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Title: Systematic Review: A comparative study of Community Led Total Sanitation, Total Sanitation Campaign and Micro-finance led sanitation to assess what works better in developing countries with special focus on India.

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1. ABSTRACT

Background: The world is lagging behind access to improved sanitation even in the 21st century. There are about 2.4 billion people who are denied the benefits of the improved sanitation. Subsequently people succumb to diarrhoeal disease especially children less than 5 years of age. India is one of the countries where vast number of people lack access to improved sanitation.

Different developing countries have adopted different approaches like Total Sanitation Campaign (TSC), Community Led Total Sanitation (CLTS), School-Led Total Sanitation, Micro-finance Led Sanitation, Sanitation Market etc. to promote sanitation. This review will assess the effectiveness of TSC, CLTS and Micro-finance Led Sanitation approaches in term of toilet construction and health outcomes.

Methodology: The systematic review adopted Cab Abstract, Global Health, EMBASE, PubMed, SCIRUS and ELDIS databases along with websites working in the field of water and sanitation. The literature search completed by the end of July. The review included both randomized control and non –randomized control trials conducted in developing countries with the outcome of study being either toilet construction or health indicator as primary or secondary outcomes.

Results: A total of 705 papers were identified. After screening for duplicates and irrelevant articles, 5 papers were selected that met the inclusion criteria. The studies found a significant effect of the IEC education through CLTS on the latrine construction. However CLTS had no significant effect on diarrhoeal morbidity among children < 5. Similarly, the impact of TSC suggested that diarrhoeal morbidity reduced significantly in open defecation free (ODF) villages as compared to non- open defecation free (NODF). However 23% of the population in ODF villages still suffered from diarrhoea.

Conclusion: The evidence from studies suggested that CLTS may be effective in promoting sanitation; however neither TSC nor CLTS were effective to address diarrhoeal morbidity under 5.

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3. Acronyms Key

FGD	Focus Group Discussion
LSHTM	London School of Hygiene and Tropical Medicine
MDG	Millennium Development Goal
NU	United Nations
WHO	World Health Organisation
ODF	Open Defecation Free
TSC	Total Sanitation Campaign
CLTS	Community Led Total Sanitation
NGP	Nirmal Gram Puraskar
SGBGSA	*Sant Gadge Baba Gram Swachata Abhiyan*
BCC	Behaviour Change Communication
BPL	Below the Poverty Line
NGO	Non-governmental organization
MUAC	*Mid-Upper Arm Circumference (WHO* indicators)
VERC	Village Education Resource Centre
MFIs	Micro-finance institutions
SLTS	School Led Total Sanitation
CATS	Community Approaches to Total Sanitation
PSM	Propensity Score Matching
CHC	Community Health Club
VIP	Ventilated Improved Pit
IHHLs	Individual Household Latrines
VERC	Village Education Resource Centre

4. INTRODUCTION:

According to the UN report 2012, 'sanitation is the big taboo in international development, although, it is universally accepted as being essential for human life, dignity and human development'. Sanitation has been either neglected or given less priority by different governments in the developing countries for years. It was for the first time in 2008 the world leaders recognised the importance of working together on the issue and passed a UN resolution to declare the year as 'International Year of Sanitation'. On 20 December 2010 the UN General Assembly adopted a resolution calling upon the UN member states to "redouble efforts to close the sanitation gap" by launching the Drive to 2015 by UN Secretary-General Ban Ki-moon (UN report, 2012).

Access to improved sanitation is not only a human rights issue but it also brings large benefits to the development of individual countries through improvements in health outcomes and economy through improved productivity of the individuals. According to WHO report, '2.4 billion people do not have access to any type of improved sanitation facility. Diarrhoeal disease is the biggest killer of children in developing countries. About 2 million people die every year due to diarrhoeal diseases; most of them are children less than 5 years of age'. 'Of 2.4 billion people who lack access sanitation four in five of these people are in Asia with approximately one in five in both India and China'(Cairncross, 2003).

There is no doubt some countries have made remarkable progress in improving access to sanitation. The UNICEF/WHO report 2012 estimates that 63% of the world's population has access to improved sanitation. Nevertheless the progress is inadequate to reach the Millennium Development Goal (MDG) for sanitation. However, the recent revelation by Indian census 2011 report showed an awakening reality of sanitation situation in the country. The report shown by state governments on the website of the Total Sanitation Campaign (TSC) run by the Union Ministry for Rural Development showed 68 per cent sanitation for the country as a whole, however the 2011 Census report found just 32.7 per cent of the country population has access to sanitation. Most states have performed poorly. For instance 'Andhra Pradesh had claimed sanitation coverage of about 77 per cent, but the Census found that it has only 34.9 per cent of coverage. Gujarat had claimed sanitation coverage of 81.6 per cent; the Census data showed only 34.2 per cent. Jharkhand has only eight per cent coverage in the Census, but it had claims 42 per cent'(Menon, 2012). The census data indicates a complex story of sanitation in the country. This could be one of the reasons that the impact of sanitation in the rural area is minimal in the country. The child mortality due to diarrheal disease is still very high.

Different developing countries have adopted different approaches to promote sanitation in their country. Most prominent approaches to promote sanitation are Total Sanitation Campaign (TSC), Community Led Total Sanitation (CLTS), School-Led Total Sanitation (SLTS), and Micro-finance Led Sanitation. More recently, the "Sanitation Market" approach has been adopted by some of the countries. This review will assess the effectiveness of TSC, CLTS and Micro-finance Led Sanitation approaches.

4.1 Total Sanitation Campaign:

India's first national programme on rural sanitation, the Central Rural Sanitation Programme, was initiated by the Rural Development Department in 1986. The focus of the programme was to promote toilet construction through subsidy on hardware and to generate demand for toilet construction. Behaviour change was never addressed in this programme. Subsequently there was hardly 1% annual growth of sanitation coverage throughout the 1990 (WSP, 2011).

To improve the existing sanitation programme in the country the Government of India restructured the programme and launched the Total Sanitation Campaign (TSC) in the year 1999 to achieve universal rural sanitation coverage by 2012. 'The focus of the TSC was to support village communities to end open defecation in their areas and achieve total sanitation, to improve social dignity, privacy and ensure hygienic and healthy living environment. Demand for sanitation was generated through behaviour change communication (BCC) to make the community open defecation free'(Jha,2012).This programme was administered by the Ministry of Drinking Water and Sanitation.

The restructured sanitation programme aimed to provide financial incentive to Below the Poverty Line (BPL) families for construction and use of toilets. However, the focus of the campaign was to create sustainable awareness and behaviour change among the people, through capacity building and motivation to build individual household latrines (IHHLs) to own and maintain (Jha, 2012).

The TSC campaign received a major thrust with the introduction of *Nirmal Gram Puraskar* (NGP) at the national level. The award was given to those 'open defecation free' *panchayats* (one or two to three villages), blocks and districts which have become fully sanitized. Some states like Maharashtra introduced additional incentive called *Sant Godge Baba Gram Swachata Abhiyan* (SGBGSA) to usher the process of open defecation free villages. Similarly the southern state, Tamil Nadu, announced Clean Village Campaign in addition to

NGP in the year 2003. Since its inception in 2003, the Clean Village Campaign was introduced simultaneously by other states in the country. The Clean Village Campaign differed from earlier TSC approaches in number of ways. First, it moved away from 'counting toilets constructed' to 'counting the number of communities that have become 'open defecation free' (ODF). Second, it shifted from individual household toilet construction to community-level behaviour change to end open defecation as the objective of a sanitation program (UNICEF, 2009).

The TSC has taken a paradigm shift over the years. The key principles of the TSC are to promote a demand-driven approach to emphasis creating awareness and generating demand for sanitary facilities through community mobilization campaigns. In principle it is no longer a supply driven approach. The second major change in the approach is the provision of incentives to the community to be open defecation frees (ODF) rather than providing subsidies for household toilets. Thirdly, the TSC relies on the leadership of the Gram Panchayat (village-level self-government), women's groups, NGOs and other local stakeholders. Fourthly, the TSC has prioritised sanitation and hygiene in rural schools, recognizing the important role of children in learning and adopting new ideas and then advocating for behaviour change in the community (UNICEF, 2009).

4.2. Community led total sanitation approach (CLTS)

Community Led Total Sanitation (CLTS) was pioneered by Dr. Kamal Kar, a development consultant from India, together with Village Education Resource Centre (VERC), a local Non-governmental organization (NGO) and partner of Water Aid in Mosmoil village in the Rajshahi district of Bangladesh in 2000. The idea of CLTS triggered whilst evaluating a traditionally subsidised sanitation programme (Mehta, 2009).

Dr. Kamal Kar persuaded the local NGO to stop top-down toilet construction through upfront subsidy. He advocated change in institutional attitude and the need to draw on intense local mobilisation and facilitation to enable villagers to analyse their sanitation and bring about collective decision-making to stop open defecation (Mehta, 2009).

Community-Led Total Sanitation (CLTS) is an integrated approach to achieve and sustain open defecation free (ODF) status. CLTS entails the facilitation of the community' analysis of their sanitation profile, their practices of defecation and its consequences, leading to collective action to become ODF(Mehta, 2009). The underlying assumption is that when people realise that they are 'eating one another's shit' they make their communities open

defecation free and collectively adopt improved hygiene behaviour. It is fundamental that CLTS involves no individual household hardware subsidy and does not prescribe latrine models. Social solidarity, help and cooperation among the households in the community are a common and vital element in CLTS (Kar & Chambers, 2008).

'The CLTS triggering process often starts with an informal talk with a few community members during a walk through the village. The aim is to motivate people to carry out a more substantial sanitation analysis involving the whole community'(Kar & Chambers, 2008). Slowly other community members are encouraged to participate in the community walk. After the community walk 'communities are facilitated to face the shit (using the crude local word). They map and inspect their defecation areas, calculate how much shit they deposit, and identify pathways between shit and mouth. Disgust, dignity and self-respect triggers self-help to dig pits, adopts hygiene behaviour and become ODF'(Kar & Chambers, 2008).

