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The Illusion of Sustainability*

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Abstract: The history of foreign development assistance is one of movement away from addressing immediate needs to a focus on the underlying causes of poverty. A recent manifestation is the move towards "sustainability," which stresses community mobilization, education, and cost-recovery. This stands in contrast to the traditional economic analysis of development projects, with its focus on providing public goods and correcting externalities. We examine evidence from randomized evaluations on strategies for combating intestinal worms, which affect one in four people worldwide. Providing medicine to treat worms was extremely cost effective, although medicine must be provided twice per year indefinitely to keep children worm-free. An effort to promote sustainability by educating Kenyan schoolchildren on worm prevention was ineffective, and a "mobilization" intervention from psychology failed to boost deworming drug take-up. Take-up was highly sensitive to drug cost: a small increase in cost led to an 80 percent reduction in take-up (relative to free treatment). The results suggest that, in the context we examine, the pursuit of sustainability may be an illusion, and that in the short-run, at least, external subsidies will remain necessary.

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Give a man a fish and you feed him for a day, teach him to fish and you feed him for a lifetime.
--Chinese Proverb

Feed the world.
--Bob Geldof

1. Introduction

The history of development assistance can be viewed as a series of attempts to identify and address ever more fundamental causes of poverty. Oxfam, for example, started out in 1942 as the Oxford Committee for Famine Relief, but long-ago shifted to "support for self-help schemes whereby communities improved their own water supplies, farming practices, and health provision."[2] In the 1950's and 1960's, it was widely argued that long-run welfare depended on capital investment, and helping countries raise savings through a "big push" (Rosenstein-Rodin 1943) would launch them into self-sustaining growth, or "take-off" (Rostow 1960). Accordingly, the World Bank funded infrastructure, like dams and roads.

However, by the 1980's development institutions decided that capital accumulation and technological progress depended not so much on investment and careful engineering, but rather on a better economic policy environment, characterized by reduced tariffs, appropriate foreign exchange, exchange rates, and low inflation (Williamson 1990, World Bank 1993). Development assistance was extended conditionally to encourage countries to adopt economic policies associated with this "Washington consensus" view. By the 1990's, this approach too became widely seen as unsuccessful. According to a new consensus the mandated policies would have only limited impact in the absence of more fundamental institutional reforms (World Bank 1998). This current thinking comes in two forms, one emphasizing issues of corruption and governance, while the other, more micro-oriented side, focuses on the notion of sustainability in community-level projects that we examine in this paper.

The publication of a recent World Development Report entitled *Sustainable Development in a Dynamic World* (World Bank 2002) puts an official seal of approval on foreign aid donors' embrace of the

[2] Refer to the Oxfam website for the details (http://www.oxfam.org.uk/about_us/history/history2.htm).

concept. Sustainability has many meanings, including an environmental meaning, but here we focus on financial sustainability. Whereas orthodox public finance analysis suggests that governments should indefinitely fund public goods and activities that generate positive externalities, advocates of sustainability emphasize the importance of local "ownership" of projects, and promote interventions that only require start-up funding, and can then be maintained locally without external support. This focus on financial sustainability in development has been motivated by a combination of factors, including widespread failure by less developed country governments to maintain infrastructure funded by foreign aid once construction is completed and opposition to indefinite development assistance "hand-outs."

The idea of sustainability has affected a wide variety of development policies. For example, many donors have only backed microfinance groups if they believed initially that funding these organizations would eventually allow them to achieve financial sustainability, defined as being able to fully cover costs from their lending operations (Morduch 1999). In the area of water supply, advocates of sustainability suggest that given the history of donor built water projects falling into disrepair, it is essential to organize community water committees that raise funds locally to maintain and repair wells. In public health, advocates of sustainability concentrate on health education, community mobilization, and cost-recovery from program beneficiaries, rather than simply medical treatment subsidies that generate positive externalities.

