

Research Paper

Water, sanitation and hygiene practices in early childhood development (ECD) centres in low socio-economic areas in Nelson Mandela Bay, South Africa

Paula Melariri, Liana Steenkamp, Margaret Williams, Chwayita Mtembu, Jessica Ronaasen and Ilse Truter

ABSTRACT

Water, sanitation and hygiene (WASH) are vital indicators to healthy living and safe environments for child development. The aim of the study was to determine WASH status and practices in ECD centres located in low socio-economic areas of Nelson Mandela Bay during 2017. This cross-sectional study elicited responses from 46 ECD centres which had a total of 3,254 children and 172 caregivers.

A structured questionnaire and visual observation were used. Using core WASH in schools' indicators (WinS) showed that despite improved water sources being available in 91% of the facilities, WinS for hygiene was poor. The study observed that 57% of the respondents had improved toilets accommodating both genders. In 29% of ECD centres, 6–10 children make use of a 'pottie' while in 9% of the cases, more than 20 children make use of one 'pottie'. The use of the bucket system was noted in 22% of the ECD centres. In 79% of the ECD centres, children wash their hands in a communal plastic bowl. Only 11% of the study population washed hands hygienically under a running tap or tippy tap. WASH conditions in the ECD centres in the study area require urgent attention and further investigation for practical solutions.

Key words | hand washing, hygiene, sanitation, water, wins indicators

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INTRODUCTION

Water, sanitation and hygiene (WASH) refers to the provision of safe water for basic human needs such as drinking, washing and domestic activities. Implementation of WASH standards are crucial to human development

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and well-being (Shrestha *et al.* 2017). Poor protective behavioural practices and inadequate WASH standards are associated with increased morbidity and mortality, particularly in low socio-economic areas (Reddy *et al.* 2017). Globally, diarrhoea remains one of the leading causes of death in children below 60 months of age (Fischer Walker *et al.* 2012). Evidence also indicates that inadequate WASH conditions can negatively impact on growth in children,

especially in relation to childhood stunting (Cumming & Cairncross 2016). Accordingly, the provision of good quality water sources, sanitation and adequate hygiene practices are essential for the survival and development of children (Darvesh *et al.* 2017). Recently, improvements in WASH practices, attributable to robust interpersonal communication from a community health promoter, have been linked to improved child development in pre-school children (Tofail *et al.* 2018), which secures optimal school performance and better quality future outcomes.

In 2015 an estimated 5.2 billion people used a safely managed readily available drinking water service (UNICEF & WHO 2017). Conversely, the 844 million people who do not have access to sound water supplies (UNICEF & WHO 2017), have to make use of potentially unsafe drinking water sources such as unprotected wells, springs and surface water. In addition, 2.3 billion people globally do not have access to basic sanitation services. Sub-Saharan Africa ranks at a low level regarding the improvement of drinking water sources and sanitation (Roche *et al.* 2017), and is eight times higher than other regions of the world in terms of providing satisfactory drinking water, which is due to a general lack of provision regarding maintenance and upgrading of sources (Grebmer *et al.* 2015). In 1996, approximately 21 million people in South Africa lacked access to adequate sanitation (Phaswana-Mafuya & Shukla 2005), despite attempts at improvement (Hoossein *et al.* 2016). There are definite problems regarding the sustainability of improving sanitation.

In 2016, there were approximately 1.26 million residents in Nelson Mandela Bay (NMB), 92.5% of whom had access to formal housing and 77.8% with piped water in their homes. Only 2% of households lacked piped water to yard level (one functional tap for the household) (ECSECC 2017). In 2016, 26,500 households in NMB had no formal refuse removal while 28,600 households experienced sporadic refuse removal (ECSECC 2017). Because of the increasing number of children in NMB who attend ECD facilities, it is essential to monitor WASH practices beyond the household level in order to achieve the Sustainable Development Goals (SDG), particularly SDG 6 (WHO/UNICEF 2016). Thus, it is essential to monitor WASH in schools, particularly those accommodating children under five years of age.

