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Multi-Sector Analysis of the Progress and Challenges of Soil-Transmitted Helminth Eradication in Rural Udaipur

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MULTI-SECTOR ANALYSIS OF THE PROGRESS AND CHALLENGES OF SOIL-
TRANSMITTED HELMINTH ERADICATION IN RURAL UDAIPUR

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Table of Contents

ACKNOWLEDGEMENTS.....	3
ABSTRACT.....	4
ABBREVIATIONS.....	5
INTRODUCTION.....	6
FIELD METHODS.....	9
ROLE OF SECTORS	
Government.....	11
Non-Governmental Organizations.....	14
Medical	16
MULTI-SECTORAL CHALLENGES	
Investment of Local Leaders.....	19
Social Barriers to Deworming: WASH and Education	23
Addressing Related Diseases.....	28
CONCLUSION.....	30
BIBLIOGRAPHY.....	32
RECOMMENDATIONS OF FURTHER	
STUDY.....	33

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Abstract

India is home to 240 million children currently at risk of Soil-Transmitted Helminthiasis, which is spread via unclean water, soil, and food, and causes acute pain and malnutrition. While acknowledging the research debates over WASH and mass drug administration, this study seeks to identify the systemic multidisciplinary issues affecting STH elimination efforts in rural Udaipur. Twenty-three interviews were conducted in villages, government departments, NGOs, and medical sectors to identify the challenges within each approach to deworming, and their experiences with multi-sectoral collaboration. The most recurring issues across disciplines were need for invested local leadership, increase in health literacy of adults, and coordination between NGO and government. Specifically there is a need for consistent communication and reporting between government health and education departments. The results of this study and further research hope to make deworming treatment and prevention more comprehensive and efficient so that India might achieve the WHO goal of eliminating STH-related mortality by 2020.

Abbreviations

ASHA - Accredited Social Health Activist

ANM - Auxiliary Nurse Midwife

CHC - Community Health Center

GoI - Government of India

GP - Gram Panchayat

ICDS - Integrated Child Development Scheme

MDWS - Ministry of Drinking Water and Sanitation

MLA - Member of Legislative Assembly

MoHFW - Ministry of Health and Family Welfare

MTC - Malnutrition Treatment Center

NHM - National Health Mission

NGO - Non-Governmental Organization

ODF - Open Defecation Free

OPD - Out Patient Department

SPHC - Specialized Primary Health Care

STH - Soil Transmitted Helminths

TBA - Traditional Birth Attendant

RCHO - Reproductive and Child Health Officer

WASH - Water, Sanitation, and Hygiene

WHO - World Health Organization

Introduction

The World Health Organization (WHO) currently estimates that India is home to 240 million children at risk of infection from parasitic worms known as Soil Transmitted Helminths (STH). The three most common of these infections are roundworm (*Ascaris lumbricoides*), whipworm (*Trichuris trichiura*) and hookworms (*Necator americanus* and *Ancylostoma duodenale*). All three infections are one hundred percent attributable to the environment.¹ STH infections are transmitted by ingesting larvae that are most commonly found in uncooked or unwashed vegetables, unclean water, and soil. Extensive literature has shown that these worms siphon vital nutrients from children and pregnant women², cause acute pain and stunting, and lower school attendance rates³. Since 2010, the world's leaders have increasingly recognized STH and similar infectious diseases as causes of deep, cyclic poverty, and have responded with mass programs to treat and prevent infection in the most endemic areas. In February 2015 the Indian government held its first National Deworming Day, and administered a single dose of albendazole⁴ medication to 179 million children. The Union Health Minister has described a vision of "Worm Free India" similar to the recent success of polio-free India.⁵ However, the risk factors for reinfection of STHs remain abundant in rural India, and must be addressed in order to fully break the cycle of disease, and address its social consequences.

The multidisciplinary approach to STH elimination as described in this study calls to question the concept of Specialized Primary Health Care (SPHC).⁶ Their paper disputed the growing international opinion that Comprehensive Primary Health Care should be the goal of

¹ Pruus, and Ustan, Preventing Disease Through Healthy Environments.

² WHO. March 2016.

³ Bleakley. "Disease and Development: Evidence from Hookworm Eradication in the American South."

⁴ While mebendazole can also be used for STH mass drug administrations, albendazole was the only drug mentioned by respondents in this study.

⁵ Keshavamurthy, H. R. "New De-worming Initiative launched to make India Worm Free."

⁶ Walsh, Warren. "Selective Primary Health Care"

public health programs to improve health statistics and poverty-related health issues. Instead, SPHC refers to programs aimed to treat and prevent one specific disease, based on evidence that it has a high prevalence, morbidity, mortality, and is feasible to control. SPHC is an important approach for the world's developing countries dealing with endemic infectious diseases and lower health care budgets. According to the original 1979 paper, *Ascaris* (roundworm) is a low-priority disease for SPHC due to the consistent need for chemotherapy, and relatively low rates of mortality and morbidity compared to malaria, tuberculosis, and polio which were three front-runners. Hookworm is listed as a medium-priority disease again due to its consistent need for chemotherapy. But the feasibility of control of *Ascaris* and hookworm would likely improved, following the results of the London Declaration of 2012 when 13 multinational pharmaceutical companies pledged to donate medicines to eradicate STH and other Neglected Tropical Diseases⁷. This lowers the cost of controlling STH, potentially raising it to a higher SPHC priority.

