# IMPACT OF WATER, SANITATION AND HYGIENE INTERVENTIONS ON HEALTH AND NUTRITION

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Acción contra el Hambre, Francois Lenoir, Mauritania


## Abstract

Improving access to drinking water and sanitation is one of the biggest goals of the 21th century. Nowadays, millions of people lack access to basic sanitary facilities, to quality water and do not have hygiene habits. As consequence, each year millions of people, especially children, die due to water related diseases.

During the last 40 years, different studies have been done trying to quantify the impact of water, sanitation and hygiene (WASH) interventions on health and nutrition. Although the evidence is not enough to quantify the impact of these interventions, it is enough to prove that WASH interventions are a key point reducing children's undernutrition risk, especially during the first 1,000 days of the newborn.


## Key Messages

- Access to drinking water, sanitation and hygiene contributes to reduce child undernutrition, especially during the first 1.000 days of the newborn, and mortality. Adding water, sanitation and hygiene interventions to nutrition interventions could save 3 million lives each year and increase between 1,5 and 1,9 cm the height of babies under 18 months.

- Water, sanitation and hygiene interventions face basic and underlying causes of undernutrition. These interventions not only lead to a diarrhoea reduction and to a better absorption of food, but also save time and resources, which impact positively on vulnerable people's livelihood.

- Action against Hunger-Spain advocates for an increasing integration of water, sanitation and hygiene interventions in undernutrition programs and for an increasing of funds for these interventions. Likewise, it is important to continue with the researches about the impact of water, sanitation and hygiene interventions on nutrition and with the capitalization of the evidences about the benefits of this integration.

Action against Hunger-Spain is a global humanitarian organization committed to ending world hunger. Works to save the lives of malnourished children while providing to communities sustainable solutions to hunger.


Document prepared by Julián Ibargüen Onsurbe

## Introduction

Clearly, better access and quality water, promotion of hygiene habits and improved sanitation have important effects on people`s health. Thus way, interventions on Water, Sanitation and Hygiene (WASH) became a key strategy to improve health in European and American cities on late 19th century (Schmidt, 2014).

Nevertheless, the World Health Organisation (WHO) & Unicef (2014) report that about 2,5 billion people lack sanitary environment, an estimated 748 million lack access to quality water and around 1 billion people carry out open defecation.

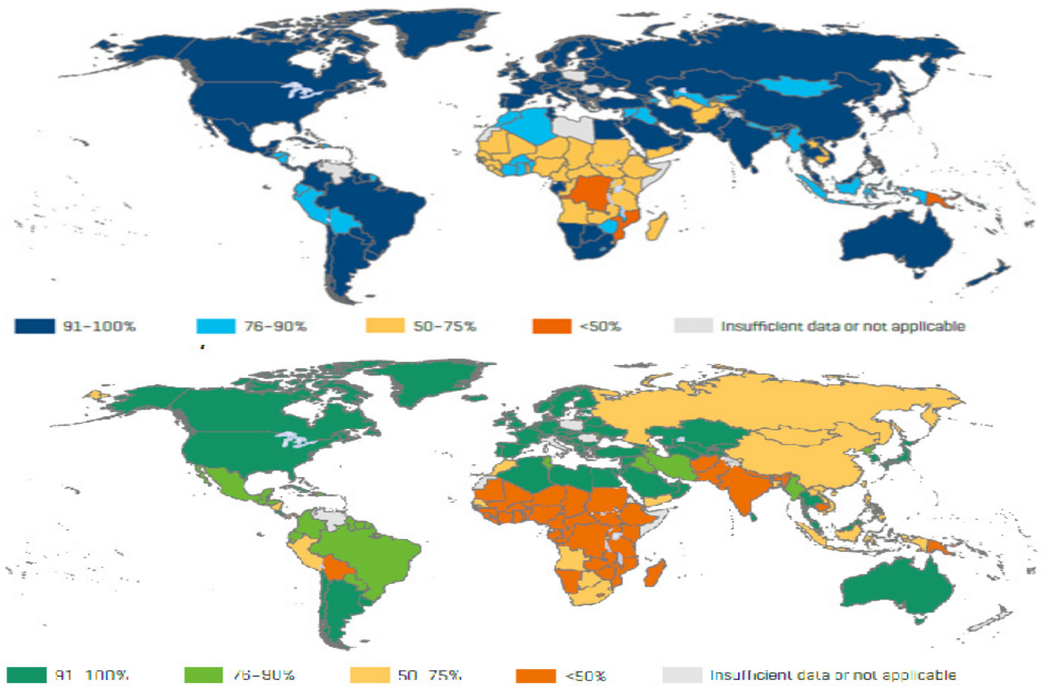
Therefore, many children have no choice but to drink unsafe water, and when safe water is available it is in low quantity, leaving little for hygiene habits. Also, time wasted collecting water or suffering water-related illnesses prevents young people from getting an education. All of these leads to impaired health, decreased well-being and poor economic development of population.