Early childhood development is a priority area for stakeholders where intervention is required in order to provide equitable access to education and child services and to ensure the right to education. Currently, the Department of Social Development is responsible for ensuring quality ECD services and for supporting the registration, organization and management of these partial care facilities. ECD centres in South Africa are either school, community or home-based and only 12% of ECD practitioners are in possession of a recognized qualification (Atmore 2013). There are a total of 23,482 ECDs in South Africa with 1,030,473 children enrolled in the centres. Forty-nine per cent are in urban areas and 40% located in rural areas (Atmore 2013). Flushing toilets and piped water are available in 53% of ECD facilities while 8% do not have flush toilets and piped water. The adverse effect of social and economic inequalities experienced by a majority of young children in South Africa have been described (Atmore 2013).

One of the goals of the National Integrated Early Childhood Development Policy is to ensure that by 2030 all infants and young children living in low socio-economic areas, which include rural and informal urban areas, have an adequate supply of safe drinking water, sanitation facilities and adequate hygiene practices (Department of Social Development 2015). One of the major objectives of the Department of Social Development is to achieve the 2030 goal by implementing strategies to ensure that all communities have access to safe sanitation facilities, regular removal of refuse and the observation of basic hygienic practices (Department of Social Development 2015). The implementation of adequate WASH practices reduces the vulnerability of the populace to infectious diseases. The presence of vectors (e.g., flies and mosquitoes) and disease pathogens are traceable to inadequate WASH practices, particularly in kitchen and bathroom areas. For example, in 2017, a *Listeria* outbreak was reported in South Africa which had a recorded mortality of more than 36 individuals (Centre for Enteric Diseases and Division of Public Health Surveillance and Response 2018). Listeriosis is caused by eating food contaminated by *Listeria monocytogenes* which are found in soil and water. Eating without washing hands, particularly after playing in a garden environment, as well as eating unwashed vegetables, are risky behaviours which encourage the transmission of listeriosis, as well as

other pathogens. Furthermore, improper management of human excreta poses a serious health risk to the populace due to the potential contamination and pollution of local water sources. Reports also show that adequate WASH practices have the potential to reduce the helminth burden (Strunz *et al.* 2014). Therefore, staff at ECD centres should be educated and equipped to understand, implement and promote adequate WASH practices.

WASH programmes have been included as part of the SDG so that progress can be tracked (WHO/UNICEF 2016). Preschool children spend a large amount of their time at ECD centres during the day while their parents or caregivers are working. Monitoring WASH in ECD settings is therefore vital to the well-being and educational outcomes of these school children (Jordanova *et al.* 2015). In the current study, a baseline evaluation of WASH practices at ECD centres in the study area was carried out to determine current practices. This was done in order to investigate the need for possible WASH intervention strategies to ensure alignment with the global strategy. The baseline study is pivotal in anchoring the implementation and development of future programmes. Findings from this study will facilitate targeting specific WASH concerns related to ECD centres in the study area.

MATERIALS AND METHODS

The study, which commenced in 2017, aimed to determine the WASH practices in ECD centres located in low socio-economic areas of NMB. The study population comprised purposively selected ECD centres in NMB ($n = 46$), all of which were associated with an ECD training centre, and all consented to participate in the study. All chosen ECD centres worked with children of 0–6 years of age. A structured questionnaire developed for this cross-sectional study was used to gain responses regarding access to water, building type and composition plus sanitation and hygiene practices in the 46 ECD centres. Permission was obtained from the principal of each ECD centre prior to study commencement. A pre-tested questionnaire was administered to respondents (caregivers and principals in ECD centres) who consented to participate in the study. The questionnaire was pre-tested to ascertain participants

understanding of the research tool. The pre-test identified and revised questions that were ambiguous prior to the actual study. The content of the questionnaire was in line with the primary and specific objectives of the study and comprised 88 questions which were intended to capture information on ECD centres' location, of demographics of the children, building or shelter information, plus WASH practices at the centre. The questionnaire took 15–20 minutes to complete.

Globally, countries are encouraged to make use of the WHO/UNICEF Joint Monitoring Programme (JMP) service ladders in reviewing the WinS standards and targets in their respective countries (WHO/UNICEF 2016). With this in mind, the WASH in schools' (WinS) monitoring package (UNICEF 2011) and the updated service ladders (UNICEF & WHO 2017) were consulted during the generation of the questionnaire for this study in order to classify each facility's WASH setup up into levels and observable hygiene practices.