Some anecdotal evidence suggests that sustainability has often been a chimera – and sometimes a costly one.[3] Morduch (1999) argues that pursuit of sustainability by microfinance organizations has led them to move away from serving the poor, and that it has not, in fact, yielded organizations that break even financially – but rather organizations that learn to better hide their continued subsidies. At least in one case, the move away from donor support for water well maintenance to the establishment of community committees has allowed water infrastructure to fall into terrible disrepair: in one large water project in the area of Kenya we study, 43 percent of bore hole wells were useless ten years after the shift

[3] Tanner (1998) discusses the concept of sustainable development in regards to health. Meuwissen (2002), Cave and Curtis (1999) and McPake (1993) present evidence on cost-sharing in less developed countries.

to the “sustainable” local approach (Miguel and Gugerty 2002). In Uganda, funding for immunization – consistently rated one of the most cost-effective public health interventions – appears to have fallen following a fiscal decentralization reform that granted local sub-county governments increased responsibility for health fund raising (Azfar and Livingston 2002). In Niger, a health cost-recovery program led to unexpectedly large drops in health care utilization, and the local health committees set up to administer the program failed in most of their responsibilities (Meuwissen 2002).

While sustainability is certainly a desirable goal, it may be difficult to achieve. Teaching people to fish rather than providing fish is great if it works, but it works only if the donor knows more about fishing in the local area than the people who live there, and if the donor can transfer this knowledge. Yet it is difficult for outsiders to understand how institutions, politics and societies function, let alone how to influence them in a way that does not create unforeseen consequences. Even if a hypothetical planner could target foreign assistance so as to change communities and institutions for the better, the principal-agent problems involved in foreign assistance make it hard to do this in practice. It is difficult enough to monitor aid workers handing out fish, since they are not subject to market pressures, nor held democratically accountabe to the people who they are charged with serving. However, at least one can determine whether fish have reached the intended recipients, and presume that if so, the recipients are better off. In contrast, it is much more difficult to determine whether training sessions for leaders of non-governmental organizations (NGOs) working with the local fishermen have in fact made anyone better off. Foreign aid workers may provide encouraging anecdotes, but given their incentive to select among anecdotes, it is difficult to know whether donors would have been better off simply handing out fish.

In this paper we try to bring systematic empirical evidence to bear on the impact of organizing foreign assistance around this idea of sustainability. We present evidence on the issue within the context of a public health project designed to reduce intestinal worm infections among Kenyan school children. Intestinal worms infect one in four people worldwide. Worm infections can be fought in several different ways. One approach emphasizes periodic medical treatment with low-cost drugs. However, people soon become reinfected, so treatment must continue twice per year indefinitely. Utzinger et al. (2003) argue in the *Lancet* that rather than focusing narrowly on drugs, a broader approach with greater emphasis on health education, latrine construction, and water provision would be more sustainable. Other potential ways to make anti-worm programs sustainable include requiring cost-sharing payments from those taking drugs and encouraging local "ownership" of deworming projects.

This paper uses a random assignment methodology to obtain empirical evidence on a number of approaches for fighting worms. In prior work, Miguel and Kremer (2004) found that providing deworming drugs reduced school absenteeism by approximately one-quarter, or seven percentage points, and led to significant gains in several measures of health status, including worm infection, child growth stunting, anemia, and self-reported health (although there were no significant academic or cognitive test score gains). Moreover, providing free deworming drugs significantly reduced worm infection and increased school participation among untreated children in the treatment schools, and among children in neighboring primary schools. Traditional public finance analysis would support providing deworming medicine, since three quarters of the benefit is in the form of externalities (Miguel and Kremer 2004) and since deworming costs only $3.50 per extra year of school participation generated, making it one of the most cost-effective ways we know of to boost school participation.

However, it seems worth exploring alternatives to subsidizing treatment over the long-run. The introduction of a small fee led to a sharp 80 percent reduction in treatment rates relative to free treatment. Intensive school health education had no impact on child worm prevention behaviors, and thus child health is likely to be worsened to the extent funds are diverted from medical treatment into health education in this setting. A verbal commitment "mobilization" intervention – which asked people to commit in advance to adopt the deworming drugs, taking advantage of a finding from social psychology that individuals strive for consistency in their statements and their actions – had no impact on treatment rates. A non-experimental analysis suggests that household latrine construction and local borehole well density are both far less cost-effective than deworming drugs in reducing the rate of worm infection.