Yet the multidisciplinary approach discussed in this study is more befitting of Warren and Walsh's Multiple Disease Control approach. WASH programs are included in Multiple Disease Control, but require an enormous financial investment and "the success of such projects depends on rigorous maintenance and alteration of engrained cultural habits" (Walsh and Warren, 1979). These issues, in relation to STH control in rural Udaipur, are addressed through education efforts and mobilization of government and NGO services towards behavior change.

India's deworming programs are closely tied with success of the *Swaach Bharat* (Clean India) campaign begun by Prime Minister Modi in 2014. *Swaach Bharat* represents the water, sanitation, and hygiene (WASH) sector of public health that is inextricably tied to transmission

⁷ London Declaration on Neglected Tropical Diseases.

of STH. Diverse aspects of rural health care including WASH, maternal health, and child nutrition, along with education and accessibility determine the realistic outcome of deworming campaigns. This study aims to bring together these ideas and examine the multi-sectoral work surrounding deworming⁸ in rural Udaipur, India.

Udaipur was chosen as the location of this study due to the heavy burden of STH in the district⁹, and the broad presence of both government⁹ agencies and non-governmental organizations (NGO). Seva Mandir is a large NGO in Udaipur that works to address rural development needs in over six-hundred villages through democratic participation and holistic, sustainable programs. Seva Mandir's programs encompass education, health, women's empowerment, and sustainability, all of which play a part in the effectiveness or longevity of deworming. This study was conducted primarily through qualitative interviews with rural health providers, villagers, physicians, government workers and Seva Mandir employees. Respondents represented various health interests, policy-makers, and implementing agencies that contribute to deworming.¹⁰ Interviews discussed the individual goals and challenges of the sector as well as collaboration with government policy and other sectors.

Deworming progress in rural Udaipur is shaped by medical treatment access for socially and geographically isolated populations, which is increased by presence of invested and empowered local leaders. There is a need for productive, and not redundant, collaboration between government and NGOs to reduce the social barriers to health, specifically education and

⁸ The term "deworming" in this study refers to all multi-sectoral work that contributes to the control and eventual eradication of STH infections. This work is done both directly and indirectly, and does not only refer to mass albendazole treatments.

⁹ Global Atlas of Helminth Infections.

WASH. Finally, there must be systems to care for child malnutrition and maternal health which are medical consequences of STH infections.

Field Methods

Primary data for this study was collected through twenty-three personal interviews with government officers, health providers, and village women in Udaipur district. Rural interviews were conducted in Gogunda block and Girwar block. Both of these blocks are have a 95% tribal population with a hilly, arid terrain.¹¹ Seva Mandir, the NGO chosen for this study, operates in a similar capacity in both areas. Interviews with village women and rural health providers were conducted mostly in Hindi with help of a Hindi-English translator. Women in the village of Dholigarti in Gogunda block spoke only the village language Wagdi, and so some interviews required a second Hindi-Wagdi translator. Some names have been changed or omitted in this report to protect privacy when requested. Where named credit is due can be found in the bibliography. All interviews were created and conducted in a manner appropriate for undergraduate level research, and in cooperation with ISP regulations. No persons in a vulnerable medical condition or underage were interviewed.

A total of nine local women were interviewed, all of whom were married and had one or more children still living in the village. Having children in the village was necessary so that the women would be able to talk about school deworming, taking children to health clinics, and would be familiar with ASHA and ANM work from their pregnancies. Interview respondents were selected at village anganwadi centers during two separate Seva Mandir malnutrition check-up events. This setting allowed for interviews with mothers, as well as Seva Mandir employees, two ASHAs, two Traditional Birth Attendants (TBAs) and one ANM who were working at the

¹¹ 2011 census data

events. Despite three separate visits to anganwadi centers, no anganwadi worker was available for interview. ASHAs and TBAs were able to answer the majority of questions regarding anganwadi deworming work, but it should be noted that deworming, sanitation, and education topics in this study occur at anganwadi centers for children under six-years old. It would have been preferable to speak with an anganwadi worker.

The remaining interviews were conducted in English in urban settings with doctors, government officials, and Seva Mandir employees. Of the five doctors interviewed, two were primary care physicians working in the Gogunda Community Health Center (CHC), two were pediatric malnutrition specialists in Udaipur city, and one was a Principal Medical Officer and gynecologist in Udaipur. These interviews were designed to discuss diagnosis of worm infections, and decisions about albendazole treatment guided by personal practice and government policy. Doctors also discussed how deworming affects their specialty area of medicine (nutrition or gynecology), and their interaction with WASH, education, and NGO work. From the government health sector, an interview was conducted with the Reproductive and Child Health Officer (RCHO). The RCHO is responsible for directing all programs related to reproductive and child health in Udaipur district. Questions in this interview centered more around policy, administrative challenges, and collaboration with other government departments.