To determine the WASH conditions in the study area, the study evaluated ECD centres based on core WinS indicators adapted from UNICEF standards. The core indicators evaluated in the study area, based on the core WinS indicators adapted from UNICEF standards (WHO/UNICEF 2016) were 'basic' drinking water, sanitation and handwashing. In this study an 'improved' drinking water source is one that is adequately protected from external contamination with faeces or disease vectors. According to the literature, optimal or so-called improved water sources for school settings include: 'piped, protected well/spring (including boreholes/tubewells, protected dug wells and protected springs), rainwater catchment, and packaged bottled water'. Not optimal or 'unimproved' sources include: 'unprotected well/spring, tanker-trucks, and surface water (e.g., lake, river, stream, pond, canals, irrigation ditches) or any other source where water is not protected from the outside environment' (WHO/UNICEF 2016).

The study was approved by the Research Ethics Committee (Human) of Nelson Mandela University (Ethics number H16-HEA-DIET-005). Data from the study were coded and entered into a Microsoft Excel sheet and Statistica program version 13.4 was used for analysis. Descriptive statistics such as frequency tables and pie charts were utilized to present the data summary.

Table 1 | Information on the building type and ages of children in the ECD centres

Type of building	Type of building, number (%)	Type of house	Type of house, number (%)	Age range of children	Number of ECD centres with indicated ages (%)
Apartment	2 (4)	Permanent bricks	24 (52)	Age <6 months	18 (39)
Separate house	14 (30)	Temporary corrugated iron	3 (7)	Age >6 ≤ 12 months	17 (37)
Part of caregivers' house	12 (26)	Temporary wood	8 (17)	Age >1 ≤ 2 years	34 (74)
Wendy house (a small, wooden structured dwelling)	8 (17)	Combination of any above	4 (9)	Age >2 ≤ 3 years	30 (65)
Container	1 (2)	Other	7 (15)	Age >3 ≤ 4 years	30 (65)
Other			9 (20)	Age >4 ≤ 5 years	31 (67)
				Age >5 ≤ 6 years	12 (26)
				Age >6 years	1 (2)

Total number of children = 2,435.

Total number of boys = 1,134; total number of girls = 1,258; gender not indicated = 43.

Total number of caregivers = 173.

RESULTS AND DISCUSSION

Information on the composition of the ECD centres is provided in Table 1. There were 2,435 children enrolled in the 46 ECD centres with 172 caregivers. The ages of the children showed that approximately 72% of the children were five years or younger. The building type and composition of the facilities varied: 52% are centres built with permanent bricks, 30% were in a separate house while 26% were part of the caregivers' house (Table 1). Although the Department of Social Development (DSD) provides a subsidy in the form of financial support for registered ECD centres, most centres utilized in this study were not registered. The reason for this is that ECD principals, particularly in low socio-economic areas, were generally unable to register their centres because they do not meet infrastructural standards such as an adequate number of windows in the classrooms, or the building type and structure were substandard. Therefore, most of the ECDs in this study were unable to access financial support from DSD. Without access to governmental funding these centres cannot make the necessary structural improvements or repairs and are thus frozen in the unregistered category, resulting in lack of funding with which to upgrade, improve or maintain their current structures. This finding compares well with reports from studies showing inadequate funding or poor allocation of funds to low socio-economic schools (Sibiya & Gumbo 2013; Jordano *et al.* 2015). Most of the centres (32, 76%) in the current

study indicated their dependence on school fees and financial assistance received from parents, which is erratic due to the prevalence of unemployment and subsequent poverty in the study area. The study showed that the lowest and highest amount of fees paid monthly per child was 0 and 500 rands, respectively. The lower quartile was R110 while the upper quartile was R195. This shows that 25% of the children paid R110 or less (lower quartile), while 25% paid R195 or more for the upper quartile. While most of the children paid R100, the mean amount of fees paid at the ECD centres was $R162 \pm 85$ per month. The amount paid by the upper quartile is still grossly inadequate to achieve and uphold the standards expected at the ECD centres, hence they remain unregistered and unable to access funding from DSD. This may explain why the infrastructure for standard hygiene and sanitation facilities is lacking in most of the ECD centres.