While going through the community pathways the facilitator is not supposed to tell people what to do rather enable the community to have an embarrassment experience facing shits on the way. Subsequently this experience is called 'walk of shame'. Hence CLTS does not tell people what they should do. It tells them what they are doing and the process of dialogue begins with the support of a facilitator. In most cases the facilitator is an external individual who may be a powerful and eloquent as compared to the villagers (Mehta, 2009).

Since its emergence in early 2000, CLTS has spread in different countries and has now also moved to Africa and the Middle East. Today CLTS is in more than 20 countries including at least six different countries in Asia (Bangladesh, India, Indonesia, Nepal, Pakistan and Cambodia) seven countries in Africa (Ethiopia, Tanzania, Kenya, Nigeria, Uganda, Zambia, Sierra Leone) and Latin America (Bolivia) as well as Yemen in the Middle East (Mehta, 2009).

4.3 Micro-finance led sanitation

The history of microfinance to very poor goes back to Bangladesh in 1976 when *Grameen Bank* was created. In this strategy borrowers did not require to give guarantee for loan, however the process of getting microfinance needed the borrowers to form a group and give guarantee each other's borrowings. In India these groups are called self-help groups (SHGs) mostly consisting of women who share strong community ties. Individual from the groups could borrow small amount with very low rate of interest. The *Grameen Bank's* experiment has revealed that there was a very low rate of default on solidarity loans and repayment rates are greater than 90% (Fonseca, et al., 2007). The experience of sanitation

microfinance pilot projects with NGOs in Tamil Nadu in India have reached repayment rates greater than 90% for ventilated household pit (VIP) and cluster latrines in rural areas and urban slums (Sijbesma, et al., 2008).

Historically, water supply and sanitation activities were a low priority for individual households and subsequently people never considered to borrow money to have household sanitation facilities. Hence Microfinance for water and sanitation was not available (WHO, 2005).It was during 1980s and 1990s that microfinance was incorporated in water supply and sanitation projects through a revolving fund component. 'The repayment of this money was then supposed to enable the funds to be 'revolved' to further households'(Pfeiffer, 2009). Initially the revolving fund was part of the project funded by funding organisation. However now-a-days different Microfinance institutions, commercial banks, non-banking financial institutions, NGOs, credit cooperatives or solidarity lending groups have come forward to join hand with NGOs to support Microfinance for sanitation. Microfinance is known by different names like micro-credit or micro-loan or micro-loan in different countries.

Microfinance is playing a more and more important role in communities to improve access to sanitation to all section of the society. Potential clients of microfinance for sanitation or sanitation-related services include small scale private providers and households. Microfinance has been used for the construction of household latrines, construction of public toilets, manual latrine-cleaning services and suction truckers which are used to empty pit latrines (WHO, 2005).Currently Microfinance led sanitation is reported in countries such as India, Lesotho, Vietnam, Bangladesh, Pakistan and Burkina Faso (Knapp, 2004).

4.4. Rationale for the review:

It is well known that there are about 2.4 billion people in the world who lack adequate sanitation. Lack of sanitation contributes to about 10% of the global disease burden, causing mainly diarrhoea disease (Mara,et al., 2010). There have been efforts to improve access to sanitation at the cost of millions of dollars implementing various sanitation programmes by governments and non-government organisations throughout the world. Governments and Non-governments organisations have implemented different approaches like TSC, CLTS, CATS, Social marketing, School Led Total Sanitation (SLTS),Community Wide Approach, Learning by Doing , BRAC WASH programme, National rural Sanitation and Hygiene Programme etc. (Peal and Voorden, 2010). Nevertheless it has been a daunting task for many governments especially in developing countries to cover every section of the population. On the other hand there has been no synthesis of the evidence on effectiveness

of different approaches that can guide policy makers to adopt a right approach in their country.

This systematic review is aimed to assess the effectiveness of Total Sanitation Campaign (TSC), Community Led Total Sanitation (CLTS) and Micro-finance Led Sanitation in terms of latrine construction and health impact and reflects on their suitability for implementation in developing countries.

5. Aim

The aim of this systematic review is to gather and assess the evidence on the effectiveness of TSC, CLTS and Micro-finance led sanitation to promote latrine /toilet construction in developing countries.

5.1 Objectives

a) To undertake a systematic review on three different approaches to household latrine/toilet construction: community led total sanitation (CLTS); micro-finance led sanitation; and total sanitation campaign (TSC).

b) To compare the effectiveness of these different approaches in term of toilet construction and health outcome.

6. METHODS

6.1. Inclusion criteria

i) Population: All studies conducted in developing countries were eligible for inclusion. The nations categorised as developing counties were taken from World Bank's concurrent list of developing countries.

ii) Intervention: A clear defined intervention which adopted any of these approaches; CLTS, TSC and Micro-finance, to promote sanitation were eligible for inclusion. Studies which combined water and sanitation and hygiene were also included in addition to studies conducted exclusively on sanitation.

iii) Controls/Comparison Group: All the studies were included if they had clear defined control group for comparison in the study. The control group had to be decided before the start of the intervention. A group could be its own control if a baseline survey was conducted ("before-and-after study").

iv) Outcome: All the articles were included in the review if the outcome included construction of toilet or health indicators such as reduction in diarrhoea, cholera, typhoid, schistsomiasis, guinea worm, child morbidity etc. applying any of these approaches. Studies with other outcomes were eligible for inclusion if they had other outcomes, however construction of toilet or health indicators must be either primary or secondary outcome of the study.

v) **Type of Study Design:** The study included all experimental design, randomized control trial (RCT) with assignment with individual level or community (cluster) levels. Evidence from randomized control is desirable however in the absence of randomized control trial, non-randomized intervention study, cross sectional survey, cohort, mixed methods of studies or any other observational study were eligible for the review.

vi) Literature published in any language or publication status was eligible for inclusion.

6.2. Exclusion criteria

The review excluded papers on the following grounds:-

i. Studies were not conducted in developed countries.
ii. Studies were conducted before 2000.
iii. Articles were editorial and opinion papers.
iv. Outcome of interest were not toilet construction and health impact through CLTS, TSC or Micro-finance approaches of sanitation.
v. Studies included hygiene intervention other than sanitation promotion and health impact.
vi. Studies did not include CLTS, TSC and Micro-finance led sanitation approach.

6.3. Literature search methods

6.3.1. Information sources

In the beginning of the literature search Google scholar was used as preliminary search to identify suitable search term. Once the search terms were finalized following databases were searched for appropriate literatures:

i. **Cab Abstract:** This database was chosen as it provided information on the applied life sciences including subjects on international coverage on environmental science and wide varieties of other topics. The database was accessed on 12th June 2012. Literatures on the related topics dated up to June 2012 were searched.
ii. **Global Health:** This database was chosen as it covers all aspects of international Public Health issue and literature including environmental health. The database was accessed on 12th June 2012. Literatures on the related topic were searched till dated June 2012.
iii. **EMBASE:** This database was chosen as it covers all aspects of clinical medicine, allied health, health policy and public health literatures. Therefore related literature on the research topics were accessed on 13th June 2012. Relevant literatures were searched which were published till June 2012.
iv. **PubMed:** This database was chosen because it holds all aspects of clinical

v. medicine, allied health and health policy. The database was accessed on 13th June 2012. Relevant literatures were searched which were published till June 2012.

vi. **SCIRUS:** This database is science-specific web search engine however it contains high quality environmental scientific sources. The database was accessed on 14th June 2012. All relevant literatures published till June 2012 was searched.

vii. **ELDIS:** The database holds comprehensive coverage of grey literature in international development and health. The database was accessed on 26th June 2012. All relevant literature published till June 2012 was searched.

viii. The websites of organizations working in the field of water, sanitation and hygiene were searched for relevant literature. The following organizations' websites were searched: UNICEF, Water and Sanitation Programme (WSP), Water AID, Institute of Development Studies and Institute for Fiscal Studies, London. There was also an effort to contact experts working in the field of water and sanitation.

ix. **References of all included papers:** Relevant references from the included papers were reviewed to identify studies that have been published but may not have been captured through database search.

6.3.2. Search strategy

As per the planning and conducting literature search, literature search concepts were developed in the beginning of the literature search. Following concepts were developed from the search question and used as a base for all literature searches in the above database.

i. (Community led total sanitation* or CLTS or *Shame and disgust or* tale of shit)
ii. (Community led total sanitation* or CLTS* or shame*)
iii. (micro-loan* OR micro-financ* OR micro-enterprise OR micro-payment* OR microloan* OR microfinanc* OR microenterprise OR micropayment*)
iv. (micro-loan* OR micro-financ* OR micro-enterprise)
v. (Total Sanitation Campaign or TSC or people oriented or demand driven)
vi. (Total Sanitation Campaign or TSC or demand driven)
vii. (toilet* OR latrine* OR sanitation)

Once the search concepts were finalised they combined terms together using Boolean operators. Truncation was also used with text words to specify different endings to words. This was done to expand the database search in any words which start with the root.

There are three main concepts such as TSC, CLTS and Micro-finance led sanitation which were combined separately with the fourth concept to search appropriate literature. For Example (Community led total sanitation* or CLTS or Shame *and disgust or* tale of shit) AND (toilet* OR latrine* OR hygiene OR sanitation), (micro-loan* OR micro-financ* OR micro-enterprise OR micro-payment* OR microloan* OR microfinanc* OR microenterprise OR

micropayment*) AND (toilet* OR latrine* OR hygiene OR sanitation), (Total Sanitation Campaign or TSC or demand driven) AND (toilet* OR latrine* OR hygiene OR sanitation). The same search was then run in all databases via Ovid Cab Abstract, PubMed, EMBASE and Global Health.