Between the government and NGO sector, interviews were designed to ask the same questions to leaders in the same discipline, from both sectors. Representing the interests of WASH, interviews were conducted with the director of Seva Mandir's WASH program, the Udaipur District Coordinator for *Swachh Bharat*, and a UNICEF representative who was working as a district consultant for *Swachh Bharat*. From education departments, interviews were conducted with a government school principal in Gogunda block, and the director of

education program at Seva Mandir. Conclusions about deworming challenges and progress were found from analysis of these twenty three qualitative interviews, and background literature as cited throughout this paper.

Roles of Sectors

Government

Administering safe, effective deworming drugs to children at schools is a development “best buy” due to its impact on educational and economic outcomes and low cost - Ministry of Health and Family Welfare

The role of the Government of India (GoI) in deworming extends from national policy-setting to physically handing each child an albendazole tablet. While albendazole has been used in clinics for individual STH treatment, the first National Deworming Day was held in India on February 10th 2015. On this day 179 million children were treated for hookworm, whipworm, and roundworm in the largest single-day drug administration in the world.¹² The impetus for this event came from multiple agencies including the WHO, the Ministry of Health and Family Welfare (MoHFW), and the Deworm the World Initiative at US-based NGO, Evidence Action. In accordance with the 2015 Sustainable Development Goals, the United Nations has emphasized increased efforts to eradicate Neglected Tropical Diseases, of which STH are a significant percentage. Therefore the basic targets and guidelines for Indian’s deworming campaign were designed by the WHO, and modified by India’s MoHFW. The specific program planning, monitoring, and implementation strategy was designed within existing frameworks of India’s health and education systems, with technical support from the Deworm the World

¹² Admin, Evidence Action. "National Deworming Day India..."

Initiative.¹³ National Deworming Day is one aspect of India's School Health Program, launched by the National Health Mission.

The process of deworming in India utilizes the existing medical knowledge and community trust of ASHA, ANM, and Anganwadi workers. Every February 10th children at government and private schools line up to receive the appropriate dose of albendazole, swallowed with a glass of water. The model is designed to treat every child without screening, due to the few or nonexistent side effects of albendazole. Additionally the WHO has calculated that treatment without screening reduces the cost of deworming by four to ten times.¹⁴ In India, the cost of mass deworming - including albendazole, advertising materials, and staff training - is paid for by the state government. This is typical for all health-related issues under GoI.

Medicine at school deworming (ages six to eighteen) is distributed by trained teachers, principals, ASHA, or ANM. At the Anganwadi level (ages one to six years), the Anganwadi worker is trained to administer medicine, again with the assistance of ASHA or ANM depending on location. The number of children treated on Deworming Day is then recorded from each institution, totaled, and reported by the ANM to block-level medical officer. There is a second "Mop Up Day" on February 15th, during which the children who did not attend, or children who are not enrolled in school or Anganwadi, are sought out and treated individually. In the weeks leading up to National Deworming Day, there are community announcements and advertising materials provided by the state, and used to encourage school attendance on Deworming Day.

Aside from treatment guidelines for children, GoI also sets goals and guidelines for related issues, without which Worm Free India cannot be achieved. These include guidelines for deworming of pregnant women, and the aforementioned *Swachh Bharat* mission. Pregnant

¹³ Ministry of Health and Family Welfare. National Deworming Day Operational Guidelines.

¹⁴ World Bank. School Deworming at a glance.

women are a crucial population in need of deworming due to the significant correlation between STH infection and maternal anemia, which determines birth weight and mortality.¹⁵ *Swachh Bharat* is a separate mission under the Ministry of Drinking Water and Sanitation (MDWS). Prime Minister Modi has established a national goal of Open Defecation Free (ODF) India by 2019. There are a multitude of incentives, interventions, and projects associated with this mission, but due to the nature of STH transmission, this study focuses on open defecation. Under *Swachh Bharat*, local governments called Gram Panchayat may distribute 12,000 Rs to every home that builds a latrine.¹⁶ This is a continuation of similar but smaller incentive programs under the former Total Sanitation Campaign, and Nirmal Bharat Abhiyan. The full extent of *Swachh Bharat* includes access to clean drinking water and widespread adoption of personal hygiene habits such as hand washing.

Non-Governmental Organizations

Development and governance should not just be left to the state... but citizens and their associations should engage separately and jointly with the state - Seva Mandir mission statement

NGOs exist where government institutions and policies have left “gaps” of underserved populations and unmet needs. Two crucial aspects of operating as a successful NGO are to provide support in the areas where the populations requests it, and not to operate in parallel with the government. Parallelism describes programs or institutions that are replicas in function or result to that of an existing government. Parallel structures become a waste of both NGO and government resources, and can cause a confusion and distrust within the population. In the way

¹⁵ MHFW. National Guidelines for Deworming in Pregnancy.