ECD centres are governed by principals and non-profit committees made up of members of the community and parents. There are however national standards set out for ECD centres which are prescribed by the Department of Social Development. These include structural requirements which are related to environmental health regulations. For instance, if the ECD lacks space and adequate facilities with which to optimally maintain adequate hygiene, their ability to maintain high WASH standards will be compromised. This is evident in the ECD centres which took part in this study where space availability is inadequate relative

to the number of enrolled children. An indoor play area should have a minimum of 1.5 m² free unobstructed floor space available per child (Government Gazette & Notice 2015), which was not in evidence in approximately 50% of the ECD centres surveyed. Due to lack of funding, 12 (26%) of the ECD centres were accommodated in the ECD principal's house. It appears as though ECD centres are often established in the homes of the principals or practitioners, either in informal structures such as shacks or brick structures such as RDP homes (Housing Development Agency 2014). Because the house is used simultaneously as the ECD and a home, space for the children is limited and results in potentially unhygienic practices.

In this study, 44 (96%) of the ECD centres had access to improved drinking water sources (Table 2); of significance, only 42 (91%) of the ECD centres (Table 2) actually make use of improved water sources. A few centres indicated using additional water sources such as JoJo tanks, public taps, rain water and bottled water. This finding suggests that there could be occasions in ECD centres when water might not be available, leading to ECD centres storing water for later use. A number of the respondents (27, 59%), admitted to storing water for future use, and five (11%) of these respondents confirmed that stored water was unprotected from external contamination. Many

respondents (43, 95%) admitted that the quality of the water used in the centre (microbiological, chemical and physical) is never checked or tested. This needs to be done, especially in ECD centres where children make use of stored water, in order to reduce health risks and improve the well-being of the children. Shields et al. (2015) reported that the quality of stored water is usually lower than the quality of water from a reputable source due to potential contaminants. The same study reported that there is no separation between the food processing area and the nappy area in eight (17%) of the centres. This presents a concern for positive WASH practices as faecal matter and used nappies may be stored near food preparation areas. The potential for contaminated food is heightened by the small dwellings which have inadequate access to running water, limited ventilation and poor waste removal systems. Furthermore, the study observed that 19 (41%) of the ECD centres were located less than 50 m from a public waste dump. The aforementioned may be associated with the presence of potential disease vector(s) in the facility such as cockroaches, rats, ants, mice and mosquitoes, as reported by 29 (63%) respondents. This presents the need for education and intervention on adequate kitchen facilities and standards related to maintaining food on an ECD premises.

Variations existed in the toilet facilities available in the ECDs in this study, where 36 (78%) of the respondents had improved toilets with tissue paper always available and 26 (57%) had improved and usable separate toilets for different sexes (Table 2). Thirty-two (70%) used flush toilets while 9 (20%) and 28 (61%) used bucket and potties, respectively. Only 31 (67%) of the centres cleaned the potties after every use, and at 29 (63%) of the centres between one and five children shared one pottie. In 13 (29%) of the centres, 6–10 children shared a pottie, while in four (9%) of the centres 20 children shared one pottie, a concern. Similarly, 11–20 children and >30 children in 8 (18%) and 12 (28%) of the ECD centres, respectively, shared a wash basin while washing hands. According to the WinS indicator for sanitation in the study area, based on core WASH in schools' (WinS) indicators adapted from UNICEF standards (WHO/UNICEF 2016), improved sanitation needs to be achieved in most of the ECD centres in the study area.

There are health risks associated with the unimproved sanitation such as the use of the bucket system, the close

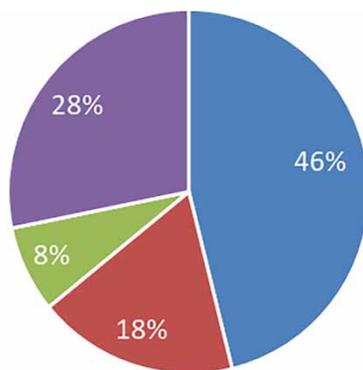
Table 2 | WASH in schools' (WinS) indicators (*n* = 46)