In this context, about 50% of child and maternal undernutrition is due to health problems, such as diarrhoea and intestinal infections, through poor quality water and lack of sanitation (Prüss-Üstün, Bos, Gore & Bartram, 2008).

Moreover, around 751 million children under five years old die due to diarrhoea (Liu, et al., 2012) and about 2 billion people suffer from soil-transmitted helminthiases, able to cause undernutrition (WHO, 2012).

In total, near 2,4 million people die as a result of diarrhoea and undernutrition, and its consequences (Prüss-Üstün, et al., 2008).

*Figura 1: Proportion of the population using improved drinking water sources and sanitation in 2012*




*WHO & Unicef (2014)*





## WASH and fight against undernutrition and mortality

According to research of ACF Spain in Mali and Mauritania, the integration of WASH programs in Nutritional Health Centres leads to significant decrease in mortality:

- 7,7% at the Inpatient Nutritional Rehabilitation Unit in Mali during 2011-2013
- 12,1% at the Ambulatory Nutritional Rehabilitation Unit in Mali between 2012-2013
- 5,9% at the Inpatient Nutritional Recovery Centre in Mauritania between 2012 and 2013

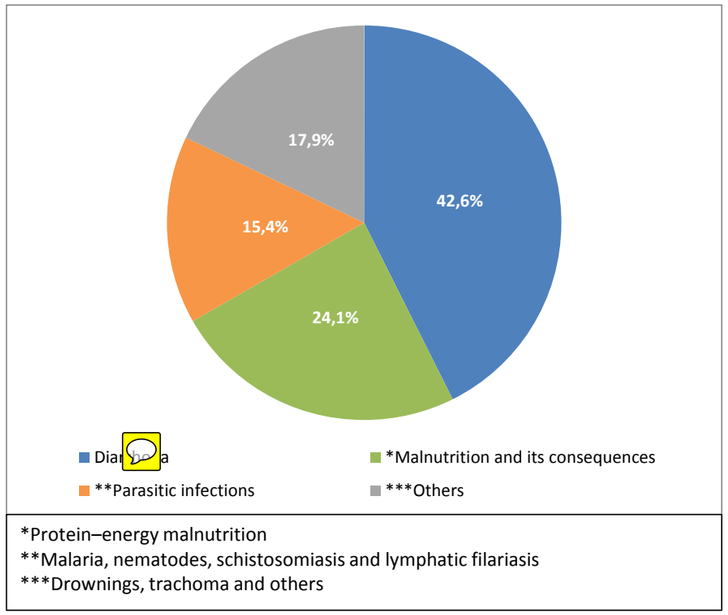
Likewise, according to WHO, 35% of all deaths (3.575.000) could be avoided applying WASH interventions, which add to and work with nutritional interventions; more than three million deaths (3.011.000) refer to children under 14 years old (Prüss-Üstün, et al., 2008).

Also we have to highlight that, of these more than three and a half million deaths, 42,6% are consequence of diarrhoea, and another 24,1% are due to undernutrition and its consequences (Figure 2).

These and other studies reveal the great impact of WASH interventions on health status. Thus, WASH area is especially important to improve well-being by implementing nutrition sensitive interventions (Ruel & Alderman, 2013) and tackling the underlying causes of child and maternal undernutrition and mortality (Unicef, 1992), by disease prevention, sanitation impulse and the promotion of good child caring practices (Dangour, et al., 2013).

By the application of these nutrition sensitive interventions, such as WASH activities, the effect and coverage of specific interventions are increased promoting and improving health status, growth, development and diet, but also increasing resilience to face crisis (Ruel & Alderman, 2013).

*Figure 2: Impact of WASH related diseases over the total deaths due to a lack of WASH (2002)*




*Adapted from Prüss-Üstün, et al. (2008)*

Therefore, WASH area to be under a comprehensive action against undernutrition and become an essential component of the nutrition security framework (Figure 3).

