Bangladesh	Urban	Households	General populations	No theory reported	Handwashing - unspecified	5	Yes
Makata 2021	Randomized controlled trial	Tanzania	Rural	Schools	Children (Girls and Boys)	No theory reported	Handwashing with soap and water	4	No
Malik 2022	Non-randomized quantitative	Pakistan	Rural; Urban	Schools	Children (Boys only)	No theory reported	Handwashing - unspecified	4	Yes
Manaseki-Holland 2021	Randomized controlled trial	The Gambia	Rural; Urban	Households	Adults (Women only)		Handwashing with soap and water	4	Yes
Mane 2017	Non-randomized quantitative	India	Rural	Schools	Children (Girls and Boys)	No theory reported	Handwashing with soap and water	4	Yes
Mathew 2018	Non-randomized quantitative	India	Unspecified	Schools	Children (Girls and Boys)	Goal attainment model	Handwashing - unspecified	3	Yes
Maughan 2016	Randomized controlled trial	United States	Rural	Markets	Adults (Women and Men)	No theory reported	Handwashing - unspecified	3	Yes
Mbakaya 2019	Randomized controlled trial	Malawi	Urban	Schools	Children (Girls and Boys)	Social-cognitive learning theory	Handwashing with soap and water	5	Yes
McGuire-Wolfe 2012	Non-randomized quantitative	United States	Unspecified	Workplaces	Non-food occupational workers	No theory reported	Handrubbing with alcohol-based rub	3	No
Mendes 2020	Non-randomized quantitative	Brazil	Peri-urban	Childcare centers	Adults (Women only); Children (Girls and Boys)	Health Belief Model	Handwashing with soap and water	3	Yes
Mezaache 2021	Mixed methods	France	Unspecified	Households	Adults (Women and Men)	COM-B	Handrubbing with alcohol-based rub	3	Yes

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Mohamed 2019	Non-randomized quantitative	Malaysia	Urban	Schools	Children (Girls and Boys)	No theory reported	Handwashing with soap and water	2	Yes
Moll 2007	Non-randomized quantitative	Guatemala; Honduras; Nicaragua; El Salvador	Unspecified	Households	General populations	No theory reported	Handwashing - unspecified	3	Yes
Morse 2020	Randomized controlled trial	Malawi	Peri-urban; Rural	Households	Children (Girls and Boys)	RANAS	Handwashing with soap and water	2	Yes
Mott 2007	Randomized controlled trial	United States	Rural	Workplaces	Adults (Men only)	No theory reported	Handrubbing with alcohol-based rub	2	Yes
Nagapraveen 2016	Non-randomized quantitative	India	Unspecified	Households	General populations	No theory reported	Handwashing with soap and water	4	Yes
Nair 2017	Randomized controlled trial	India	Rural	Households	Mother-child dyads	No theory reported	Handwashing - unspecified	2	No
Naluonde 2019	Randomized controlled trial	Zambia	Rural	Schools	Children (Girls and Boys)	No theory reported	Handwashing with soap and water	4	Yes
Nandrup-Bus 2009	Randomized controlled trial	Denmark	Unspecified	Schools	Children (Girls and Boys)	No theory reported	Handwashing - unspecified	2	Yes
Newton-Lewis 2021	Non-randomized quantitative	India	Unspecified	Households	Mother-child dyads	No theory reported	Handwashing - unspecified	5	No
NikRosmawati 2018	Non-randomized quantitative	Malaysia	Unspecified	Schools	Food workers	Theory of Planned Behavior	Handwashing - unspecified	5	Yes
Nuhu 2019	Randomized controlled trial	Bangladesh	Unspecified	Households	Mother-child dyads	No theory reported	Handwashing with soap and water	4	Yes
Öncü 2021	Randomized controlled trial	Turkey	Urban	Schools	Children (Girls and Boys)	No theory reported	Handwashing with soap and water	4	Yes
Oruc 2021	Non-randomized quantitative	Mozambique; Ethiopia; Uganda	Unspecified	Workplaces	Food workers	No theory reported	Handwashing - unspecified	3	Yes
Oswald 2014	Non-randomized quantitative	Peru	Unspecified	Households	Adults (Women only)	No theory reported	Handwashing with water; Handwashing with soap and water	3	Yes