SCIRUS and ELDIS:

To find grey literature three main concepts such as TSC, CLTS and Micro-finance led were combined separately with the fourth concept to search appropriate literature. Following were the combinations of concepts used in the literature search:

1. (Community led total sanitation* or CLTS or *Shame and disgust or* tale of shit) AND (toilet* OR latrine* OR hygiene OR sanitation)
2. (Community led total sanitation* or CLTS* or shame*) AND (toilet* OR latrine* OR hygiene OR sanitation)
3. (micro-loan* OR micro-financ* OR micro-enterprise OR micro-payment* OR microloan* OR microfinanc* OR microenterprise OR micropayment*) AND (toilet* OR latrine* OR hygiene OR sanitation)
4. (Total Sanitation Campaign or TSC or people oriented or demand driven) AND (toilet* OR latrine* OR hygiene OR sanitation)
5. (Total Sanitation Campaign or TSC or demand driven) AND (toilet* OR latrine* OR hygiene OR sanitation)

Citation Searching:

As relevant papers were identified they were imported into Mendeley and saved. Once the literature searched had been completed the papers were evaluated based on the inclusion and e

xclusion criteria for the possible inclusion for the review. Irrelevant literatures were excluded from the review.

6.4 Methods for assessing the literature:

6.4.1 Review for relevance to the topic

Once the literature search was completed, all the selected papers were stored in Mendeley in different sub-groups. Duplicates were removed from the group. Subsequently the title and abstracts of the screened papers were read and they were evaluated based on inclusion and exclusion criteria. If papers did not fit the inclusion criteria they were rejected. Reasons for removal of each paper have been explained. Further detail can be obtained in **(Appendix 3).**

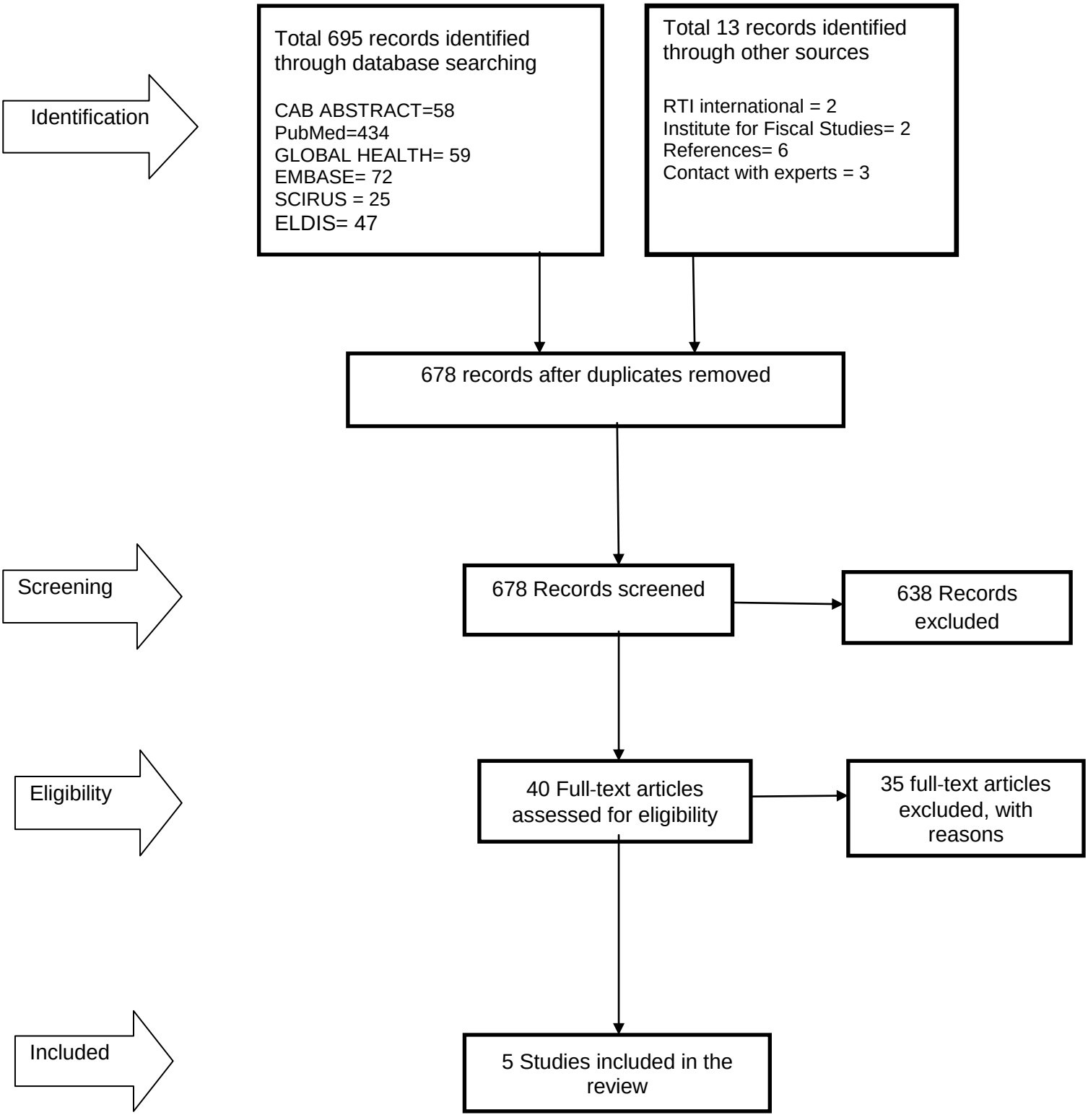
The selected papers were evaluated using the same criteria. They were screened by reading title and abstract based on the same inclusion and exclusion criteria. If the papers satisfied the selection criteria they were grouped together for appraisal of their quality. If papers did not fit the eligibility criteria they were excluded after full text review. Reasons for exclusion were recorded (See **Appendix 3).**

7. RESULTS

7.1 Search results:

There were a total of 705 papers found to be relevant to the subject of study. They were screened after reading titles and abstracts. In the process of screening 30 duplicate papers were found. They were removed from the review list. A further 638 papers were excluded after reading title and abstract for not fulfilling the set criteria. The remaining 40 papers were extracted for full text review. In the course of reading the full text, 35 papers were found to be not eligible for inclusion. They were excluded from the review and reasons for exclusions were stated (see **Appendix 3).**

Table 1: PRISMA flow chart for identifying relevant studies (Adopted from PRISMA 2009 Flow Diagram)



7.2 Description of studies:

A total 5 studies qualified for inclusion in the review of which one was a cluster randomized trial, two studies were cross sectional surveys, and another two were a cohort study and mixed methods of study, respectively. These studies exclusively or partially apply CLTS or TSC approaches to promote sanitation. The outcomes of these approaches are either latrine construction or health impact or both as primary or secondary outcomes. No studies were identified measuring the impact of the Micro-finance led approach.

One study which applies a cohort study design was published in two separate papers by the same study team (Pattanayak, et al., 2009;Dickinson, et al., 2011). The study location, population and study period are the same in the two papers. The outcome of the one paper was latrine ownership and the outcome of the second paper was diarrhoea under 5 year's children.

The study conducted in Mozambique applied Community Approaches to Total Sanitation (CATS) which is developed by UNICEF (Elbers, et al., 2011). This approach combines CLTS training methods developed by Dr. Kamal Kar with a reward system for communities that become open defecation free (ODF). As originally developed by Dr. Kamal Kar, the CLTS approach is against the principle of giving any monetary incentive. However the study has been considered for inclusion in the review as it includes basic principle of CLTS training and it answers the object of the research question.

The geographic distribution of the studies is overlaid on the map in Figure 1, below, which also describes the number of countries which have < 50% access to improved sanitation.

Figure 1: Developing countries need for sanitation promotion and study site locations
(Number indicates the number of studies conducted in each location)

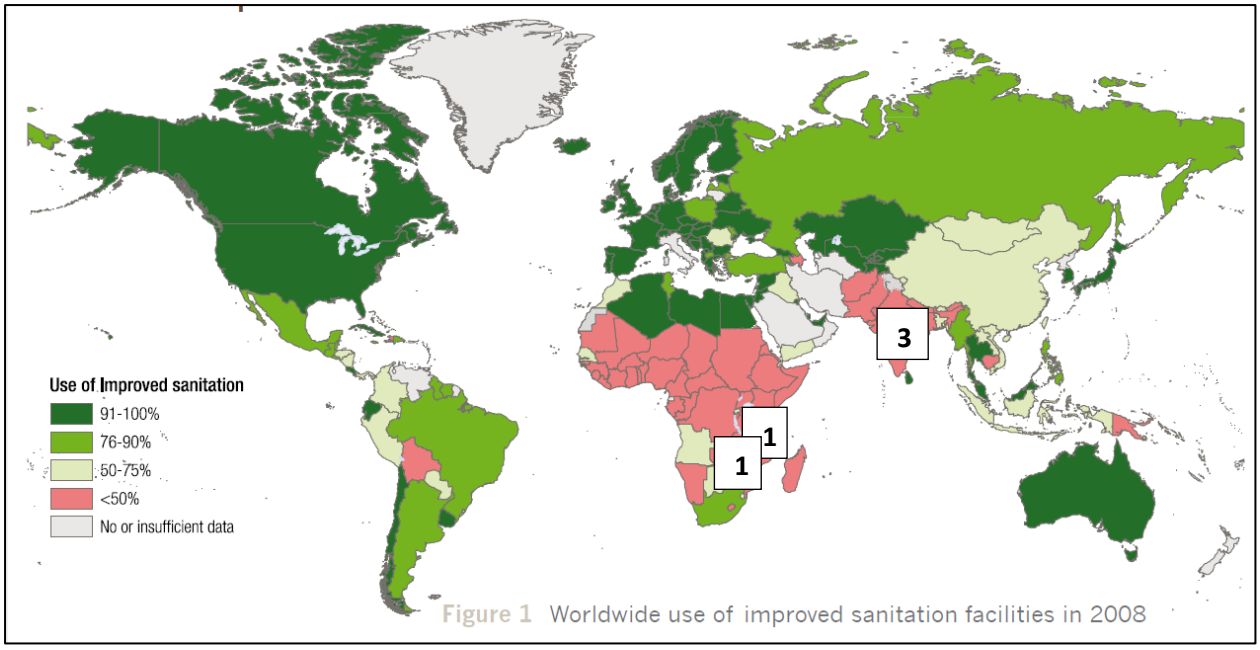


Figure 1 Worldwide use of improved sanitation facilities in 2008

Source: Adapted from Progress on Sanitation and Drinking –Water 2010 update by WHO and UNICEF.