In this sense, there is evidence supporting positive effects of WASH interventions on health and nutrition. However, nowadays we find deep controversies about the reliability and quality of this evidence, especially when it refers to quantifying the effect of WASH interventions (Esrey, 1996; Dangour, et al., 2013; Evans, et al., 2014; Schmidt, 2014).

**BARRIERS AND RECOMMENDATIONS FOR FRAMING WASH IN NUTRITION**
**(Teague, Johnston & Graham, 2014)**

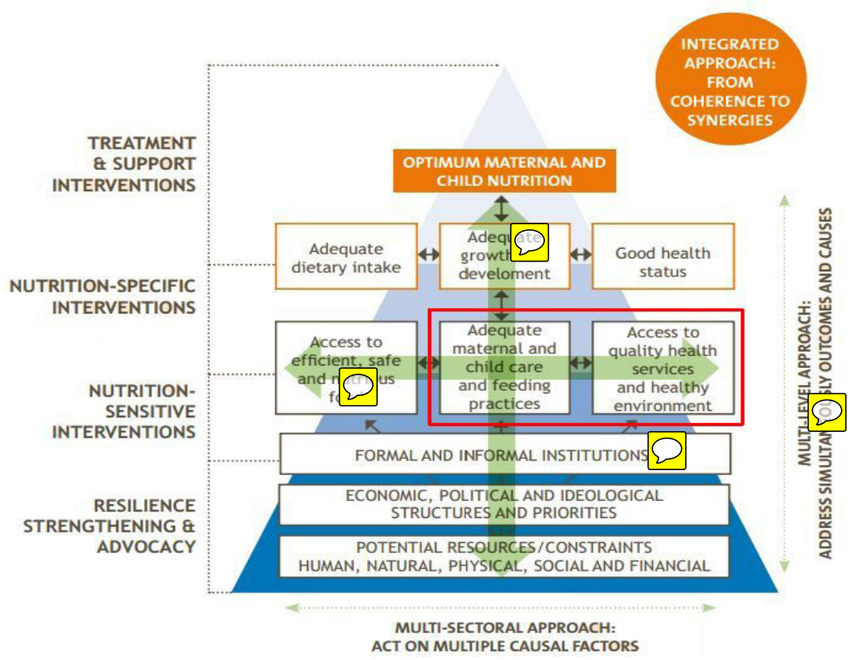
**Barriers**:

- Insufficient or siloed funding
- Staff capacity and interest
- Knowledge of each sector
- Coordinación entre sectores
- Lack of evidence on impact of integrated programs

**Recommendations**:

- Comprehensive strategy
- Coordination between sectors
- Funding and donor support
- Evidence of impact of integrated programs
- Leadership

*Figure 3: Nutrition security framework*




*Action contre la Faim (2014)*



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## State of art: measuring the impact of WASH on health and nutrition

Since the 70's an amount of studies try to measure the impact of WASH interventions on health and nutrition (Schmidt, 2014). Since then, different methodologies have been applied aiming to achieve more rigorous designs and more reliable results.

Therefore, different types of studies have been applied: case-control, randomised controlled trials, meta-analysis or microbiological. Nevertheless, these studies have found different difficulties and have fallen into several biases misguiding the reliability and validity of its results.

Following Cairncross, et al. (2013) and Schmidt (2014) we can underline the next **difficulties**: Low funds and high cost of interventions, especially on water; difficulties to conduct studies in those areas where they are more needed, difficulties to carry out microbiological analysis which allow the measurement of subclinical diseases and difficulties to accomplish longitudinal studies which can deprive from interventions during a long time.

Likewise, following the same authors, we can stress the next **biases**: Lack of randomizing and coverage of the samples, lack of control of confounding variables, respondent bias when interventions are not blinded to respondents and observation bias when researches only attend to autoreferred diarrhoea for health outcomes.

At the same time, some studies have reported conclusions that remain over time and seem to have consolidated as evidence. Between these **conclusions** we can highlight:

- Lack of water, sanitation and hygiene contributes to mortality by diarrhoea, which can lead to undernutrition (Cairncross, et al., 2013).
- Benefits of WASH intervention transcend diarrhoea finding other diseases such as acute respiratory infection, soil-transmitted intestinal helminth infection or undernutrition (Cairncross, et al., 2013).
- Enteric infections, such as Environmental Enteropathy, are associated to a lack of growth in children (Humphrey, 2009; Kosek, et al., 2013; Lin, et al., 2013).
- WASH interventions allow saving time which can be invested in other activities (Cairncross, et al., 2013).
- Growth outcome is more affected than weight outcome, pointing, therefore, to a larger effect on stunting than on wasting or underweight (Esrey, 1996; Bhutta, et al., 2008; Dangour, et al., 2013).