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Ozcan 2020	Non-randomized quantitative	Turkey	Peri-urban	Schools	Children (Girls and Boys)	No theory reported	Handwashing - unspecified	4	Yes
Patel 2012	Non-randomized quantitative	Kenya	Rural	Schools	Children (Girls and Boys)	No theory reported	Handwashing with soap and water	2	Yes
Phuanukoonnon 2013	Non-randomized quantitative	Papau New Guinea	Rural	Households	General populations	No theory reported	Handwashing with soap and water	3	Yes
Pickering 2013	Randomized controlled trial	Kenya	Unspecified	Schools	Children (Girls and Boys)	No theory reported	Handwashing with soap and water; Handrubbing with alcohol-based rub	2	Yes
Pickering 2019	Randomized controlled trial	Kenya	Urban	Households	General populations	No theory reported	Handwashing with soap and water	4	No
Pinfold 1990	Randomized controlled trial	Thailand	Rural	Households	General populations	No theory reported	Handwashing - unspecified	2	Yes
Pokharel 2017	Non-randomized quantitative	Armenia	Rural	Universities	Adults (Women and Men)	No theory reported	Handwashing - unspecified	2	Yes
Prado 2015	Non-randomized quantitative	Brazil	Unspecified	Universities	Food workers	No theory reported	Handwashing - unspecified	2	No
Prasetyo 2022	Non-randomized quantitative	Indonesia	Urban	Workplaces	Adults (Women and Men)	No theory reported	Handwashing with soap and water; Handwashing with water	4	Yes
Ram 2017	Randomized controlled trial	Bangladesh	Unspecified	Households	Adults (Women only)	Heuristic model for teachable moments; Health Belief Model	Handwashing with water; Handwashing with soap and water	4	Yes
Ram 2020	Randomized controlled trial	Bangladesh	Rural	Households	Mother-child dyads	Social Cognitive Theory; Theory of Planned Behavior; Health Belief Model	Handwashing with non-alcoholic antiseptics	3	Yes
Ray 2010	Non-randomized quantitative	India	Rural	Households	General populations	No theory reported	Handwashing - unspecified	3	No

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ReyesFernández 2015	Randomized controlled trial	Costa Rica	Urban	Universities	Adults (Women and Men)	Health Action Process Approach	Handrubbing with alcohol-based rub	4	No
Riaz 2016	Non-randomized quantitative	Bangladesh	Unspecified	Households	Adults (Women only)	No theory reported	Handwashing with soap and water; Hand drying	3	Yes
Rissman 2021	Non-randomized quantitative	Malawi	Unspecified	Childcare centers	Adults (Women and Men); Children (Girls and Boys)	No theory reported	Handwashing with soap and water	3	Yes
Roberts 2008	Non-randomized quantitative	United States	Rural	Workplaces	Food workers	No theory reported	Handwashing - unspecified	2	No
Roberts 2022	Randomized controlled trial	United States	Unspecified	Schools	Food workers	Theory of Planned Behavior	Handwashing with soap and water	1	No
Rosen 2006	Randomized controlled trial	Israel	Unspecified	Schools	Adults (Women and Men)	No theory reported	Handwashing with soap and water	4	Yes
Routh 2018	Mixed methods	Malawi	Urban	Households	Children (Girls and Boys)	No theory reported	Handwashing with soap and water	3	Yes
Russo 2012	Non-randomized quantitative	Malawi	Rural	Households	Adults (Women only)	No theory reported	Handwashing with soap and water	4	Yes
Rutter 2020	Mixed methods	United Kingdom	Rural	Schools	Adults (Women and Men)	No theory reported	Handwashing with soap and water; Hand drying	2	Yes
Saboori 2013	Randomized controlled trial	Kenya	Rural; Urban	Schools	Children (Girls and Boys)	No theory reported	Handwashing with soap and water; Handwashing with water	3	Yes
Samreen 2021	Randomized controlled trial	Pakistan	Rural	Schools	Children (Girls and Boys)	No theory reported	Handwashing - unspecified	2	No
Sanders 2021	Non-randomized quantitative	Tanzania; Uganda; Malawi	Urban	Households; Schools	Children (Girls and Boys)	No theory reported	Handwashing - unspecified	3	No