¹⁶ MDWS. Guidelines for Swachh Bharat Mission (Gramin)

that their work relates to deworming, Seva Mandir fills both population and resource gaps. Seva Mandir operates 160 schools in Udaipur district, with 6,000 students.¹⁷ Schools are planned such that the scattered layout of tribal areas does not isolate children from an education. In this manner they fill the geographic gap between tribal students and government schools. In accordance with the school deworming guidelines mentioned above, these 6,000 children also receive annual albendazole treatment which they would have missed when they did not attend school. Despite the best intentions of Mop Up Day, children who are not regular attendees of anganwadi or government schools do not get sought out by government health workers.

Seva Mandir also has programs aimed at malnutrition, maternal health care, and WASH access, all of which indirectly affect deworming progress. Seva Mandir employs *balsakhi* and TBA who are local women trained to care for small rural populations of children and pregnant women, respectively. *Balsakhi* - in Hindi literally meaning “friend of the children” - regularly monitor the height, weight, and diet of every child in their own village, and run a day care (*balwadi*) that allows children to learn about hygiene and early school subjects, and allows mothers to go to work. Through their close and consistent relationships, *balsakhi* are able to identify acute cases of worm infection in the children and refer them to medical services or provide ointment for symptoms such as skin rashes.¹⁸ STH infection is also a major cause of anemia and other forms of malnutrition, which is the more immediate purpose of *balsakhi* work.

TBA have a similar relationship with pregnant women. TBA are women with a long history in the village and who have raised multiple children themselves. They counsel throughout all aspects of antenatal, birth, and postnatal care. In interviews with two TBAs, they reported no direct treatment of deworming. But like *balsakhi* they are a respected figure in the community

¹⁷ Riddhi Shah, Nov. 2016

¹⁸ Balsakhi worker. Personal interview. 11 Nov. 2016.

and have an effective voice in referring anemic and sick mothers to medical care, which increases the opportunities for pregnant women to be treated for STH. This is especially important due to the risk of maternal anemia from STH infection.^{19,20}

One of the outcomes of Seva Mandir's WASH program is eliminating the source of STH infection from unclean drinking water, open defecation, and lack of personal hygiene. Through their schools and *balwadi* Seva Mandir workers teach children about the importance of hygiene. Children then return home and become an example to their families. The same model is employed in government schools, but as mentioned above Seva Mandir's schools exist in areas that have been isolated from adequate government schools. Seva Mandir frequently rearranges school locations when government schools expand so as not to operate in parallel. Seva Mandir's WASH program also helps to build latrines and water filtration systems where they do not exist. More importantly however, Seva Mandir creates local demand and encourages democratic advocacy towards the Gram Panchayat. Using these government paths, families can build their own clean water and toilets, and receive the government 12,000 Rs incentives.²¹

Through their inclusive and intimate relationships between village members, health workers, and government, Seva Mandir's development programs are filling the sanitation, treatment, and education gaps left by government programs. The result of this work eliminates the source of STH infection, and provides treatment to people who could not previously receive it.

¹⁹ Traditional Birth Attendant. Personal interview. 10 Nov. 2016.

²⁰ Traditional Birth Attendant. Personal interview. 11 Nov. 2016.

²¹ Pankaj Ji, Seva Mandir WASH program director, Nov 2016

Medical Sector

If I give information to ten, it might not be possible to change the attitude of ten people. But it is possible to change the attitude of one or two people - Udaipur pediatrician

For physicians, nurses, and other hospital-based health providers, the primary interaction with STH is in swift and frequent diagnosis in the Out Patient Department (OPD). Following interviews with five doctors at tertiary and CHC level hospitals, OPD diagnosis is based off of anemia and malnutrition symptoms, chronic abdomen pain, skin rashes, and any reports of worms found in stool. A stool test is rarely ordered to confirm a diagnosis, again because albendazole is effective and relatively harmless for all patients. But Dr. Gaurav, an Udaipur specialist in pediatric malnourishment, orders stool tests for unexplainable anemia or extreme cases of abdomen pain.²² Dr. Gaurav also practices “family deworming”, and prescribes extra albendazole tablets for each family member whenever a child is treated with albendazole. Since STH infections result from lack of hygiene habits and sanitation facilities, it is very likely that more than one person is infected in a home with no latrine, no hand washing, or unclean water. Yet this family deworming differs between doctors. Of the three tertiary physicians interviewed, all were aware of family deworming, but only Dr. Gaurav practiced it. All doctors reported that when they prescribe deworming medication, they first ask the accompanying adult whether the child had recently been dewormed at school or another clinic. If he or she has not been dewormed in the last four to six months, the doctor will again prescribe albendazole. In one Udaipur tertiary hospital, a pediatric doctor reported that between two and five patients in OPD receive deworming every day. In a rural CHC, doctors reported about twenty to thirty percent of OPD patients receive deworming every day.