As can be seen, several have been the methodologies applied to the study of WASH interventions impact on health and nutrition, and several have been the difficulties and biases found. However, it seems that some evidence remain through time.



## Conceptual framework of wash impact on health and nutrition

Impact of WASH interventions on health and nutrition can follow different pathways. Thus, two ways have been identified through which WASH interventions impact on health and nutrition: directly and indirectly, which correspond in the Figure 4 with green and blue squares respectively.

When talking about **direct impact of WASH on health and nutrition**, we are referring to the capability of interventions to prevent and increase the resistance of the body to diseases which affect the absorption of nutrients, such as diarrhoea, enteric infections or nematode infections (Dangour, et al., 2013).

In this sense, feature interventions focus on:

•Avoiding the contamination of environment by stool with the construction of latrines and baths (Humphrey, 2009; Spears, 2013; Dangour, et al., 2013).

•Improving hygiene habits such as hand-washing (Luby, et al., 2006; Humphrey, 2009; Dangour, et al., 2013).

•Promoting free stool spaces for the leisure and feed of children (Ngure, et al., 2014).

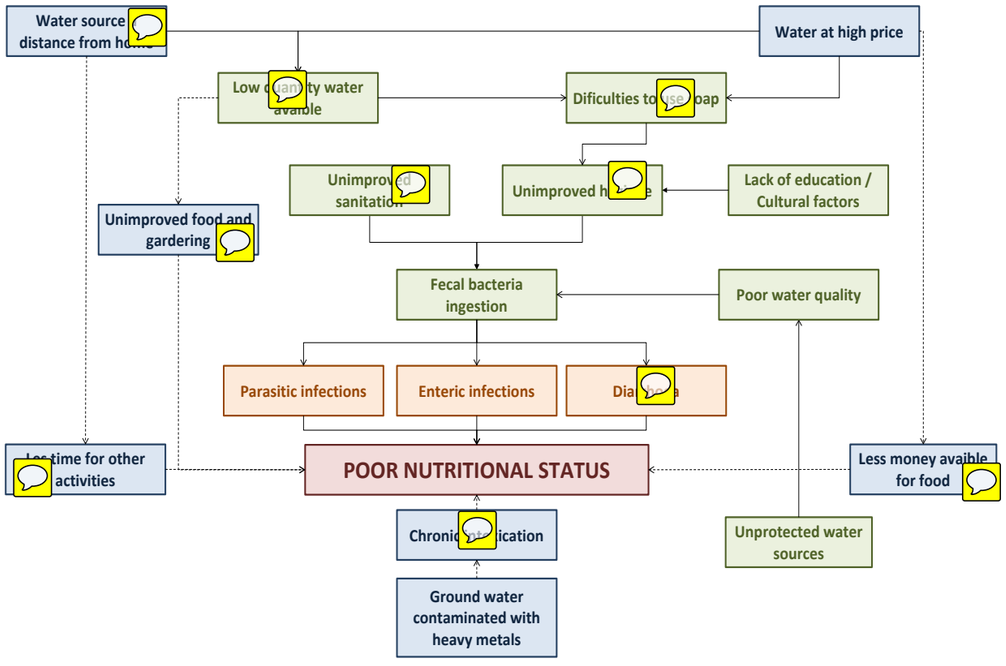
When referring to **indirect impact of WASH on health and nutrition**, we are talking about the effect of interventions on improving access to water, lowering down its price and eliminate heavy metals (Dangour, et al., 2013). Therefore:

•Improving water access allows investing more time in other activities (Esrey, 1996; Howard & Bartram, 2003; Dangour, et al., 2013), put into practice hygiene habits (Howard & Bartram 2003; Dangour, et al., 2013) and improve food preparation and cultivation (Keene, n.d.; Howard & Bartram 2003; Dangour, et al., 2013).

•Reducing the price of water grants the possibility of investing more resources to access other essential goods (Cairncross & Kinnear, 1992; Dangour, et al., 2013).

•Avoiding heavy metal water contamination prevents health problems (Dangour, et al., 2013).