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Sangalang 2021	Randomized controlled trial	Philippines	Unspecified	Schools	General populations; Children (Girls and Boys)	No theory reported	Handwashing with soap and water	4	No
Sania 2017	Mixed methods	Bangladesh	Urban	Households	Children (Girls and Boys)	IBM-WASH	Handwashing with soap and water	5	Yes
Schroeder 2016	Non-randomized quantitative	United States	Rural	Workplaces	General populations	No theory reported	Handwashing with soap and water	3	Yes
Scott 2008	Non-randomized quantitative	Ghana	Unspecified	Households	Food workers	No theory reported	Handwashing with soap and water	2	Yes
Shah 2021	Non-randomized quantitative	India	Unspecified	Households	Mother-child dyads	No theory reported	Handwashing with soap and water	3	Yes
Shahar 2022	Randomized controlled trial	Malaysia	Rural	Schools	Adults (Women and Men)	Health Belief Model	Handwashing with soap and water	5	No
Sheth 2004	Non-randomized quantitative	India	Rural; Urban; Peri-urban	Schools	Children (Girls and Boys)	No theory reported	Handwashing with soap and water	3	Yes
Simiyu 2022	Mixed methods	Kenya	Urban	Households	Mother-child dyads	Behavior-centered Design/Evo-Eco Model	Handwashing with soap and water	2	Yes
Simmerman 2011	Randomized controlled trial	Thailand	Peri-urban	Households	Mother-child dyads	No theory reported	Handwashing with soap and water	5	No
Sneed 2015	Non-randomized quantitative	United States	Urban	Households	General populations; Children (Girls and Boys)	No theory reported	Handwashing with soap and water	3	No
Snow 2008	Randomized controlled trial	United States	Unspecified	Schools	Adults (Women and Men)	No theory reported	Handwashing with soap and water	2	Yes
Soares 2013	Non-randomized quantitative	Portugal	Urban	Universities	Children (Girls and Boys)	No theory reported	Handwashing - unspecified	3	Yes

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Sobel 2022	Non-randomized quantitative	Not reported	Unspecified	Households	Food workers	No theory reported	Handwashing with soap and water	3	Yes
Solehati 2017	Non-randomized quantitative	Indonesia	Unspecified	Schools	Mother-child dyads	No theory reported	Handwashing with soap and water	3	Yes
Stebbins 2010	Randomized controlled trial	United States	Unspecified	Schools	Children (Girls and Boys)	No theory reported	Handwashing with soap and water; Handrubbing with alcohol-based rub	2	Yes
Stedman-Smith 2015	Randomized controlled trial	United States	Urban	Workplaces	Children (Girls and Boys)	Theory of Planned Behavior	Handrubbing with alcohol-based rub	4	Yes
Strohbehn 2011	Non-randomized quantitative	United States	Unspecified	Workplaces	Adults (Women and Men)	No theory reported	Handwashing with soap and water	3	No
Suen 2020	Non-randomized quantitative	China	Unspecified	Schools	Food workers	No theory reported	Handrubbing with alcohol-based rub	2	Yes
Sutherland 2021	Non-randomized quantitative	South Africa	Urban	Households	Children (Girls and Boys)	No theory reported	Handwashing with soap and water	2	Yes
Takanashi 2013	Non-randomized quantitative	Vietnam	Urban	Households	General populations	No theory reported	Handwashing with soap and water	3	Yes
Taware 2018	Non-randomized quantitative	India	Peri-urban	Schools	Mother-child dyads	Health Belief Model	Handwashing with soap and water	3	Yes
Thorseth 2021	Mixed methods	Ethiopia	Urban	Internally displaced persons camps	Children (Girls and Boys)	No theory reported	Handwashing with soap and water	4	No
Tian 2019	Mixed methods	China	Unspecified	Households	General populations	No theory reported	Handwashing - unspecified	3	Yes
Tidwell 2019	Randomized controlled trial	India	Rural	Households	General populations	No theory reported	Handwashing with soap and water	4	Yes
Tidwell 2020	Non-randomized quantitative	India	Urban	Schools	Adults (Women only)	No theory reported	Handwashing with soap and water	4	Yes
Topan 2020	Non-randomized quantitative	Turkey	Unspecified	Schools	Children (Girls and Boys)	No theory reported	Handwashing with soap and water	4	Yes