Indicator variable	Description	Number (%)
Drinking water	With an improved drinking water source	44 (96%)
	With drinking water available from an improved source	42 (91%)
Sanitation	With improved toilets which are usable	32 (70%)
	With improved toilets and tissue papers always	36 (78%)
	With improved toilets which are usable and single-sex	26 (57%)
Hygiene	With handwashing facilities which have water available	5 (11%)
	With handwashing facilities which use wash basin with water and soap available	41 (89%)
	Children wash hands in plastic bowls with soap or detergent when running water is not available	36 (79%)
	Children wash hands in tippy tap when running water is not available	5 (11%)

proximity of public refuse piles to the centres, the presence of potential disease vectors including flies, cockroaches, mice and mosquitoes. Additionally, there is mouth contact with toys not cleaned adequately or regularly and possible cross-contamination between children and drinking water sources that are not protected from external contaminants. In the study by [Shields *et al.* \(2015\)](#) the impact of faecal contamination on pipe water and household stored water was discussed. Similarly, unimproved sanitation facilities and poor hygienic conditions were closely associated with the prevalence of acute diarrhoea among children aged 0–50 months ([Adane *et al.* 2017](#)). In this study, the WinS indicator for hygiene was poor with only five (11%) of the study population reportedly washing hands hygienically under running tap water (when water is available) or under tippy tap (when water is not available) ([Table 2](#)). At 36 (79%) of the centres, children collectively shared plastic bowls for hand washing due to the absence of running water. The communal hand washing ([Figure 1](#)) observed in the study area remains the alternative in 79% of the ECD centres where there is water scarcity and no tippy taps in use.

CONCLUSIONS

The results confirm that while most of the ECD centres in the study area have access to improved water source, they lack adequate sanitation facilities and overall safe hygiene standards and behaviour are low. The observed poor sanitation and hygiene standards could be a result of



■ 1-10 Children/hand wash basin ■ 11-20 Children/hand wash basin
■ 21-30 Children/hand wash basin ■ >30 Children/hand wash basin

Figure 1 | Number of children sharing a wash basin ($n = 39$).

inadequate knowledge of the disease burden attributable to inadequate WASH practices. Equally poor WASH practices in the study area could be associated with inadequate funding for the management of the ECD centres. The Department of Social Development plays a crucial role in supporting the management structures of ECD centres, but service delivery needs to improve. Low socio-economic areas by definition have a vast range of challenges due to poor access to water, limited funding for structural maintenance, sanitation and hygiene practices. WASH intervention is a vital component to ensure an environmentally safe ECD centre. Children at the ECD centres have the right to a steady supply of safe and clean drinking water. When water cannot be accessed from a clean source, it should be treated to guarantee safety by using approved national health guidelines for the treatment of water.

In line with Sustainable Development Goal 6 (SDG6), lack of safe water and sanitation systems are a leading cause of childhood mortality and morbidity due to contributing to undernutrition and stunting. WASH is essential in ECDs in order to engage children in actions that promote behaviour change related to hygiene, sanitation and water ([UNICEF 2003](#); [Grebmer *et al.* 2015](#)). Training and capacitation regarding water purification should be highlighted in ECD intervention programmes. The unhygienic sharing of one potty by more than five children, as observed in ECD facilities, could be due to lack of age-equivalent toilets for children in the centre. The same premise is applicable to the use of washbasins. Toilet and hand washing facilities must be in reach of children over the age of three years. Priority should be given to providing affordable and safe waste disposal alternatives for ECD centres. Ideally, one potty should be available for every five children and waste from potties should be disposed of hygienically, and the potty cleaned after use and disinfected. This standard needs to be applied through training, and modelled, in order to create a safe WASH culture at the ECD centres. Similarly, in centres where sewerage is available, at least one toilet and a hand washing basin should be available for every 20 children between the ages of three and six years. In the absence of wash basins, alternative low-cost hand washing points, such as a tippy tap or a pitcher of water and a basin, should be used appropriately to enhance hygiene practices ([Government Gazette & Notice 2015](#)). Nappy

changing areas should be clearly demarcated and equipped with an easy to clean surface.