7.2.1 Cluster Randomized control trial: One study included in the review used a cluster randomised control trial**.** The study was conducted in remote villages in coastal district in the state of Orissa in India. The primary purpose of this trial was to determine the effectiveness of a sanitation campaign applying CLTS approaches on latrine construction and use. The trial recruited 20 villages in the intervention group and 20 villages in the control area and total sample of 1086 households from these villages were selected randomly(Pattanayak, et al., 2009).

7.2.2 Cross sectional survey:

Two of the included studies used cross sectional surveys to assess the impact of TSC and CLTS on health impact and latrine construction. The study conducted in the state of Madhya Pradesh in India assessed the impact of TSC on diarrhoea and other health outcomes. The study was conducted after a gap of one year after being declared ODF villages by TSC intervention. Comparison was made between two ODF and two NODF villages. The studies included epidemiological investigation along with microbiological, parasitological examination, water quality analysis and sanitary inspection. Sample size for the study was 1245 households (Chakma, et al., 2008).

The study conducted in 9 districts in Mozambique used a cross sectional survey design to determine the impact of CLTS on latrine construction and health outcomes on older

individuals and under 5 children. The paper summarises the findings from baseline survey and mid- term survey. The sample size of the study were1600 households. There were 290 household dropped out of the survey in the second round (Elbers, et al., 2011).

7.2.3 Cohort design: One of the studies included in the review used a cohort design applying CLTS approaches to latrine adoption and use to estimate the impact of latrines on child health (Dickinson,et al., 2011)**.** This was the same study in which the cluster randomized trial conducted to assess effectiveness CLTS on latrine construction. The study was conducted in remote villages in coastal district in the state of Orissa in India. The trial recruited 20 villages in the intervention group and 20 villages in the control villages population and total sample of 1086 households from these villages were selected randomly. The follow up period was for one year.

7.2.4. Mixed Method: One of the studies included in the review used Mixed Method to assess the effectiveness of CLTS on latrine construction. The study used short survey, semi-structured interviews and focus group discussion as data collection techniques. The study compared the effectiveness of Community Health Club approach and Community Led total Sanitation (CLTS). The study was conducted in three districts in Zimbabwe consisting population from Shona and Shangaan speaking communities. Sample size was 233 households (Whaley & Webster, 2011).

Table 2: Description of studies

Author & year of publication	Methods; study design , sample size	Outcome variable	Control Group	Intervention Group	Effect estimate and statistical significance
Cluster Randomized Control Trial					
Pattanayak, S. K., et al., (2009)	Cluster randomized trial; Sample size 1086 household: 534 in treatment & 552 household in control group	Latrine ownership	20 villages did not have any intervention.	CLTS implemented at 20 villages	29% (95% CI: 14.6-42.9, P-value: 0.000); among non BPL: 21% (95% CI: 6.2-35.2, P-value: 0.000)
Cohort Study Design					
Dickinson, K. L., et al., (2011)	Cohort Design; sample size 1080 households (treatment - 534 & control-552); Follow up period one year.	Diarrhoea (< 5 Children)	20 villages did not have any intervention.	CLTS implemented at 20 villages.	π 0.04, p-value< 0.04; Pooled effect: π 0.5, p-value < 0.04
Cross Sectional Survey					
Tapas Chakma, et al., (2008)	Cross sectional survey; sample size 1245 individuals, 843 (76%) of total population in ODF and 402 (50%) of NODF villages	Diarrhoea under 5 years & Other infection	2 NODF villages.	2 ODF villages declared by TSC	Diarrhoea morbidity: OR 5.84; P-value <0.00 & Other infections: OR 0.81; P-value >0.05.
Elbers, C., et al., (2011)	Survey design;1600 households	Latrine construction and water borne disease	Baseline survey result	Midterm survey result	Latrine construction (π 0.12, p-value <0.05) & Health outcome Older individuals (π -0.08 , p- value <0.04) Children < 5(π 0.03, P-value <0.02)
Mixed Methods of Study					
Whaley, L.,& Webster, J. (2011)	Mixed methods; 233 households	Latrine construction	CHC	CLTS	44% increase (p-value <0.065)

8. Measures of Effectiveness:

There is wide range of heterogeneity in the studies included in the final review in term of study participants, setting and nature of interventions. The study included both randomized control trial and non- randomised control trials. All the studies have different methods of presentation of the measures of effectiveness. Only one study showed 95% confidence intervals for the measurement of effect. Some studies have provided measurement effect in percentages and p-values with no adjustment for confounding factors. In the absence of 95% confidence interval it is difficult to assess the effectiveness accurately.

The main outcome for two of the included studies was construction of individual household latrines. The studies found a statistically significant impact of the intervention on latrine construction. In the first study (Pattanayak, et al., 2009), there was an overall 29% increase in individual latrine construction within a year(p-value <0.00); however, the 95% confidence interval is very wide. Among non BPL families which did not have subsidy, there was 21% increase in individual latrine construction (p-value <0.00). Here too the 95% confidence interval is wide. The second study also found a significant impact of the intervention on latrine construction (Whaley and Webster, 2011). There was a 44% increase in individual household latrines. Nevertheless the p-value did not quite meet the 0.05 threshold (p-value < 0.07).

The study by Dickinson, K. L. et al., (2011) aimed to measure the impact of CLTS on diarrhoea among children under 5 years. The study did not find a statistically significant effect of CLTS on diarrhoea. The study did not show 95% confidence interval. Similarly another study conducted by Tapas, et al., (2008) aimed to study health impact of TSC intervention. The study was carried out after a year the villages declared open defecation free under the TSC intervention. The study found significant reduction in child diarrhoeal morbidity. The Diarrhoeal morbidity was 6 times higher in non-open defecation free villages (p-value <0.00). However, the rate of diarrhoea in the villages still remained 23% which was very high. The result was supported by microbiological and parasitological examination. Water quality analysis found that well water was contaminated with thermotolerant coliforms (TTC) and Enterococcus faecalis (EF) above the WHO guidelines values.

The study by Elbers, et al., (2011) aimed to study CLTS impact on individual household latrine construction and on waterborne disease among children under five years and adults. There was a 12% point increase in in-house toilet construction (IHT) within a year of intervention. However; the p-value did not quite reach the 0.05 threshold (p-value <0.06). The study did not show 95% confidence interval. The study findings suggest that there was

no reduction in water-borne diseases of the intervention in children under five years. On the contrary to this the findings suggest that there was 8% point reduction of water-borne diseases among the older household members was statistically significant (p-value <0.04). Nevertheless, actual health impact of the intervention cannot be accurately measured in individual adult members. The result might be confounded by other factors which is difficult to remove even after adjustment. This study is still on-going. The analysis was based on the baseline and midterm survey. Hence this interim result may change. The summary results are presented in the table 3.

Table 3: Summary results of the included studies

Author	Outcome Variable	Confounding factors controlled for	OR/% /Regression Coefficient	Adjusted Regression Coefficient	95% CI	P-value
Pattanayak, S. K. et al. (2009)	Latrine ownership		21%		6.2-35.2	<0.00
Dickinson, K. L., et al. (2011)	Diarrhoea <5	Village, household & individual characteristics	0.04	0.05		<0.04
Tapas Chakma et al. (2008)	Diarrhoea <5		5.84			<0.00
	*Other infection		0.82			>0.05
Elbers, C. et al. (2011)**	**Water- borne disease <5 children	Household size & wealth		0.03		<0.02
	**Water- borne disease (older member)	Household size & wealth	-0.08	-0.08		<0.04
	Latrine ownership	Household size & wealth	0.12	0.13		>0.05
Whaley and Webster, (2011)	Latrine Construction	-	44%	-	-	>0.05

*Other infection=Hookworm, H. nana, ascaris, thread worm, amoeba, mixed infection.

**Water borne disease: diarrhoea, typhoid, cholera

9. Methodological quality and risk in included studies:

All the included 5 studies were assessed for quality using checklist adopted from CONCORD and STROBE checklist for randomized control trial and non-randomized control trials respectively (CONSORT, 2010;STROBE, 2008). If papers met all the criteria of the checklist they were graded 'A' meant the study has low risk of bias. If the paper fulfilled one or some of the criteria from the checklist they were graded 'B'. Papers qualifying 'B' grade is interpreted as paper having moderate risk of bias. Four papers have been graded 'B'. Finally remaining paper was graded 'C' for not fulfilling one or more criteria from the checklist. Paper qualifying grade 'C' is interpreted as paper having high risk of bias. Further detail can be seen in **Appendix 1.**

The reviewer has adopted the NCBI guideline on assessment of the risk of bias from Closing the Quality Gap: Revisiting the State of the Science (Vol. 2) (Williams, et al., 2012). Tables 3 and 4 present the assessment of the risk of bias for the included studies for the cluster randomised control trial and the non-randomized control trials, respectively. The selected papers were all subjected to a quality check. The review has adopted two checklists one for randomized control trial and another for non-randomized control trials. Since there are two different types of study different assessment tools are used. There are three types of non-randomized control trials in the review (cross sectional survey, cohort study and mixed methods. For all four of the non-randomised control trials, it was impossible to assess whether they suffered from performance bias. There is no discussion about adjustment for confounding in two studies. For one study it was not possible to assess the presence of selection bias. In Cluster randomized trial it is unclear whether attrition bias was considered in the study or not.