*Figure 4: Conceptual framework showing how lack of WASH might impact child nutritional status, directly and indirectly*




*Adapted from Dangour, et al. (2013)*





## Quantifying WASH impact on health and nutrition

Given the diversity of studies developed which try to measure the impact of WASH interventions on health and nutrition, we have done a compilation of results reported in ten different researches.

| AUTHOR | YEAR | COUNTRY | RESULTS |
|---|---|---|---|
| Hasan, et al. | 1985 | Bangladesh | Hand-pumps, latrines and hygiene promotion reduce diarrhoea incidence by 25%. |
| Hasan, et al. | 1985 | Bangladesh | There is no significant impact of these interventions on children's nutritional status. |
| Esrey | 1996 | Multicountry | 40% reduced diarrhoea prevalence between an optimal sanitation and an unimproved sanitation when both groups have unimproved water (urban context). |
| Esrey | 1996 | Multicountry | 13% reduced diarrhoea prevalence between an optimal sanitation and an unimproved sanitation when both groups have intermediate water (urban context). |
| Esrey | 1996 | Multicountry | 19% reduced diarrhoea prevalence between an optimal sanitation and an unimproved sanitation when both groups have optimal water (urban context). |
| Esrey | 1996 | Multicountry | Improvements on sanitation have no effects on diarrhoea prevalence in rural context. |
| Esrey | 1996 | Multicountry | Improvements between an unimproved sanitation to an intermediate sanitation increase height between 0,8 cm and 1,1 cm on 18 months old babies. |
| Esrey | 1996 | Multicountry | Improvements between an unimproved sanitation to an optimal sanitation increase height between 1,5 cm and 1,9 cm on 18 months old babies. |
| Esrey | 1996 | Multicountry | Improvements on sanitation lead to a reduction of growth deficit between 22% and 53% in urban context. |
| Esrey | 1996 | Multicountry | Improvements on sanitation lead to a reduction of growth deficit between 4% and 37% in rural context. |
| Esrey | 1996 | Multicountry | Improvements on sanitation lead to a reduction of weight deficit between 11% and 41% in urban context. |
| Esrey | 1996 | Multicountry | Improvements on sanitation lead to a reduction of weight deficit between 5% and 35% in rural context. |
| Alam, Marks, Baqui, Yunus & Fuchs. | 2000 | Bangladesh | Dysentery is associated with an annual loss of 0,5 kg and 1,15 cm on children under 5 years old. |
| Checkley, et al. | 2004 | Peru | 24 months old babies living in the worst WASH conditions are 1 cm shorter than those living in the best WASH conditions. |
| Checkley, et al. | 2004 | Peru | 24 months old babies living in the worst WASH conditions have 54% more diarrhoea episodes than those living in the best WASH conditions. |

| AUTHOR | YEAR | COUNTRY | RESULTS |
|---|---|---|---|
| Checkley, et al. | 2004 | Peru | 24 months old babies with smaller storage containers have 28% more diarrhoea episodes than those with bigger storage containers. |
| Checkley, et al. | 2004 | Peru | Lack of sewage disposal explains 0,9 cm of the deficit growth on 24 month old babies. |
| Checkley, et al. | 2004 | Peru | Children who live in households with water connection, but without adequate sewage disposal and small storage containers, are 1,8 cm shorter than those who live in households with adequate sewage disposal and storage containers. |
| Luby, et al. | 2006 | Pakistan | 55% reduced diarrhoea prevalence with bleach and storage container interventions. |
| Luby, et al. | 2006 | Pakistan | 51% reduced diarrhoea prevalence with hand-washing with soap interventions. |
| Luby, et al. | 2006 | Pakistan | 64% reduced diarrhoea prevalence with disinfectant interventions. |
| Luby, et al. | 2006 | Pakistan | 55% reduced diarrhoea prevalence with disinfectant and hand-washing with soap interventions. |
| Bhutta, et al. | 2008 | Multicountry | 30% reduced diarrhoea incidence with hygiene habits promotion. |
| Bhutta, et al. | 2008 | Multicountry | Each diarrhoea episode increases by 4% the possibility of suffering stunting. |
| Bhutta, et al. | 2008 | Multicountry | Hygiene coverage of 99% reduces stunting prevalence by 2,4% on under 36 months old children. |
| Langfor, Lunn & Panter-Brick | 2011 | Nepal | 41% reduced diarrhoea morbidity with hand-washing interventions. |
| Langfor, Lunn & Panter-Brick | 2011 | Nepal | Hand-washing interventions do not reduce gut mucosal damage or immune stimulation. |
| Langfor, Lunn & Panter-Brick | 2011 | Nepal | Hand-washing interventions do not reduce growth deficit. |
| Dangour, et al. | 2013 | Multicountry | Solar disinfection of water, provision of soap and improvement of water quality slightly improve growth on children under 5 years old. |
| Kosek, et al. | 2013 | Multicountry | Children with maximum punctuation on Environment Enteropathy outcome grow 1,08 cm less, in six month, than those with the minimum punctuation. |
| Lin, et al. | 2013 | Bangladesh | 22% reduced stunting prevalence on children when living in healthy environment, compares to those living in contaminated environments. |