Overall, these results suggest that there may be no alternative to continued subsidies for deworming.[4] As discussed in the conclusion, there may be other cases in which trying to build sustainable programs is appropriate. But given the agency problems in administering foreign assistance and the many pressing, immediate needs in developing countries, donors should insist on evidence that they are funding more than the illusion of sustainability. In the absence of such evidence, they should fund the many projects – like deworming – that could make people better off at low cost, whether or not they are sustainable.

Aside from their relevance to the "sustainability" debate, the cost-sharing findings together with the social learning results (in Miguel and Kremer 2003) indicate that large subsidies may be necessary to sustain high take-up of medicines for diseases characterized by positive treatment externalities – a finding especially important for Africa, where half the disease burden is associated with infectious and parasitic diseases (WHO 1999). We also find that take-up is not sensitive to changes across a range of positive prices, suggesting that it may be particularly counter-productive to charge small positive prices.

The remainder of the paper is structured as follows. Section 2 discusses worm infections and describes the Primary School Deworming Project. Section 3 presents the deworming subsidy results. Sections 4 and 5 present the health education and verbal commitment results, respectively. Section 6 discusses wells and latrines, and the final section concludes with a discussion of broader implications for development assistance.

2. The Primary School Deworming Project (PSDP) in Busia, Kenya

Over 1.3 billion people worldwide are infected with hookworm, 1.3 billion with roundworm, 900 million with whipworm, and 200 million with schistosomiasis (Bundy 1994). Most have light infections, which are often asymptomatic, but more severe worm infections can lead to iron deficiency anemia, protein

[4] Lengeler (1999) reaches similar conclusions in regard to public health programs in poor countries. Note, however, that another possibility for public health policy is a large up-front investment in deworming treatment in order to reduce worm infection prevalence down near zero, in which case indefinite subsidies would not be necessary. However, this approach is unlikely to be successful for lasting worm control in rural Africa, given the high likelihood of continued contact with untreated individuals, and thus rapid re-infection.

energy malnutrition, stunting, wasting, listlessness, and abdominal pain. Heavy schistosomiasis infections can have even more severe consequences.[5]

Helminths do not reproduce within the human host, so high worm burdens are the result of frequent re-infection. The geohelminths (hookworm, roundworm, and whipworm) are transmitted through ingestion of, or contact with, infected fecal matter, which can occur, for example, if children do not use a latrine and instead defecate in the fields near their home or school, areas where they also play.[6] Schistosomiasis is acquired through contact with infected freshwater; for example, in our Kenyan study area people often walk to nearby Lake Victoria to bathe and fish. Medical treatment for helminth infections creates externality benefits by reducing worm deposition in the community and thus limiting re-infection among other community members (Anderson and May 1991).

We study the Primary School Deworming Project (PSDP), a school health program carried out by a Dutch NGO, ICS Africa, in cooperation with the Kenyan Ministry of Health. The project took place in Busia district, a poor and densely-settled farming region in western Kenya, and the 75 project schools include nearly all rural primary schools in this area, with over 30,000 enrolled pupils between the ages of six and eighteen, over 90 percent of whom suffer from intestinal worm infections. In January 1998, the PSDP schools were randomly divided into three groups (Group 1, Group 2, and Group 3) of twenty-five schools each: the schools were first divided by administrative sub-unit (zone) and by involvement in other non-governmental assistance programs, and were then listed alphabetically and every third school assigned to a given project group.[7]

Due to administrative and financial constraints, the health intervention – which included both deworming medicine and health education on worm prevention behaviors – was phased in over several years. Group 1 schools began participating in 1998, 1999, 2000 and 2001, and Group 2 schools in 1999, 2000 and 2001, while Group 3 began participating in 2001. This design implies that in 1998, Group 1