Table 3: Risk bias Assessment: Cluster Randomized Control Trial

Domain	Selection Bias		Performance Bias		Detection Bias	Attrition Bias	Reporting Bias	Other Sources of Bias	Summary assessment of Risk of Bias
Cluster randomized control trial	Was this study randomized?	Were the study subjects randomized?	Was blinding of subject done?	Was Blinding of personnel (research) done?	Was blinding of outcome assessment done?	Was Incomplete outcome date present and handled? (including whether intention treat (ITT) analysis done)	Were all outcomes reported (i.e. was there evidence of selective outcome reporting?)	Were results adjusted for clustering?	
Pattanayak, S. K., et al. (2009)	Yes	Yes	No	Yes	Yes	Unclear	Yes	Yes	B

*Source: NCBI guideline on quality assessment of individual studies

Table 4: Risk bias Assessment: Non-Randomized Control Trial

Domain	Selection Bias		Comparison group	Performance Bias	Attrition Bias	Detecting bias		Reporting Bias	Summary assessment of Risk of Bias
Non-Randomized study	Are the inclusion/ exclusion criteria clearly stated?	Are key characteristics of study participants similar between intervention and control groups?	Is the selection of the comparison group appropriate?	Was Blinding of personnel (research) done?	Was Incomplete outcome data present and handled?(including whether intention treat (ITT) analysis done)	Are interventions/ exposures assessed using valid and reliable measures, implemented consistently across all study participants?	Were appropriate statistical methods used to control for confounding factors?	Are findings for all primary outcomes reported?	
Dickinson, K. L., et al., (2011)	Yes	Yes	Yes	Unclear	Yes	Yes	Yes	Yes	B
Tapas Chakma, et al. (2008)	Yes	Yes	Yes	Unclear	Yes	Yes	Unclear	Partially	B
Elbers, C., et al., (2011)	Yes	Yes	Yes	Unclear	Yes	Yes	Yes	Yes	B
Whaley, L.,& Webster, J. (2011)	No	No	Yes	No	Unclear	Partially	No	Yes	C

*Source: NCBI guideline on quality assessment of individual studies

Studies were assessed on the scale of 'A', 'B' and 'C' grades depending upon the criteria they met which are outlined in following description. This guideline has been adopted from Cochrane collaboration 2006.

A. **Low risk of bias:** If the studies met all the evaluation criteria set in the checklist they were considered to be having low risk of bias. They were termed as 'A' grade studies. In such studies plausible bias are unlikely to seriously alter the result.
B. **Moderate risk of bias:** If the studies met one or more criteria they were judged to have low or moderate risk of bias. They were judged as 'B' Grade studies. In such studies plausible bias raises some doubts about the studies.
C. **High risk of bias:** If the studies did not meet one or more criteria they were judged as 'C' grade studies. In 'C' grade studies plausible bias seriously weakens confidence in the result.

10. Discussion:

The review presents findings from 5 interventions, of which one was a randomised control trial and four were non-randomised control trials. Four of the included studies used the CLTS approach to sanitation promotion and one study used TSC. In the literature search process, relevant studies on Micro-finance Led Sanitation could not be identified. Hence Micro-finance Led Sanitation could not be assessed in the review for its impact either on child health or toilet construction. Further discussion will not include this approach.

All 5 included studies were heterogeneous in their nature with respect to interventions and outcomes assessed. In addition to toilet construction and child health indicators as primary or secondary outcomes, interventions also examined hygiene practice which is not the subject of study in the review. Therefore the study has concentrated on toilet construction and child health outcomes in its assessment. There are wide variations in the interventions in terms of settings, study participants, assessment tools, follow up periods and outcomes measured. Hence a meta-analysis of the study results was not considered appropriate.

10.1 Effectiveness of CLTS on individual latrine construction:

The study by Pattanayak et al. found a significant effect of the IEC education through CLTS on latrine ownership, which increased 21% among non-below poverty line and 29% in the overall population within a year (95% CI: 6.2-35.2; P value <0.00) (Pattanayak, et al., 2009). Although the P- value is small, the confidence interval is wide. In this study there is no discussion of controlling for confounding which might have either increased or decreased the effect of CLTS on latrine ownership. The study by Elbers, at el. supports the above finding

but the evidence is weak (p-value >0.05). Latrine ownership increased 12% points (Elbers, et al., 2011). There was no difference in the effect after controlling for confounding (p-value >0.05). The study result does not discussion about the 95% confidence interval. Thus it is difficult to interpret the real effect of CLTS on latrine construction. One can justify this inconclusive finding on the grounds that this is an on-going project. The analysis was based on the baseline and midterm surveys. Final study report is expected by the end of 2012.

Both the studies suggested some evidence that CLTS approach does have some effect on increasing latrine ownership, and that if interventions apply the CLTS approach; individual household latrine construction can get momentum in the process of sanitation promotion. But the evidence available from the review is weak. The third study by Whaley and Webster, (2011) was graded 'C' which is interpreted as high risk of bias. Hence the evidence from this study cannot be generalised. The study by Elbers, et al., (2011) partially applied CLTS teaching principles. Hence evidence from that study cannot be accepted as the absolute effect of CLTS intervention. Therefore this evidence too is weak for generalizability. Therefore the evidence from one study by Pattanayak, et al., (2009) is not sufficient to decide whether this approach is really effective or not. Further evidence from large scale intervention is required to support the findings.

10.2 Effectiveness of CLTS on child health:

The results from two studies on CLTS suggest that there is no significant effect on diarrhoea among children under 5 years. Both the study by Dickinson, et al. (2011) and Elbers, C. et al. (2011) suggested no effect of CLTS in reduction of child diarrhoeal morbidity (adjusted correlation coefficient 0.05 & 0.03). Nevertheless the study by Elbers, et al., (2011) indicated that the benefits of the sanitation intervention are mainly enjoyed by household members above the age of 5 years. There was 8% point reduction in water born disease (p-value <0.04).This result might be confounded by other factors. It is the fact that children are more likely to get diarrhoea as compared to adults. Therefore measuring CLTS effectiveness on adult health might be misleading. In addition, as mentioned in the earlier paragraph this study applied only some principles of CLTS. The evidence from this study cannot be taken to represent the effect of CLTS. Hence this can be considered as weak evidence. Further evidence from large scale intervention is required to support the findings.

10.3 Effectiveness of TSC on child health

The results from the study on the impact of TSC suggest that diarrhoeal morbidity reduced significantly in ODF villages as compared to NODF. Diarrhoeal morbidity was 5 times higher in NODF villages (p-value <0.00) (Chakma, et al., 2008). However even after the

intervention 23% of the population in ODF villages suffered from diarrhoea, which was very high. This indicated that people still practiced open defecation. This suggestion is supported by the other evidence from the same study. The study found prevalence of worm infestation of 36%, hookworm infestation 16.2% hymenolepis nana 8.1% and Ascaris 2.3% in ODF villages. There was no reduction of other infection in ODF villages. The study results on other infections were statistically not significant (p-value >0.05). Results from water quality analysis further supported the evidence that water was contaminated with thermotolerant coliforms (TTC) and Enterococcus faecalis (EF) above the WHO guideline value of <1cfc/100ml. Hence the study suggested that people from the ODF villages still practiced open defecation and there was still high diarrhoea related morbidity. The change in behaviour was not sustained after the intervention was lifted and it changed over the period. Therefore the evidence from the study suggested that impact of TSC in the ODF villages was not sustainable. Behaviour of the people changed within a year. The effectiveness of this approach did not guarantee a positive health impact in the community. This is also to note that there were no studies of TSC that looked at impact on latrine construction. However, evidence on health impact from one study is not sufficient to rule out this approach to sanitation promotion. Further evidence from large scale intervention is required to arrive at any decision on the effectiveness of this approach to sanitation promotion.

11. Research work underway on CLTS and TSC:

Currently there are four studies underway on TSC, CLTS and Micro-finance led sanitation. The Impact Evaluation of Large-Scale Sanitation and Hygiene Interventions are based on Total Sanitation and Sanitation Marketing project underway in Tanzania, India and Indonesia funded by World Bank. The objectives of the study are to increase access to hygienic sanitation and improved health for poor households and communities in rural villages, small towns and informal urban settlements. Another study sponsored by LSHTM is a Cluster Randomised Trial based on Total Sanitation Campaign conducted in India. The aim of the study is to assess the impact of the construction and use of latrines in rural settings on diarrhoeal disease, helminth infections and nutritional status. The study based on CLTS conducted by the University of Zambia is implemented in Zambia. The aim of the study is to contribute to reduction and subsequent control of T. solium and STH infections.

A study on Micro-finance led sanitation is underway in India conducted by the Institute of Fiscal Studies, London. The project is reaching its final phase which will be evaluated by the end of 2012. The intervention is a randomized control trial and one of the objectives of the study is to evaluate health impact of the intervention. This study may contribute evidence on

the effectiveness of this method in sanitation promotion. Since project is underway no comments can be made on the effectiveness of the micro-finance sanitation.

The above summary indicates that large scale studies are being undertaken on all three approaches to assess the health impacts of the interventions. Once evidence from these studies is available, it will be possible to make a stronger assessment on which of these approaches is suitable to implement in a country.

12. Limitations:

The review is subjected to numerous limitations. Following are some of the important limitations.

Literature search term developed was more suitable for article search in English languages. Important publications published in other languages may have been missed. Time did not permit an extensive search for unpublished literature, which may also have led to missing articles. . Every attempt was made to find relevant article on the subject. However some evidence on the subject of review could have missed due to incomplete identification of studies.