²² Udaipur pediatrician. Personal interview. 16 Nov. 2016

All five doctors who were interviewed reported giving some level of WASH-related advice when prescribing albendazole. Every doctor teaches the importance of regular hand washing after defecation and before eating, but there was disagreement about whether latrine building was an appropriate topic for a physician to discuss. Dr. Gaurav felt that it was not within his authority to tell a family to build a latrine, if it is clear that the family cannot afford to meet basic nutritional needs. Dr. Saahil, an Udaipur gynecologist, said he specifically recommends women to cut their fingernails short because unclean soil in fingernails can get transferred to food, water, or children. Only the two doctors at CHC mentioned their knowledge of government incentives for building latrines, and they agreed that sanitation and hygiene education was rapidly improving in their surrounding villages.

The three tertiary level doctors also spoke on how deworming affects their specializations. Both malnutrition pediatricians give albendazole to every child admitted for anemia or malnutrition, and on National Deworming Day they give albendazole to every child seen in OPD. Dr. Saahil has similar mass treatment practices with pregnant patients. Every women visiting for the first time after five months gestation receives albendazole, as well as women who are anemic (less than 10g hemoglobin level). There are a number of theories that albendazole causes negative side effects in newborns such as eczema, but numerous studies^{23,24} have shown this to be untrue after the first trimester. Dr. Saahil said that he has never seen adverse effects of albendazole treatment. Every woman who is given albendazole during pregnancy is reported to the National Health Mission (NHM) and the treatment is reported on the ante-natal care card given to every women during her pregnancy. There is, however, no such

²³ Larocque, Gyorkos. "Should Deworming Be Included..."

²⁴ Gyorkos, et al. "Lack of Risk of Adverse Birth Outcomes..."

system of reporting for child deworming. The reasons and consequences of this will be discussed in greater detail later in this paper.

The care, advice, and extra practices surrounding deworming differ significantly between each physician and each hospital. And while the same could be said for lower-level health providers like ANM and ASHA, the status and relative freedom of practice given to physicians makes deworming issues in medical sector a pattern of individual decisions, rather than systematic.

Multi-disciplinary Challenges

Having explored the separate roles and concerns of each sector, it is clear that organizations do not operate within their own ideal conditions. Each individual worker and program is constantly operating around the effects of others' work, the daily behaviors of another industry, or social standards of another people's deep-rooted culture. The following sections seek to analyze the common challenges expressed by multiple sectors, and identify some potential solutions considering the multidisciplinary nature of deworming.

Investment of Local Leaders

Areas of widespread STH infection are, by definition, endemic. STH infections remain unaffected by rainy or dry seasons, and there is no obvious disfiguration or tragic death among the infected. The consequences of this are that even successful deworming can appear monotonous, and even futile. Therefore carrying out sequential years of deworming requires

informed leaders who are also invested in the long term effects of deworming such as reduced anemia, improved maternal health, increased school attendance^{25,26}.

One way that socially-supported, local leaders can contribute to deworming is by increasing the frequency and quality of rural health treatment. Seva Mandir's health programs reflect this belief in their program design and their selection of individuals for *balsakhi* and TBA. In interviews with one *balsakhi* and two TBA, all three introduced themselves by describing the depth to which they know every child and pregnant woman in the village. There was immense pride in the women's detailed knowledge of every constituent and their lifestyles, and this feeling was reflected in their attentive care and strict medical referrals for sick women and children.^{27, 28, 29} Employing women who still live in the village in which they work also encourages the same care and investment from their neighbors. For example, in the village of Dholigarti, one *balsakhi* reported that women have begun reminding each other in the streets to bathe their children and make them wear shoes before attending *balwadi*.³⁰ This self-promoting behavior is a definitive sign of the *balsakhi's* success in creating long-term behavioral change, and these particular changed behaviors ultimately decrease the incidence of STH infection.

During interviews with ASHA and ANM there was no mention of similar knowledge of every person in their working community. ANM has a great deal more people in her care, often visiting multiple blocks each week.³¹ To increase accountability, the Seva Mandir-employed ANMs in report outcomes of their village visits to the Seva Mandir health department, a practice

²⁵ Miguel, Kremer. "Worms: Identifying Impacts on Education..."

²⁶ Bleakley. "Disease and Development: Evidence from Hookworm Eradication in the American South."

²⁷ Traditional Birth Attendant. Personal interview. 11 Nov. 2016

²⁸ Traditional Birth Attendant. Personal interview. 12 Nov. 2016.

²⁹ Balsakhi. Personal interview. 11 Nov. 2016.

³⁰ Preeti Siktawat, Nov. 2016

³¹ ANM. Personal interview. 12 Nov. 2016.

that is much neglected or nonexistent at the government block level.³² *Balsakhi* and TBA also report to Seva Mandir and keep detailed records of their work with children and mothers.

Reporting standards for government-employed ANM and ASHA should be equal to that of TBA and *balsakhi* if more villages seek to have more invested and involved health providers.

Another example of ownership and investment from community leaders is in Seva Mandir's education program. Seva Mandir opens schools in areas where village committees have requested one, due to distance or a treacherous walk to the nearest government school. These new schools allow isolated tribal populations access to education - and therefore annual deworming - where they did not have it before. In order to build the initial demand for education and maintain community enthusiasm, a local, permanent teacher is selected by a village committee. This teacher can then track and report on the students when they move on to government school education, and beyond. The committees who select the teacher also select the facility for the school, and appeal to the Gram Panchayat for approval. This entire movement is the result of local parents taking an definitive, organized interest in education and its associated benefits, such as health.