[5] Refer to Adams et al. (1994), Corbett et al. (1992), Hotez and Pritchard (1995), and Pollitt (1990).
[6] Note that individuals are likely to have at least some knowledge of their infection status, since they can observe certain worms in their stool, and may also see them being expelled from their body after treatment.
[7] Appendix Table A1 presents a more detailed project timeline.

schools were treatment schools, while Group 2 and Group 3 schools were the comparison schools; in 1999 and 2000, Group 1 and Group 2 schools were the treatment schools and Group 3 schools were comparison schools. Starting in 1999, signed individual parental consent was required for deworming, while in 1998 only "community consent" (a series of meetings at which parents were informed of – and could opt out of – the program) had been required. At each school, the project started out with a community meeting of parents, teachers, and the school committee, which included a discussion of worm infections, the nature of medical deworming treatment, and worm prevention measures. All primary school communities in the baseline sample agreed to participate in the project.

The project provided periodic treatment with deworming drugs in all schools where helminth prevalence was sufficiently high. The geohelminths and schistosomiasis can be treated using the low-cost single-dose oral therapies of albendazole and praziquantel, respectively. The World Health Organization has endorsed mass school-based deworming in areas with prevalence over 50 percent, since mass treatment eliminates the need for costly individual screening (Warren et al. 1993, WHO 1987), and drugs delivered through a large-scale school program may cost as little as US$0.49 per person per year in East Africa (PCD 1999); per child annual costs in the program we study were US$1.49. These higher costs are due to the smaller size of the treated population – which did not allow the program to fully exploit economies of scale in drug purchase and delivery – as well as a higher number of field workers than would be needed in a large-scale program that did not feature an evaluation component. Side effects are minor and transient, rarely lasting more than one day, but may include stomach ache, diarrhea, dizziness, fever and even vomiting in some cases (WHO 1992). Side effects are more severe for heavier schistosomiasis infections.[8] The project followed the standard practice at the time in mass deworming programs of not treating girls of reproductive age, due to concern about the possibility that albendazole could cause birth defects (WHO 1992, Bundy and Guyatt 1996, Cowden and Hotez 2000). (The WHO

[8] The manufacturer of praziquantel (Bayer) states that "Side effects are usually mild and temporary and include abdominal pain, nausea, vomiting, headache, fever, pruritus, drowsiness. Side effects may be more severe in heavy infestations" (http://www.home.intekom.com/pharm/bayer/).

recently called for this policy to be changed to allow older girls to be treated, due to the accumulating record of safe usage by pregnant women, [Savioli, Crompton and Neira 2003]).

In addition to medical deworming treatment, the project included intensive health education on worm prevention behaviors, mainly focusing on washing hands, wearing shoes, and avoiding infected fresh water. This included classroom lectures and culturally appropriate health education materials developed by the Tanzanian Partnership for Child Development. This health education effort was considerably more intensive than is typical in Kenyan primary schools, and thus the program should be more likely than existing government programs to impact child behavior. Two teachers in each school (one regular teacher and the head teacher) received a full day of training in the district capital on worm prevention lessons for schoolchildren, as well as on the details of the deworming program, and were instructed to impart these lessons to their pupils during regular school hours. These classroom lessons were supplemented through lectures by an experienced and high-quality NGO field team (the team leader was a trained Public Health Technician), which visited each school several times per year.

However, the project's health education component was not cheap. Our best estimate is that teacher lessons in school, the lectures delivered by the mobile NGO field team, and the classroom wall-charts and other educational materials taken together cost at least US$0.44 per pupil per year in the assisted schools,[9] which is comparable to the total cost of deworming drug purchase and delivery in a nearby Tanzanian program, at US$0.49 (PCD 1999). In our case, it is difficult to break out the costs of health education, data collection, and drug delivery since the same field team was responsible for all activities, so the above cost estimates should be seen as rough; nonetheless, they are generally in line with estimated school health program costs in Jamison and Leslie (1990).