The evidence available could be subjected to reporting bias which is difficult to address even if statistical methods are applied. The reviewer relied on the completeness of the study design to address the reporting bias.

Every attempt has been made to address the risk bias in the review but most of the articles in the review are from observational studies risk bias may still affecting the final outcome.

The search did not identify any studies of the impact of Micro-finance led sanitation. If studies were not identified crucial evidence might have missed in the review report and the conclusions drawn may be incomplete.

13. Conclusion:

This review provides some evidence of effectiveness of CLTS and TSC on sanitation promotion in term of toilet construction and health impact. The evidence from studies suggests that CLTS may be effective in promoting sanitation; however neither TSC nor CLTS are effective to address diarrhoeal morbidity among children under 5 years. However there is a need for further research before making any final decision. Evidence from large scale randomised control trials conducted in developing countries needed to make policy decisions.

No conclusion could be reached on the suitability of the approaches to implement a large scale intervention to promote sanitation based on the evidence available. Rigorous evidence from large scale randomized control trial is needed to make a policy level decision in any country. Therefore the review result makes a suggestion for further research on the subject of study.

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Appendix: 1 Critical assessment of included studies

Pattanayak, S. K., et al. (2009). Shame or subsidy revisited: social mobilization for sanitation in Orissa, India.

Section/Topic	Judgement	Checklist item	Judgement
Title and abstract	Yes	The study has structured summary of trial design, methods, results, and conclusions.	Grade 'B'
Introduction/ Background	Yes	The study has Scientific background and explanation of rationale.	
objectives	Yes	To determine the effectiveness of a sanitation campaign that combines shaming with subsidies for poor household in rural Orissa which has a high share of child morality.	
Methods: Trial design	Yes	Cluster randomised design	
Participants	Yes	Villages that were not subjected to TSC; latrine coverage in the area remained low and area were accessible by road. All villages were homogeneous .Village with less than 70 or more than 500 household were excluded. 40 villages were selected from Tihidi and Chandbali blocks in the coastal district of Bhadrak in rural Orissa	
Interventions		Names of each village were written on separate cards and placed in an urn. A random draw was made to select 20 intervention villages.	
Outcomes	Yes	Individual household latrine building and using	
Sample size	Yes	Statistical power included a significant level of 95%, an intra-cluster correlation of 0.12 and an attrition rate of 10%. There were enough participants to minimise the play of chance. Total sample size 1050 households (treatment -534 & control-552)	
Randomisation:	Yes	Simple random selection of villages from the list.	
Blinding	Yes	Survey manager and enumerators were blinded	

Statistical methods	Yes	Statistical test were used to assess the difference between intervention and control villages : standard errors were corrected for clustering at village level using strata 10/SE. Data collect before and after the intervention were analysed using difference -in -difference estimator to measure treatment effect	
Recruitment	Not clear	It is not clear whether all household were followed up and data collected in the same way.	
Baseline data	Yes	Yes the study have tables showing baseline demographic and clinical characteristic for each group.	
Numbers analysed	Yes	Data analysis based on simple comparison of mean and difference- in-difference estimator. Stratified analysis by household status below or above the poverty line made. 95% confidence interval and p-value presented.	
Outcomes		The results were precise. Full sample-29% increase ,p-value<0.00 ,95% CI (14.6-42.9);BPL-34.2% increase ,p-value <0.00,95%CI (18-50.4);NBPL-21% increase-value<0.00,95% CI(6.2-35.2)	
Limitations	Not clear	There is no mention of addressing the source of potential bias. Confounding was not addressed.	
Generalizability	Yes	The findings can be generalised because of sampling frame, medium sized villages in coastal districts with limited exposure to TSC is typical representative of rural India.	
Interpretation	Not clear	The interpretation was not consistent with result balancing benefits and harms. Interpretation was not made cautiously.	

Tapas Chakma, et al. (2008). Cross-sectional health indicator study of open defecation free village in Madhya Pradesh.

Section/Topic	Judgment	Checklist item	Overall Quality
Title and abstract	Yes	The study design indicated with a commonly used term in the title or the abstract.	Grade 'B'
Background/rationale	Yes	The study explained scientific background and explanation of rationale.	
Objectives	Yes	To study the prevalence of water borne diseases in ODF villages compare with NODF villages.	
Study design	Yes	Cross sectional survey along with microbiological and parasitological examination of stool sample and water quality and sanitary inspection analysis.	
Participants	Yes	All Individual in the ODF declared villages and NODF villages in the state of Madhya Pradesh, India. In NODF villages willing individuals were covered.	
Outcome Variables	Yes	Diarrhoea related morbidity and	
Data sources/measurement	Yes	The study provided sources of data and details of methods of assessment. 21 water samples collected from ODF & NODF villages for microbial contamination. Sanitary inspection and groundwater depth readings taken. 10% willing individuals stool sample collected and analysed.	
Bias	No	The study did not describe any effort to address potential sources of bias.	
Study size	Yes	843 participants (76% of total population) for ODF villages and 402 (50% of total population)	
Statistical methods	No	No statistical methods used to control for confounding. The outcome was supported with the results microbiological and parasitological examination and random unannounced community inspection.	
Results	Yes	The outcomes were clearly defined.	
Outcome data	Yes	The study reported numbers of outcome events or summary	

		measures.	
Main results	Partially	Statistically significant in diarrhoeas reduction in ODF villages.6 times more in NODF villages (t-test between percentages -8.536, df-1243, p-value<0.00); Other infection statistically not significant (t-0.91, p-value >0.05); 95% confidence intervals were not given in the report.	
Limitations	Yes	The study discussed partially about limitations of the study, taking into account sources of potential bias.	
Interpretation	Yes	The study did give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence.	
Generalizability	No	The study did not discuss the generalizability of the results however the study sample represents typical rural villages in India.	

Elbers, C.et al. (2011). Effectiveness of Large Scale Water and Sanitation Interventions.

Section/Topic	Judgment	Checklist item	Overall Quality
Title and abstract	Yes	The provided an informative and balanced summary of what was done and what was found in the abstract.	Grade 'B'
Background/rationale	Yes	The study explained Scientific background and explanation of rationale.	
Objectives	Yes	To eradicate open defecation and reduce child mortality due to diarrhoea	
Study design	Yes	Survey design.	
Participants	Yes	Randomly selected 80 communities from 9 of 18 districts in Zimbabwe.	
Outcome Variables	Yes	Latrine construction and health outcome	
Data sources/measurement	Yes	Did the study give sources of data and details of methods of assessment (measurement) for each variable of interest?	
Bias	Yes	The Systematic sampling method to overcome selection bias, Unbiased and correct assessment of outcome, address to attrition bias form missing data and finally adjusted for confounding.	
Study size	Yes	Sample size of 1600 selected by systematic sampling method; 290 households dropped out. No statistical method used to decide sample size.	
Statistical methods	Yes	Controlling for household size, wealth, time and location fixed effects.	
Results	Yes	The outcome was clearly defined.	
Outcome data	Yes	The study reported numbers of outcome events or summary measures.	
Main results	Partially	Latrine ownershhip-12% point more likely to own a latrine (p-value>0.05); Health impact: adult-8% point reduction in contracting disease (p-value <0.04); children <5 No impact of CLTS, the coefficient estimate is 0.03 (p-value <0.02). The study did not give 95% confidence intervals.	

Limitations	Yes	The study discussed limitations of the study, taking into account sources of potential bias or imprecision.	
Interpretation	Yes	The study gave a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence.	
Generalizability	Yes	The study has not discussed the generalizability of the result. This result was based on the baseline and the midterm surveys. The end line survey is scheduled in 2013.	

Whaley, L. & Webster, J. (2011). The effectiveness and sustainability of two demand-driven sanitation and hygiene approaches in Zimbabwe.

Section/Topic	Judgment	Checklist item	Overall Quality
Title and abstract	Yes	The study provided in the abstract an informative and balanced summary of what was done and what was found.	Grade 'C'
Background/rationale	Yes	The study explained Scientific background and explanation of rationale.	
Objectives	Yes	The study has stated specific objective, a compare CHC and CLTS to select effective indicators of sanitation and hygiene.	
Study design	Yes	Quantitative and Qualitative method	
Participants	No	The study was conducted in three districts of Zimbabwe where CHC & CLTS were implemented. There was no discussion on eligibility criteria. Participants selected were every house along the way.	
Outcome Variables	Yes	Latrine construction	
Data sources/measurement	Partially	The study did give sources of data and some details of methods of assessment for each variable of interest.	
Bias	No	The study did not describe any efforts to address potential sources of bias.	
Study size	No	Total 233 households, The study did not apply any criteria for determining sample size.	
Statistical methods	No	No statistical methods used to control for confounding.	
Results	No	Outcomes were not clearly defined.	
Outcome data	Yes	Faeces disposal by some method- CHC-92, CLTS -77%(p-value <0.04) , latrine construction CHC 26, CLTS -44% (p-value >0.05) and shared latrine CHC 0, CLTS 57% (p- value <0.00)	
Main results	No	The study did not give unadjusted estimates and, if applicable, confounder-adjusted estimates and 95% confidence interval.	

Limitations	Yes	The study discussed limitations of the study, taking into account sources of potential bias or imprecision	
Interpretation	No	The study did not give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	
Generalizability	No	The study did not discuss the generalizability of the results.	

Dickinson, K. L., at el. (2011). Nature's Call : Health and welfare impacts of sanitation choices in Orissa, India.