But still there are young people in rural Udaipur who had early education, but left school for a variety of reasons. For these people it is systematically and socially difficult to re-enter schools. Seva Mandir has created camps for six months of the year where working youth are reintroduced to school with an alternative, gentler pedagogy. Through these learning camps students are also given the hygiene lessons and immunization and deworming treatment that youth are supposed to receive in schools.³³ All these initiatives require immense individual

³² Dr. Ashok Aditya, Nov. 2016

³³ Riddhi Shah, Nov. 2016

determination by teachers and health providers to reach out to every child who has been left behind or excluded from other systems.

One government school principal who was interviewed showed great knowledge and interest in school-based health and hygiene. This principal, Mr. Jawa, is an example of how government employees can also reach across disciplines and improve overall community development. Mr. Jawa regularly visits the nearby Anganwadi centers to record the number of children regularly attending, as well as the amount of food being distributed. In years and months prior he has personally visited homes that did not have a functioning toilet, and instructed families how to request funds from the Gram Panchayat. This was not required for his job as school principal, and now every home in the village has a functioning latrine and bathroom.³⁴ He was also incredibly informed about the details of National Deworming Day, other in-school medications provided by ASHA and ANM, and all health reporting processes. According to the Udaipur district RCHO, the primary challenge to deworming is school teachers and principals not taking individual ownership of anemia and child health issues.³⁵ Invested behavior like Mr. Jawa's is not the norm, and from most blocks, the RCHO cannot receive any reports of school deworming.

These examples of strong, active community leaders are not meant to imply that a Worm Free India requires one or two people to extend their work hours and take on extra responsibility. Rather, if local community members are employed in positions of strength they will naturally do their job with a greater community development mindset. This especially applies to women because they traditionally have less power in their opinions, but are more aware of domestic problems such as sanitation and childhood illness.

³⁴ Government school principal. Personal interview. 22 Nov. 2016

³⁵ Dr. Ashok Aditya, Nov. 2016

At higher bureaucratic levels there exists a similar need for ownership of rural development and public health issues. Because health issues in India are handled by the state governments, long term change requires state representatives who are acutely aware of the issues most affecting their constituents. In an interview with Mr. Choun, the Udaipur District Coordinator for *Swachh Bharat* he said that out of the nine MLAs representing Udaipur “three or four of them have taken sanitation as primary agenda. Four or five have taken development as important agenda. Now question is, how do you link sanitation with development?” Mr. Choun argues that since overall development is a more likely talking point for MLAs, smaller subjects like sanitation and deworming must be discussed as part of this greater goal. Since both the causes and consequences of STH endemics are multidisciplinary, it is imperative that the methods of addressing it must be as well.

Social Barriers to Deworming: WASH

The health impact of reducing open defecation and improving WASH measures has been proven time and again in research. Schools with hand washing stations, or villages with clean water hand pumps have significantly reduced levels of STH infection.³⁶ A 2014 publication about the effects of WASH upon STH control shows that India currently has less than 50% of its population covered by sufficient sanitation, and two-thirds of its children require STH drug treatment.³⁷ These rates are far below other nations of similar economic development, and show a national correlation between lack of sanitation and STH infection. Both Seva Mandir and the government *Swachh Bharat* programs have devised very similar solutions to increase WASH infrastructure and health literacy by creating multidisciplinary WASH teams at the block level of

³⁶ Greenland, et al. "The Epidemiology of Soil-Transmitted Helminths..."

³⁷ Campbell. "Water, Sanitation, and Hygiene..."

government. Both Seva Mandir employees and District Coordinator Mr. Choun said they do not work at all with the other's program, but after examining it seems there are aspects to be learned from both.

Seva Mandir's director of WASH programs described their WASH teams as group of multidisciplinary block-level experts. These experts come from backgrounds in women and child development, village government, and health, and are specifically trained in WASH issues by Seva Mandir. The team then visits villages and hamlets where village level health workers, teachers, and interested community members learn and disseminate the information.

The government WASH teams are also multidisciplinary at the block level, but tend to focus less on health education and more on provision of latrines. Girwar block is one of the most successful examples of the government WASH teams. In Girwar there existed a very effective leadership team of Mr. Choun (District Coordinator), an MLA, and a state resource group. These leaders then encouraged the sarpanch (elected leader of the Gram Panchayat) to teach all forty to sixty members of the Gram Panchayat about sanitation. These members came from the five GP departments of health, primary education, ICDS, women's development, and agriculture. As a measure of social progress it should be noted that at the beginning of this project the sarpanch was unable to list the names of these coworkers.

Using this now large and diverse WASH team, each team member was assigned an equal share of homes that did not have household latrines, and was responsible for educating and assisting them in building one. This divide-and-conquer solution transformed the burden of several thousand homes needing latrines, to only a few dozen homes per team member. The approach worked extremely well, and the GP in Girwar has now declared ODF status. But skepticism about ODF declarations are heard across all sectors. Building latrines is not sufficient

to stop disease transmission without the necessary behavior change. If Mr. Choun's team approach to building latrines was combined with the Seva Mandir approach to educate village leaders about sanitation and hygiene, the social and health results of WASH intervention could be greatly improved.