Although there is no agreement, an amount of studies address an improvement of health and nutritional status due to WASH interventions. Therefore, Esrey (1996) reports an increase of 1,5 to 1,9 cm on growth of 18 month old babies when interventions improve sanitation to an optimal level.

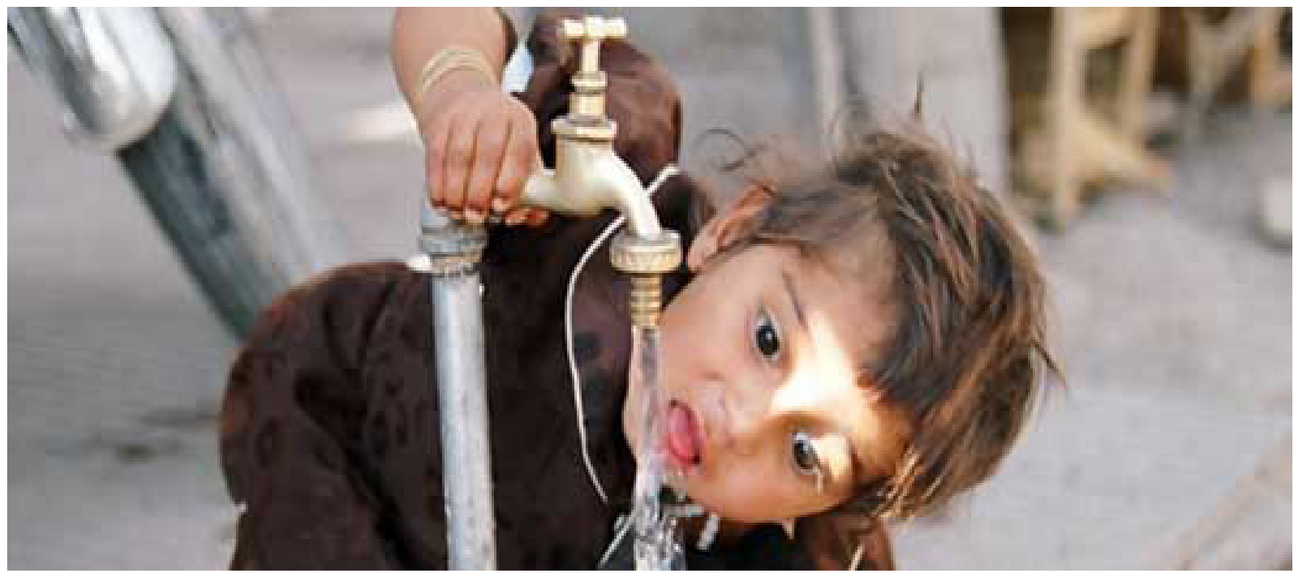
Likewise, Checkley, et al. (2014) inform that children who live in households with water connection, but without adequate sewage disposal and small storage containers are 1,8 cm shorter than those who live in households with adequate sewage disposal and storage containers.

Referring to health status, in particular to diarrhoea episodes, we find that Luby, et al. (2006) published a result of 64% reduction on diarrhoea prevalence with disinfectant intervention, 55% decrease with bleach and water vessel interventions and 55% reduction of diarrhoea prevalence with disinfectant and hand-washing interventions.

Meanwhile, some microbiological analyses confirm an association between Environmental Enteropathy and growth. Therefore, Kosek, et al. (2013) inform that children with a maximum punctuation on Environmental Enteropathy outcome grew, in six months, 1,08 cm less than those who present a minimum punctuation. Likewise, Lin, et al. (2013) report a 22% stunting prevalence decrease in households with improved sanitation, consequently with less enteric bacteria.