Section/Topic	Judgment	Checklist item	Overall Quality
Title and abstract	Yes	The provided an informative and balanced summary of what was done and what was found in the abstract.	Grade 'B'
Background/rationale	Yes	The study explained Scientific background and explanation of rationale.	
Objectives	Yes	To evaluate effect of CLTS on child health (diarrhoea)	
Study design	Yes	Cohort design	
Participants	Yes	Villages that were not subjected to TSC; latrine coverage in the area remained low and area were accessible by road. All villages were homogeneous .Village with less than 70 or more than 500 household were excluded. 40 villages were selected from Tihidi and Chandbali blocks in the coastal district of Bhadrak in rural Orissa	
Outcome Variables	Yes	Diarrhoea (< 5 Children)	
Data sources/measurement	Yes	The study did give sources of data. It has used a difference -in -difference intention to treat estimator. It also used z-score for MUAC for age by comparing observed values of reach child. Details of methods of assessment (measurement) for each variable of interest?	

Bias	Partially	Simple random selection of villages and participants. There is no discussion to address attrition bias from missing data however regression analysis adjusted for confounding.	
Study size	Yes	Random selection of 20 of the 40 villages for treatment and 20 control villages. Total sample size 1080 households (treatment -534 & control-552) and Sample collect 1050 (treatment-529 & control-521) in follow u survey. There was 28 loss of follow up.	
Statistical methods	Yes	Regression methods used for analysis. Following variables were Controlled for confounding: population density, road distance ,open caste, land owner, education of primary caregiver, expenditure on food and non-food item, TV ownership, hand washing, improved water source, water treatment , ate , current breast feeding, sex.	
Results	Yes	The outcome was clearly defined.	
Outcome data	Yes	The study reported numbers of outcome events or summary measures.	
Main results	Partially	There is no significant reduction on diarrhoeas among < 5 children (r 0.05; p-value<0.04) MUAC z-score -0.04;p-value > 0.05).The study did not give 95% confidence intervals.	
Limitations	Not clear	The study did not discuss limitations of the study, taking into account sources of potential bias or imprecision.	
Interpretation	Not clear	The study did not give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence.	
Generalizability	Not clear	The study did not discuss the generalizability of the results.	

Appendix 2: Papers excluded after full text review

Publication	Reason for exclusion
Spears, D. (2012a). Effects of Rural Sanitation on Infant Mortality and Human Capital : Evidence from India's Total Sanitation Campaign. *Riceinstitute.org/Wordpress*.	The paper uses empirical strategy and combines several sources of individual survey and district census data for its analysis. Paper excluded although it assessed impact of TSC on infant mortality.
Spears, D. (2011). Effects of Early-Life Exposure to Rural Sanitation on Childhood Cognitive Skills : Evidence from India's Total Sanitation Campaign. *Riceinstitute.org/Wordpress*.	The paper studied the effect on children cognitive skill of early life explores to TSC which was based on the empirical strategy.
Spears, D. (2012b). Policy Lessons from Implementing India's Total Sanitation Campaign Policy Lessons from Implementing India's Total Sanitation Campaign *. *Sanitation updates: wordpress*.	This is a policy paper based on the empirical strategy.
Dyalchand, M. K. & A. (2009). Impact of Rural Sanitation on Water Quality and Water Disease. IDS research paper.	The paper is heavily based of the observational study conducted by school children with no proper training. Although there was there was some analysis of water sample taken from main water sources in each village.
Vollmer, S. K. & S. (2011). Does Improved Sanitation Reduce Diarrhoea in Children in Rural India? IDEAS, (December).	This discussion paper is based on the analysis of the district level household survey in India .There is no distinction made whether improvement in sanitation were due to TSC or CLTS of Micro-finance led sanitation approaches. The paper assessed impact of improved sanitation to reduce diarrhoea in children. Subsequently the paper does not fulfil the selection criteria.
Augsburg, B. (2011b). Financial Inclusion Improves Sanitation and Health – FINISH Project Safe Sanitation : Findings from the Impact Evaluation Baseline Survey. Institute for Fiscal Studies, (April), 1–67.	This study presents the finding from the base line data collection. The study in still not completed.

Augsburg, B. (2011a). Financial Inclusion Improves Sanitation and Health – FINISH Project Safe Sanitation : Findings from the Impact Evaluation Baseline Survey. Institute for Fiscal Studies, (March), 1–70.	This study presents the finding from the base line data collection. The study in still not completed.
Harvey, P. A. (2011). Zero subsidy strategies for accelerating access to rural water and sanitation services. Water science and technology : a journal of the International Association on Water Pollution Research, 63(5), 1037–43. doi:10.2166/wst.2011.287	The article is based on a result of a pilot study conducted on CLTS. The study does not have clear defined control group for comparison in the study.
Barenberg, A. (2009). Microfinance for water and sanitation : A case study from Tiruchirappalli , India. WEDC International Conference.	The objective of this case study is to summarise about loan program and explore the possibility and limitation of the financial model of the water and sanitation sector. Outcome is not construction of toilet and health indicator.
Blitstein, J. L., Poulos, C., Wendland, K. M., & International, C. (2007). Promoting Latrine Use and Improving Child Health : Design and Baseline Findings from a Randomized Evaluation of a Community Mobilization Campaign in Bhadrak , Orissa. *RTI International*, *Working Pa*.	This paper is a repetition of the same study written by Pattanayak et al.
Rai, S. (2011). An evaluation of the sustained impacts of a sanitation campaign in rural India. Duke University, The Sanford School of Public Policy, Master thesis.	This paper is a repetition of the same study written by Pattanayak et al.
Kumar, S. and Kumar, Y. (2008). Promoting sanitation through decentralised governance: a case study of Rajukhedi Panchayat in India. In: Beyond construction: use by all: a collection of case studies from sanitation and hygiene promotion practitioners in South Asia. London, UK, Water Aid and Delft, The Netherlands, IRC International Water and Sanitation Centre. Available at: http://www.irc.nl/page/40450	This paper is a case study of sanitation strategy in a community.
District, Y., & Pardeshi, G. (2009). Women in Total Sanitation Campaign : A Case Study from, J Hum Ecol, *25*(2), 79–85.	The study explore women's perspective that can contribute to improve planning, functioning and utilization of the sanitary facilities and not related to any approach to promote sanitation..

Hadi, A. (2000). A participatory approach to sanitation : experience of Bangladeshi NGOs, Health Policy and Planning; *15*(3), 332–337, Oxford University Press 2000.	The study assesses the role of participatory development programmes in improving sanitation in rural community and not related to the three approaches to improve sanitation.
Hubbard, B., Sarisky, J., Gelting, R., Baffigo, V., Seminario, R., & Centurion, C. (2011). A community demand-driven approach toward sustainable water and sanitation infrastructure development. *International journal of hygiene and environmental health*, *214*(4), 326–34. doi:10.1016/j.ijheh.2011.05.005	The paper illustrates the strategy of community driven approach to water and sanitation infrastructure development.
Jenkins, M. W. & Cairncross, S. (2010). Modelling latrine diffusion in Benin: towards a community typology of demand for improved sanitation in developing countries. *Journal of water and health*, *8*(1), 166–83. doi:10.2166/wh.2009.111	The research attempts to study underlining drivers of rural demand for sanitation in rural community to develop suitable strategy for improving sanitation.
Pattanayak, S. K., Poulos, C., Yang, J.-C., Patil, S. R., & Wendland, K. J. (2009). Of taps and toilets: quasi-experimental protocol for evaluating community-demand-driven projects. *Journal Of Water And Health*, *7*(3), 434–451. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/19491494	This paper describes a protocol for a quasi- experimental evaluation of community demand driven programme of water and sanitation in rural India and not a study of any of the three approaches to promote sanitation.
Waterkeyn, J., & Cairncross, S. (2005). Creating demand for sanitation and hygiene through Community Health Clubs: a cost-effective intervention in two districts in Zimbabwe. *Social science & medicine (1982)*, *61*(9), 1958–70. doi:10.1016/j.socscimed.2005.04.012	The study assesses the involvement of community health clubs to create demand for sanitation and hygiene.
Demedeme, Nutsugah(2009) . Evaluation of Community Led Total Sanitation in Ghana. Paper prepared for the West Africa Regional Sanitation and Hygiene Symposium, 3-5 Nov 2009, Accra, Ghana.	This paper is an internal evaluation report of the piloting CLTS strategies in Ghana by the Ministry of government along with UNICEF.
Kar, K. (2003). IDS Working Paper 184 Subsidy or self-respect ? Participatory total community sanitation in Bangladesh, (September).	The papers illustrate about the CLTS approaches and strategy to make community open defecation free.

Vikas Gupta, M. P. (2008). Community Sanitation Campaign: A Study in Haryana, 20–23.	This paper is an article which presents a case study of a successful community led total sanitation campaign.
Pattanayak, S. K., Poulos, C., Yang, J.-C., & Patil, S. (2010). How valuable are environmental health interventions? Evaluation of water and sanitation programmes in India. *Bulletin of the World Health Organization*, *88*(7), 535–42. doi:10.2471/BLT.09.066050	The paper illustrate an evaluation report of water and sanitation programmes in India which estimates the economic I impact of a community demand driven programme launched by government of India.
Sah. S., & Negussie, A. (2009). Community led total sanitation (CLTS): Addressing the challenges of scale and sustainability in rural Africa, *000*(May 2008), 1–8. doi:10.1016/j.desal.0000.00.000	This paper reviews an organisation's experience of promoting CLTS; critically assess the potential of CLTS addressing the issue of scales and long term sustainability.
Hasan, A. (2008). Financing the Sanitation Programme of the Orangi Pilot Project--Research and Training Institute in Pakistan. *Environment and Urbanization*, *20*(1), 109–119. doi:10.1177/0956247808089151	This paper describes the financial mechanism for the sanitation programmes rather than a study of any the three approaches to promote sanitation.
Kidanu, M., & Abraham, B. (2009). Community led total sanitation – promising antecedent to attain fully sanitized villages in Ethiopia, (about 40).	This was a conference paper describes about CLTS and its implementation strategies.
Hasan, A. (2008). Financing the sanitation programme of the Orangi Pilot Project--Research and Training Institute in Pakistan. *Environment and Urbanization*, *20*(1), 109–119. doi:10.1177/0956247808089151	This paper provides the description of the financial mechanism used for the sanitation programme where local inhabitants generated all funding to cover the costs of the sanitation.
Mader, P. (2011). Attempting the Production of Public Goods through Microfinance : The Case of Water and Sanitation. *Journal of Infrastructure Development*, *3 No 2 153*(March 2011), 1–19.	This paper is a description of an attempt to create public goods through microfinance loans.
Harvey, P A, Mukosha, L. (2009). Community led total sanitation : Triggering sustainable development in Zambia. *WEDC International conference*.	A conference paper which describes the success of CLTS in one community. The paper does not fulfil the selection criteria..