Another discrepancy between government and NGO solutions is in the type of latrine that is built. Villagers in Girwar and similar blocks are hesitant to build latrines even with the 12,000 Rs government incentives because latrines built by government use flush systems, and villagers are concerned about wasting the water in the arid Udaipur climate. Instead, Seva Mandir promotes eco-san latrines that collect human waste in three different compartments, and can later be used as agriculture fertilizer. Seva Mandir has built about 1000 of these latrines under the older NBA sanitation scheme, which provided 4,600 Rs to each household latrine. Under *Swachh Bharat*, the 12,000 Rs government incentives cover about 70% of the cost of one latrine. Families that do not have assistance from Seva Mandir must cover the remaining approximately 5,000 Rs themselves. While the successful infrastructure plans often require a labor or monetary contribution, 5,000 Rs is a large sum for many tribal families. However this study did not greatly investigate the financial consequences of government schemes.

The continual adaptation of WASH programs to the needs of the tribal villages and government policy is absolutely crucial to long term efficacy of deworming. Where WASH measures are not adequately promoted, the prevalence of STH infections can return to pre-deworming numbers after just one year.³⁸ But while WASH improvement ensures the longevity of deworming, increased education and health literacy creates demand and promotes follow-through of more families.

³⁸ Okoyo. "Monitoring the impact of a national school..."

Social Barriers to Deworming: Education

Education was cited as the single biggest challenge to deworming by all government officers and physicians interviewed in this study. Education acts as both an indicator of community health status, as well as the implementing agency for child albendazole treatment. While the district and state health departments are responsible for planning, providing, and evaluating albendazole treatment, it is the education departments that must view deworming as a priority in order for it to be fully executed. The Udaipur RCHO particularly feels this divide between health and education communication, and says that in many areas the village rates of child anemia and STH are dependent upon the personal determination of a school teacher to carry out deworming. There are few to no reliable mechanisms for reporting school albendazole treatment from the district education department to the health department.³⁹ Yet deworming and education have a two-way relationship. Numerous studies show that deworming is an incredibly affordable and effective way to raise rural school attendance.⁴⁰ If more schools were made aware of this it might encourage stronger support of deworming from individual teachers.

But education does not just refer to children learning in a classroom. According to two Udaipur pediatricians, the greatest need for education is in improving adult health literacy. If adults are educated about basic disease transmission, then the need for hand washing and household toilets will become obvious and behavioral change taught to schoolchildren will be reinforced at home.⁴¹ The second most noted challenge to deworming was tribal societies, whose living patterns are unpredictable, making standard education systems difficult to implement. But pediatrician Dr. Gaurav believes that “if you offer a workable system, educating about

³⁹ Dr. Ashok Aditya, Nov. 2016

⁴⁰ Bleakley. "Disease and Development: Evidence from Hookworm Eradication in the American South."

⁴¹ Udaipur pediatrician. Personal interview. 16 Nov. 2016

drawbacks and reasons [in tribal areas] it will be taken up”. Education will change literacy rates and ODF rates as it has slowly changed them across the rest of India. Literacy in itself also provides opportunity for health improvement. If rural adults become literate then the government will be able to spread more messages about health programs and incentives, but “if a family has no knowledge of these programs they will not come to health centers and get treatment” (Udaipur RCHO). It is also possible that increased literacy may cause families to feel less intimidated by PHC and CHC healthcare, and thus decrease the numbers of tribal families seeking treatment from “quacks”. Currently most tribal children who come into tertiary urban hospitals are only taken there in critical condition, and have previously tried to seek help from these non-medical healers or “quacks”.⁴²

WASH and education programs address sources of STH transmission and misunderstanding about its prevention and treatment options, respectively. But when combined, these principles could improve the health literacy of a village, which ultimately increases knowledge and demand for action on all matters of health.

Addressing Related Diseases

Maternal anemia and child malnutrition are important focus points in Indian public health. In December 2014 the MHFW released a separate set of guidelines for deworming in pregnant women. These guidelines serve partially to subdue fears about negative effects of albendazole in pregnant women, and to add another system to reduce maternal anemia. Maternal anemia and child malnutrition are both useful symptoms to diagnose cases of STH infection, and serious consequences of STH endemics that require prompt attention.