However, other studies do not show these positive results. In such way we have found Hasan, et al. (1985) and Langfor, Lunn & Panter-Brick (2011). The first one shows a significant lack of effect on children nutritional status of interventions with hand-pumps, latrines and hygiene promotion, while the second one emphasises that hand-washing promotion neither produce effects on children`s growth, nor improvements on gut mucosa or immune stimulation.

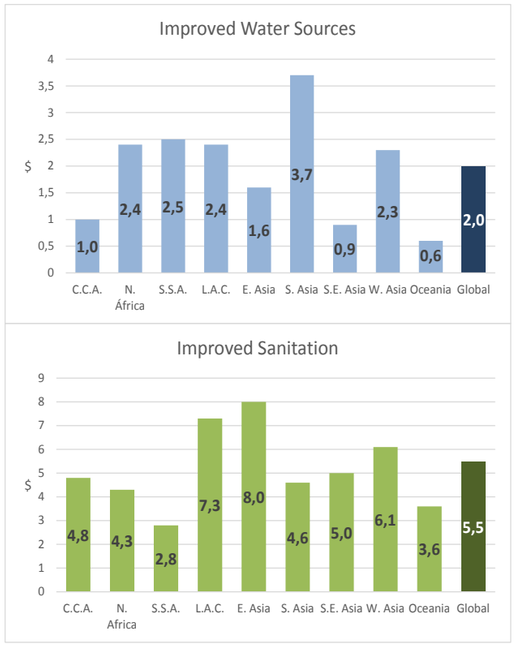
As observed, results are diverse. However, in general terms, conclusions have been presented which point that WASH interventions produce improvements on people`s health and nutritional status.



## Economic benefits of WASH interventions

Any way, WASH interventions benefits are not only nutritional and healthwise, but also produce economic profits by increasing coverage and improving water access and sanitation. Therefore, WHO reports that in 2010 for each $ invested on sanitation, 5,5$ were restored; for each $ invested on improving water access 2$ were restored (Figure 5).

*Figure 5: Benefit-cost ratios of interventions to attain universal access of improved sanitation and drinking water sources (2010)*




*Adapted from Hutton (2012)*

Thus, without underestimating the benefits of WASH interventions in health and nutritional status, these interventions also present economic profits which impulse wealth progress of developing regions. In such way, impact on one of the basics causes of child and maternal malnutrition and mortality (economic structure) would be done (Unicef, 1992).

## Conclusions

Despite the lack of agreement between the different studies, whether at a methodological level or at a results level, an amount of researches highlight positive effects of WASH interventions on health and nutrition.

Notwithstanding, since the 70`s diverse methodologies have been applied, and no one has finally move in on. Despite multiples reviews, it seems there is no conclusion which point at a methodological standardization, which probably contributes to a better agreement between results.

This way, we should not forget the complexity of WASH interventions, which many times are done by different agencies and imply an amount of outcomes, not only involving health and nutrition (Cairncross, et al., 2013). All these cause difficulties towards a methodological standardization in order to quantify WASH interventions impacts on health and nutrition.

Nevertheless, we cannot underestimate WASH interventions contribution within the fight against undernutrition and mortality. As we have seen, WASH area develops necessary activities to face underlying causes of child and maternal undernutrition and mortality. Moreover, it is necessary to promote them in order to achieve a comprehensive action to deal with undernutrition in the nutritional security framework.

Additionally, benefits of WASH interventions on education, development and gender should be enough by their self to keep investing, even though there is no health impact (Schmidt, 2014)

Furthermore, we have to take into account that, although existing evidence is not strong enough to quantify WASH interventions impact on health and nutrition, it is strong enough to emphasizes that WASH interventions are a key point to reduce undernutrition, especially during the first 1.000 days of children life (Evans, et al., 2014).





Last but not least, access to drinking water and healthy environment is a fundamental right to every human being, without discrimination. Nowadays, Millennium Development Goals are being reviewed for the next 15 years. Thus, it is important to include new WASH results aiming universal and equitable access to safe and affordable drinking water and to sanitation, likewise ending open defecation practices. Therefore, progress towards comprehensive and multisectoral actions against undernutrition are being done within the nutritional security framework.

Given the previous, is necessary to keep WASH interventions on its full scope. Thusly, in 2013, 45% of ACF-Spain beneficiaries were of WASH projects, investing a 31% of the total funds of that year.

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