Santos, A. C., Roberts, J. a, Barreto, M. L., & Cairncross, S. (2011). Demand for sanitation in Salvador, Brazil: a hybrid choice approach. *Social science & medicine (1982)*, *72*(8), 1325–32. doi:10.1016/j.socscimed.2011.02.018	The paper is a attempt to understand the choice of sanitation technology residents adopts.
Kar, K. (2003). Subsidy or self-respect ? Participatory total community sanitation in Bangladesh. IDS Working Paper 184, (September).	The paper describes the process of CLTS and its impact in accelerating construction of sanitation in a community. It does not fulfil the selection criteria.
Mick Howes, E. H. and A. N. (2008). Community Led Total Sanitation and Its Successors in Bangaladesh: Case 3. IDS research paper.	This is a case study paper of a particular project in a community. Study was not conducted to assess the health impact of CLTS.
Mick Howes, E. H. and A. N. (2009). Community Led Total Sanitation and Its Successors in Bangladesh: Case 1. IDS research paper.	This is a case study paper of a particular project in a community. Study was not conducted to assess the health impact of CLTS.
Huda, M. H. and E. (2008). Community Led Total Sanitation and Its Successors in Bangladesh: Case 2. IDS research paper.	This is a case study paper of a particular project in a community. Study was not conducted to assess the health impact of CLTS.
Arnold, B. F., Khush, R. S., Ramaswamy, P., London, A. G., Raj Kumar, P., Ramaprabha, P., Durairaj, N., et al. (2010). Causal inference methods to study nonrandomized, pre-existing development interventions. Proceedings of the National Academy of Sciences of the United States of America, 107(52), 22605–10. doi:10.1073/pnas.1008944107	The study was excluded because it was not a government supported TSC but was based on its principal supported by international non-profit organization.
Davis, J., White, G., Damodaron, S., & Thorsten, R. (2008). Improving access to water supply and sanitation in urban India: microfinance for water and sanitation infrastructure development. Water Science and Technology, 58(4), 887–891. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/18776626	The study explores the potential of providing micro-finance for low income household. Therefore the paper does not study the effect of micro-finance.

Appendix 3: List of studies included in the review.

Pattanayak, S. K., Yang, J.-C., Dickinson, K. L., Poulos, C., Patil, S. R., Mallick, R. K., Blitstein, J. L., et al. (2009). Shame or subsidy revisited: social mobilization for sanitation in Orissa, India. Bulletin of the World Health Organization, 87(8), 580–587.
Whaley, L., & Webster, J. (2011). The effectiveness and sustainability of two demand-driven sanitation and hygiene approaches in Zimbabwe. Journal of Water, Sanitation and Hygiene for Development, 1(1), 20. doi:10.2166/washdev.2011.015
Tapas Chakma, Sam Gogfrey, J. bhatt, P.V. Rao, P. M. & S. B. S. (2008). Cross-sectional health indicator study of open defecation free village in Madhya Pradesh. Waterlines, 27(Number 3), pp. 236–247(12).
Elbers, C., Godfrey, S., Gunning, J. W., Velden, M. V. D., & Vigh, M. (2011). Effectiveness of Large Scale Water and Sanitation Interventions : the One Million Initiatives in Mozambique. WASH News Africa, 1–39.
Dickinson, K. L., Pattanayak, S. K., Yang, J., Patil, S. R., Poulos, C., Program, A. S., & Author, C. (2011). Nature's Call : Health and welfare impacts of sanitation choices in. *Duke University (Draft Paper)*, 1–32.

Appendix 4: Organisation searches carried out

Organisation	Website	Searched/ Results:
Water and Sanitation Programme (WSP)	http://www.wsp.org/wsp/	No relevant literature were found
Water AID	http://www.wateraid.org/uk	No relevant literature were found
Institute of Development Studies	http://www.communityledtotalsanitation.org/page/ids-research-clts	Literature for the background study was identified.
Institute for Fiscal Studies, London	http://www.ifs.org.uk/	Two studies were identified. They were excluded from studies. Reasons have been explained in Appendix 3
UNICEF	http://www.unicef.org; http://www.communityledtotalsanitation.org/tags/unicef;http://www.communityledtotalsanitation.org/resource/unicef-community-approaches-sanitation-cats	No relevant literature were found
World Health Organization	ttp://www.who.int/water_sanitation_health/en/	No relevant literature were found

Appendix 5: Findings from studies.

Author & Year	Summary of outcome	Quality of evidence	Conclusion
Pattanayak, S. K. et al. (2009).	Cluster Randomized control Trial, Statistically significant increase in overall latrine ownership of 29%(95% CI: 14.6-42.9, P-value: 0.000);Among below poverty line (BPL): 43% increase ((95% CI: 18-50.4 , P-value: 0.000);among non BPL: 21% (95% CI: 6.2-35.2, P-value: 0.000)	Cluster randomisation of villages rather than individuals to select treatment and control group in a same district, sufficient sample size (1086 participants) ,statistical power included a significance level of 95%, and intra cluster correlation of 0.12 and an attrition rate of 10%;simple random selection of household for data collection, No loss of follow up as the villages were randomised, statistical test (difference -in-differences) were used to assess the difference between intervention and control villages; standard errors were corrected for clustering at the village level.	CLTS increased latrine ownerships. The study could be generalised to some extend because of the sampling frame used in the study which selected medium sized villages in coaster district with limited exposure to government sanitation programme. These villages represent typical of rural India.

Blitstein, J. L. et al. (2007	Cluster randomised control trail. This model does not show a significant effect of IHL adoption on diarrhoea.(Children under 3 years: significant at < 1% and children under 5 years: significant at 5% level)	Randomisation of villages rather than IHL owners to select treatment and control group a same district which affect the study result, sufficient sample size (1086 participants) ,statistical power included ;simple random selection of household to address bias, There were loss of follow up, statistical test were used to assess the difference between intervention and control villages; standard errors were corrected for clustering at the village level.	There is no conclusive evidence that programme reduced diarrhoea prevalence in < 5 years children. The study could be generalised to some extend because of the sampling frame used un the study which selected medium sized villages in coaster district with limited exposure to government sanitation programme. These villages represent typical of rural India.
Tapas Chakma et al. (2008	Cross sectional survey. Epidemiological study suggest statistically significant reduction in diarrhoea morbidity (t. test -6.966 ,P-value<0.00) &fever & jaundice morbidity (t test -8.536, P-value<0.00);Parasitological study: the result is statistically not significant (t test -0.91,P-value >0.05);The result of water quality suggest that all open well were contaminated with TTC and EF above the WHO guidelines values of <1cfu/100ml;In depth interview with ODF villages reveal that some were practising open field defecation.	The study included epidemiological investigation, microbiological and parasitological examination and water quality and sanitary inspection analysis. There was sufficient sample size (ODF-1100& NODF-843); The study design was appropriate & there was effort to address bias. **Limitation:** The study did not address confounding factors; study sample consisted of willing individuals. It did not randomize the study participants. The sample size for the parasitological was small.	There is no discussion of the generalizability of the result. Although there was significant reduction in diarrhoea morbidity , diarrhoeas prevalence was still very high and result of parasitological examination was statistically not significant evidence .Thus the study results suggested that sanitation coverage did not improve the health of villagers.

Elbers, C. et al. (2011	Survey design; CLTS had strong impact on latrine ownership (unadjusted: 12% point, p-value <0.05, more likely & Adjusted : 15% point ,p-value <0.05 , more likely to own latrine) and health outcome on older individuals (8% point reduction, p- value <0.04) and no impact on children under 5 and very limited impact on hand washing with soap(unadjusted: 10% point , adjusted: 7% point more likely to wash hand).	Data collection based on systematic sampling from a randomly chosen houseld to minimise bias. Sample size is big. Attrition bias addressed for dropped out households. Linear probability model used to estimate the effect. Confounding variables have been control in the analysis.	The study did not discuss the generalizability of the result. This result was based on the baseline and the midterm surveys. The end line survey is scheduled in 2013.Therefore the study suggests some estimates of the impact of the intervention.
Whaley, L. et al. (2011	Mixed methods of study; CHCs were significantly more effective than CLTS in safe faecal disposal (92% vs 77%, p-value <0.04) and HWF (64% vs 10%, p-value<0.00); CLTS is better than CHC in sanitation promotion. 44% CLTS respondents (p-value <0.065) owned a latrine and 57% (p-value <0.00) of the respondents used shared latrine. CHC respondents were only 26%.	There is no discussion on the generalizability of the study in the paper. The study lacked methodological quality. It neither had appropriate sampling strategy nor controlled for confounding during analysis. On the other hand the sample size of the study was small.	CLTS increases latrine ownership. There were more number of IHL owners and shared latrines. The study lacked generalizability due to its poor methodological information. However the result provided some information about the study subject and has opened door for further research.
Dickinson, K. L., et al. (2011)	Cohort design; There is no significant reduction on diarrhoeas among < 5 children (r 0.05;p-value<0.04) MUAC z-score -0.04;p-value > 0.05).	Simple random selection of villages and participants, Control for confounding variables, However there is no discussion on attrition adjustment for loss of follow up, The study did not give 95% confidence intervals, no discussion on generalizability.	Diarrhoeas rate decreased following the CLTS intervention but these effects were not statistically significant.