⁴² Udaipur pediatrician. Personal interview. 23 Nov. 2016

Child malnutrition results from the depletion of nutrients by intestinal worms, and is therefore used in identifying STH-infected patients. In one Malnutrition Treatment Center (MTC) in Udaipur, children are very rarely initially admitted due to a STH infection, or even for malnutrition. Most MTC patients here are found by screening patients in other wards, or even screening children visiting sick family members. When a malnourished child is identified they are brought into the MTC for up to two weeks, and every child in MTC is given deworming treatment.⁴³

This process of internal screening to identify more malnourished children partially explains why there was such variation in opinion about the number of deworming cases. For this particular hospital, deworming treatments are increasing, but only because more malnourished children are being sought out and treated. Doctors working at a CHC reported that deworming treatments are decreasing. But these doctors also see more immediate results of village sanitation improvements, and in their relatively small population this would appear to decrease the number of STH infections. Meanwhile in another Udaipur tertiary hospital, the doctors reported no change in deworming treatment because they have a large and diverse sample of patients, and they do not partake in internal malnutrition screening. It is important here to emphasize the phrase “deworming treatment” as opposed to STH infections. Because few patients receive a stool test which would officially diagnose a patient with STH infection, it is necessary to discuss infection in terms of number of treatments, which is the result of the aforementioned social and medical.

Albendazole is rarely prescribed to adults because of the lifestyle differences that give adults less exposure to infected soil and water. Exceptions to this are pregnant women, for whom

⁴³ Udaipur pediatrician. Personal interview. 16 Nov. 2016

there is a separate WHO and MoHFW treatment policy.⁴⁴ This system includes reliable monthly reporting to the NRHM, and internal records to monitor the change in hemoglobin levels and weight of the mother after albendazole treatment. Compared to child deworming, this method of reporting is possible due to the nature of in-hospital pregnancy check-ups. The woman is seen every month for the whole course of her pregnancy, and always in a hospital that has a duty to keep its own records. There are very different motivations for record-keeping compared to school-based child deworming, where the records are only an administrative hassle to be sent out to another office.

Still there are many women in villages whose pregnancies are taken care of primarily or entirely by ANM, TBA, or other village health provider. In interviews with these workers there was no mention of albendazole treatment in pregnant women, and interviews with mothers supported this. Village mothers reported seeing the ANM every 15 days during pregnancy, and learned much about hygiene and anemia, but nothing about maternal deworming treatment. Anemia is a strong incentive for teachers and rural health providers to regularly and responsibly administer albendazole. According to the Udaipur RCHO, school deworming is ultimately justified as a second method of curing widespread anemia, and more teachers and parents are aware of the effects of anemia than they are of STH. The Seva Mandir *balsakhis* also discuss anemia as a form of rampant child malnutrition and, as discussed earlier, a village *balsakhi* can have a huge local influence if given adequate resources and support. Therefore the consistent support and empowerment of rural health providers like *balsakhi*, TBA, ANM, and ASHA will continue the progression of deworming by addressing its associated issues of child malnutrition and maternal anemia.

⁴⁴ MHFW, “National Guidelines for Deworming in Pregnancy”

Conclusion

MHFW's vision of Worm Free India, and the WHO's goal to eliminate STH-related mortality by 2020⁴⁵, rely on more than annual school-based albendazole treatment. Deworming progress in rural Udaipur has potential to be more comprehensive, efficient, and effective by (1) empowering local, women leaders in matters of government and health, (2) promoting education and health literacy, and (3) increasing multi-sector collaboration on WASH, education, and rural health care. Village leadership positions should be filled by local, permanently established women who tend to have an increased sense of ownership for issues of village sanitation, maternal and child health, and inclusivity of isolated tribal areas. In order to spread development programs like sanitation and deworming there must be educated, health-literate adults who understand the reasons for disease transmission and can effectively respond to changes in policy and government programs. Increasing health literacy will allow parents to promote positive behavioral change alongside building household toilets. This combined behavioral change and sanitary infrastructure is needed to become Open Defecation Free, and stop the transmission of STH.

There are two prominent themes of collaboration in this study; that between education and health departments, and NGOs and government. School-based deworming is not adequately reported from schools to the district health department, which is ultimately necessary to determine the progress of STH elimination. Additionally, government *Swachh Bharat* programs should promote eco-san latrines that have been constructed by NGOs, with additional social development benefits. Both NGOs and government should emphasize health literacy and behavioral change communication aspects of sanitation programs.

⁴⁵ WHO, March 2016

In addition to these measures to eradicate STH, there should be continued attention to child malnutrition and maternal anemia. These diseases are largely the product of STH infection, and should be addressed in order to fully eradicate both the disease, and the damage caused by it.

These suggestions will allow the at-risk populations in rural Udaipur to have better access to deworming treatment, and better understanding of the causes of STH infection and prevention. The elimination of STH that this research ultimately seeks will allow women and children to live healthier, more productive lives free of worm-influenced malnutrition, and with better access to education.

Recommendation of Further Study

The conclusions of this study are specific to the tribal district of Udaipur, and the government policies and NGO programs operating there. The themes and challenges identified here would be more representative of national and state trends if it were replicated in states or countries with very different health systems. Additionally, a similar study in urban slums would identify the different systemic challenges in urban environments. These challenges to STH eradication could be applicable to other disease groups and social development goals, providing multi-sectoral implications. This study was unable to reach any Anganwadi workers or state education representatives for interview. Interview evidence with these people would help to understand motivations between education and health departments. The long term results of the WASH, education, and health interventions discussed in this paper are difficult to quantify in terms of reduced STH infections. A study using a defined population sample and stool tests would allow comparison of these different approaches.

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