The quality of programmes currently provided at the ECD centres in the study area may not be sufficient to ensure adequate growth and development of the children. Legislation supports subsidized and affordable water and sanitation as part of the comprehensive package of services children should receive in South Africa by 2030, although the realization of this package may not be seen immediately in low socio-economic areas (Department of Social Development 2015). Additionally, ECD centres should aim to improve WASH standards to be in line with the National Integrated ECD Policy strategy for a comprehensive ECD programme, including a safe and conducive centre environment (Department of Social Development 2015). The Department of Water and Sanitation and local government are primarily identified as the stakeholders responsible for pioneering such actions alongside the private sector and community. Reinforcing and promoting WASH principles in low socio-economic areas should be a message shared by ECD centres and local municipalities. The growth and the development of children command attention in diverse areas including health, nutrition, and environment. There is an urgent need for an integrated plan that creates room for active involvement and participation of parents, caregivers, government departments and non-governmental organizations which will provide a comprehensive age and developmental stage equivalent package for children and caregivers at ECD centres. This study strongly recommends that WASH messages become part of ECD practitioner training, environmental health promotion and the ECD curriculum, both at the centres and at home-based care environments. This suggestion compares well with a recommendation in a recent study, for an inclusive WASH training aimed at enhancing teachers' awareness of the barriers, challenges and enablers to WASH practices in schools to be emphasized (Zaunda *et al.* 2018). Workshops on WASH for parents, caregivers, principals, stakeholders and regular monitoring and promotion of WASH standards will be beneficial to the ECD centres in the study area. It is also recommended that ECD centres receive adequate support to improve the structural issues in order to meet environmental health standards and departmental regulations, in order to be registered as a quality partial

care facility. At a country level, and in line with SDG6, an enabling environment for WASH is required that creates the conditions for sustainable, at-scale WASH services which will facilitate the achievement of the WASH Sustainable Developmental Goal of Universal Access for All, which can only be achieved with a progressive reduction in inequality and adequate water governance (UNICEF 2016).

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REFERENCES

- Adane, M., Mengistie, B., Kloos, H., Medhin, G. & Mulat, W. 2017 Sanitation facilities, hygienic conditions, and prevalence of acute diarrhea among underfive children in slums of Addis Ababa, Ethiopia: baseline survey of a longitudinal study. *PLoS One* 12, 1–18. doi:10.1371/journal.pone.0182783.
- Atmore, E. 2013 Early childhood development in South Africa – progress since the end of apartheid. *Int. J. Early Years Educ.* 21, 152–162. doi:10.1080/09669760.2013.832941.
- Centre for Enteric Diseases and Division of Public Health Surveillance and Response 2018 *Situation Update on Listeriosis*