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Tousman 2007	Non-randomized quantitative	United States	Unspecified	Schools	Children (Girls and Boys)	Health Behavior Change Model	Handwashing - unspecified	2	Yes
Tousman 2011	Randomized controlled trial	United States	Unspecified	Not reported	Children (Girls and Boys)	No theory reported	Handwashing - unspecified	4	Yes
Umair 2019	Non-randomized quantitative	Pakistan	Unspecified	Households	Adults (Women and Men)	No theory reported	Handwashing - unspecified	3	Yes
Underwood 2017	Non-randomized quantitative	Nepal	Rural	Households	Adults (Women only)	Ideation by Cleland and Wilson	Handwashing with soap and water	4	Yes
Updegraff 2011	Non-randomized quantitative	United States	Unspecified	Universities	Adults (Women and Men)	Health Belief Model; Theory of Planned Behavior	Handrubbing with alcohol-based rub	3	Yes
Vally 2019	Non-randomized quantitative	The Philippines	Urban	Schools	General populations	No theory reported	Handwashing with soap and water; Handwashing with water; Handrubbing with alcohol-based rub	2	Yes
VazNery 2019	Randomized controlled trial	Timor-Leste	Unspecified	Households	Children (Girls and Boys)	No theory reported	Handwashing with soap and water	2	No
Violant-Holz 2021	Mixed methods	Spain	Rural	Schools	General populations	No theory reported	Handwashing - unspecified	3	Yes
Waterkeyn 2005	Mixed methods	Zimbabwe	Unspecified	Community health clubs	Children (Girls and Boys)	No theory reported	Handwashing - unspecified	4	Yes
Watson 2019	Non-randomized quantitative	Iraq	Rural	Internally displaced persons camps	Adults (Women and Men)	Behavior-centered Design/Evo-Eco Model	Handwashing with soap and water	4	Yes
Weijers 2020	Non-randomized quantitative	The Netherlands	Unspecified	Markets	Children (Girls and Boys)	Dual Process Theory	Handrubbing with alcohol-based rub	4	No
White 2003	Non-randomized quantitative	United States	Rural; Urban	Universities	General populations	No theory reported	Handrubbing with alcohol-based rub	4	Yes

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Wichaidit 2019	Randomized controlled trial	Kenya	Urban	Schools	Adults (Women and Men)	IBM-WASH	Handwashing with soap and water	4	No
Wichaidit 2019	Randomized controlled trial	Bangladesh	Urban	Households	General populations	No theory reported	Handwashing with soap and water	3	Yes
Wilson 1993	Non-randomized quantitative	Indonesia	Unspecified	Households	Children (Girls and Boys)	No theory reported	Handwashing with soap and water	3	Yes
Witt 2004	Non-randomized quantitative	United States	Rural	Schools	Adults (Women only)	No theory reported	Handwashing with soap and water	3	Yes
Wong 2022	Non-randomized quantitative	Malaysia	Unspecified	Schools	Children (Girls and Boys)	No theory reported	Handwashing with soap and water	2	Yes
Wu 2022	Non-randomized quantitative	China	Unspecified	Schools	Food workers	Health Belief Model	Handwashing - unspecified	3	Yes
Yang 2017	Randomized controlled trial	China	Unspecified	Markets	Adults (Women and Men)	No theory reported	Handwashing with soap and water	3	Yes
Yardley 2011	Randomized controlled trial	England	Urban	Households	General populations	Theory of Planned Behavior	Handrubbing with alcohol-based rub; Handwashing with soap and water	2	Yes
Yeboah-Antwi 2019	Non-randomized quantitative	Zambia	Unspecified	Households	Mother-child dyads	No theory reported	Handwashing - unspecified	5	Yes
York 2009	Non-randomized quantitative	United States	Rural	Workplaces	Food workers	Theory of Planned Behavior	Handwashing - unspecified	3	No
Younie 2020	Non-randomized quantitative	United Kingdom	Unspecified	Schools	Children (Girls and Boys)	COM-B	Handwashing with soap and water	4	Yes
Yu 2018	Non-randomized quantitative	United States	Urban	Workplaces	Food workers	Organizational behavior modification model	Handwashing - unspecified	3	Yes
Zemichael 2020	Non-randomized quantitative	Ethiopia	Unspecified	Households; Schools	Mother-child dyads	No theory reported	Handwashing - unspecified	4	Yes

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Zhang 2013	Non-randomized quantitative	Uganda	Rural	Schools	Children (Girls and Boys)	No theory reported	Handwashing with soap and water	3	Yes
Zhang 2021	Randomized controlled trial	China	Rural; Urban; Peri-urban	Schools	Adults (Women and Men); Children (Girls and Boys)	No theory reported	Handwashing with soap and water	3	Yes
Zomer 2016	Randomized controlled trial	The Netherlands	Urban	Schools	Adults (Women and Men)	No theory reported	Handwashing - unspecified	4	Yes