- Outbreak, South Africa*. National Institute for Communicable Diseases, South Africa. Available at: http://www.nicd.ac.za/wp-content/uploads/2018/04/NICD-Situation-update-on-listeriosis-outbreak-South-Africa_06-April-2018.pdf.
- Cumming, O. & Cairncross, S. 2016 Can water, sanitation and hygiene help eliminate stunting? Current evidence and policy implications. *Matern. Child Nutr.* **12**, 91–105. doi:10.1111/mcn.12258.
- Darvesh, N., Das, J. K., Vaivada, T., Gaffey, M. F., Rasanathan, K. & Bhutta, Z. A. 2017 Water, sanitation and hygiene interventions for acute childhood diarrhea: a systematic review to provide estimates for the Lives Saved Tool. *BMC Public Health* **17**. doi:10.1186/s12889-017-4746-1.
- Department of Social Development 2015 *National Integrated Early Childhood Development Policy*. Government Printers, Pretoria, South Africa, 1–140.
- ECSECC 2017 *Nelson Mandela Bay Metro Municipality Socio Economic Review and Outlook 2017*. Eastern Cape Socio Economic Consultative Council, Vincent, South Africa.
- Fischer Walker, C. L., Perin, J., Aryee, M. J., Boschi-Pinto, C. & Black, R. E. 2012 Diarrhea incidence in low- and middle-income countries in 1990 and 2010: a systematic review. *BMC Public Health* **12**, 220. doi:10.1186/1471-2458-12-220.
- Government Gazette & Notice 2015 *National Health Act: National Environmental Health Norms and Standards for Premises and Acceptable Monitoring Standards for Environmental Health Practitioners*. Department of Health, Pretoria, South Africa, 12.
- Grebmer, K., Bernstein, J., de Waal, A., Prasai, N., Yin, S. & Yohannes, Y. 2015 *Update and MDG Assessment – Progress on Sanitation and Drinking Water*. UNICEF and WHO, New York, USA.
- Hoossein, S., Tandlich, R., Whittington-Jones, K., Laubscher, R., Madikizela, P. & Zuma, B. M. 2016 Disaster management policy options to address the sanitation challenges in South Africa. *J. Environ. Health* **78**, E1–E7.
- Housing Development Agency 2014 *A New Approach for Supporting Informal Early Childhood Development Centres: Main Findings and Recommendations*. Housing Development Agency, Houghton, South Africa.
- Jordanova, T., Cronk, R., Obando, W. & Medina, O. Z. 2015 Water, sanitation, and hygiene in schools in low socio-economic regions in Nicaragua: a cross-sectional survey. *Int. J. Environ. Res. Public Health* **12** (6), 6197–6217. doi:10.3390/ijerph120606197.
- Phaswana-Mafuya, N. & Shukla, N. 2005 Factors that could motivate people to adopt safe hygienic practices in the Eastern Cape Province, South Africa. *Afr. Health Sci.* **5**, 21–28.
- Reddy, V. B., Kusuma, Y. S., Pandav, C. S., Goswami, A. K. & Krishnan, A. 2017 Water and sanitation hygiene practices for under-five children among households of Sugali tribe of Chittoor District, Andhra Pradesh, India. *J. Environ. Public Health* **2017**. doi:10.1155/2017/7517414.
- Roche, R., Bain, R. & Cumming, O. 2017 A long way to go – estimates of combined water, sanitation and hygiene coverage for 25 sub-Saharan African countries. *PLoS One* **12**. doi:10.1371/journal.pone.0171783.
- Shields, K. F., Bain, R. E. S., Cronk, R., Wright, J. A. & Bartram, J. 2015 Association of supply type with fecal contamination of source water and household stored drinking water in developing countries: a bivariate meta-analysis. *Environ. Health Perspect.* **123**, 1222–1231. doi:10.1289/ehp.1409002.
- Shrestha, A., Sharma, S., Gerold, J., Erismann, S., Sagar, S., Koju, R., Schindler, C., Odermatt, P., Utzinger, J. & Cissé, G. 2017 Water quality, sanitation, and hygiene conditions in schools and households in Dolakha and Ramechhap districts, Nepal: results from a cross-sectional survey. *Int. J. Environ. Res. Public Health* **14**, 1–21. doi:10.3390/ijerph14010089.
- Sibiya, J. E. & Gumbo, J. R. 2013 Knowledge, attitude and practices (KAP) survey on water, sanitation and hygiene in selected schools in Vhembe District, Limpopo, South Africa. *Int. J. Environ. Res. Public Health* **10** (6), 2282–2295. doi:10.3390/ijerph10062282.
- Strunz, E. C., Addiss, D. G., Stocks, M. E., Ogden, S., Utzinger, J. & Freeman, M. C. 2014 Water, sanitation, hygiene, and soil-transmitted helminth infection: a systematic review and meta-analysis. *PLoS Med.* **11**. doi:10.1371/journal.pmed.1001620.
- Tofail, F., Fernald, L. C., Das, K. K., Rahman, M., Ahmed, T., Jannat, K. K., Unicomb, L., Arnold, B. F., Ashraf, S., Winju, P. J., Kariger, P., Stewart, C. P., Colford, J. M. & Luby, S. P. 2018 Effect of water quality, sanitation, hand washing, and nutritional interventions on child development in rural Bangladesh (WASH Benefits Bangladesh): a cluster-randomised controlled trial. *Lancet Child Adolesc. Health* **2** (4), 255–268. doi:10.1016/S2352-4642(18)30031-2.
- UNICEF 2003 *WASH in A Changing World | Water, Sanitation and Hygiene | UNICEF*. Available at: https://www.unicef.org/wash/3942_statistics.html (accessed 26 November 2018).
- UNICEF 2011 *WASH in Schools: Monitoring Package*. Available at: https://www.unicef.org/wash/schools/files/wash_in_schools_monitoringpackage.pdf.
- UNICEF & WHO 2017 *Progress on Drinking Water, Sanitation and Hygiene*. Available at: <https://www.who.int/mediacentre/news/releases/2017/launch-version-report-jmp-water-sanitation-hygiene.pdf>.
- WHO/UNICEF 2016 *Core Questions and Indicators for Monitoring WASH in Schools in the Sustainable Development Goals*. Available at: https://www.who.int/water_sanitation_health/publications/core-questions-and-indicators-for-monitoring-wash/en/.
- Zaunda, H., Holm, R. H., Itimu-Phiri, A., Malota, M. & White, S. 2018 A qualitative assessment of disability friendly water and sanitation facilities in primary schools, Rumphu, Malawi. *Dev. South. Africa* **35**, 760–773. doi:10.1080/0376835X.2018.1461610.