The NGO has a policy of including community cost-recovery in all its rural development programs, to promote "sustainability" and to confer project "ownership" on the beneficiaries. In the case

[9] This figure is based on an estimate that each health education teacher taught two full hours on worm prevention behaviors in each grade per school year (given an annual teacher salary and benefits of approximately US$2,000), and that the NGO team also lectured to the school for two hours per year (given their annual salary and benefits).

of deworming, the NGO temporarily waived this policy initially, and then phased it in gradually. The 50 Group 1 and Group 2 schools were stratified by treatment group and geographic location, and then 25 were randomly selected (using a computer random number generator) to pay user fees for medical treatment in 2001, while the remaining 25 continued to receive free medical treatment that year (and all Group 3 schools received free treatment). The fee was set on a per family basis, like most Kenyan school fees, introducing within-school variation in the per child cost of deworming since households have different numbers of children in primary school, variation that we also use to estimate the effect of price on take-up. Of the 25 Group 1 and Group 2 schools participating in cost-sharing, two-thirds received albendazole at a cost of 30 Kenya shillings per family (US$0.40 in 2001) and one-third received both albendazole and praziquantel at a cost of 100 Kenya shillings per family (approximately US$1.30). Since parents have 2.7 children in school on average, the average cost of deworming per child in cost-sharing schools was slightly more than US$0.30– still a heavily subsidized price, about one-fifth the cost of drug purchase and delivery through this program.[10]

3. The Impact of Subsidies on Drug Take-up

Cost-sharing through user fees has been advocated as necessary for the sustainability of public health services in many less developed countries (World Bank 1993). Revenues from these fees could be used to improve the quality of health services (i.e., through better drug availability), or to fund other government expenditures. User fees could theoretically promote more efficient use of scarce public resources if those in greatest need of health services are most willing to pay for them, while those not in need do not pay.

A number of studies from Africa have found massive drops in health care utilization after the introduction of user fees (e.g., McPake 1993, Meuwissen 2002) – including in Kenya, where Mwabu et al (1995) find utilization fell by 52 percent in 1989. Nonetheless, it remains unclear to what extent user fees have causally affected utilization since cost-sharing is typically introduced during periods of fiscal crisis,

[10] Annual Kenyan per capita income is US$340 (World Bank 1999), but incomes are thought to be lower in Busia.

making it difficult to separate out the effect of cost-sharing from the effect of crisis. In contrast, our analysis uses random assignment to estimate the effect of cost sharing.[11]

Children in 75 percent of households in the free treatment schools received deworming drugs in 2001 (Table 1), while the rate was only 18 percent in cost-sharing schools. In a regression analysis, the introduction of the small deworming fee dramatically reduced the treatment rate by 62 percentage points (Table 2, regression 1), and the effect is similar across households with different socioeconomic characteristics (regression 2) – providing evidence on the low value most households attach to deworming.[12]

Cost-sharing had roughly the same effect on treatment rates regardless of the actual price that the household was required to pay per child (Table 2, regression 3).[13] Variation in the deworming price per child was generated by the fact that cost-sharing came in the form of a per family fee, so that parents with more children in the primary school faced a lower price per child; this specification also includes the inverse of the number of household children in treated primary schools, as well as the total number of children of all ages in the household, as explanatory variables in an attempt to control for the effect of household demographic composition on drug demand. Of course, while these variables control for a main effect of family size on the demand for deworming drugs, we cannot control for interactions between family size and changes in price given the school-level randomization project design. There is a moderate, but statistically insignificant, decrease in take-up in the albendazole and praziquantel treatment schools (100 shillings per family) relative to the albendazole treatment only schools (with a deworming fee of 30

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[11] Gertler and Molyneaux (1996) find that utilization of medical care is highly sensitive to price in Indonesia, but since the unit of randomization in their analysis is the district, and their intervention affected only eleven districts, statistical power is relatively low. In a large-scale experimental study, Manning et al (1987) find that the price elasticity of demand for medical services in the United States is a modest –0.2.

[12] The survey data used in these regressions is described in more detail in Miguel and Kremer (2003, 2004).

[13] This would not be surprising if the bulk of the total deworming cost were the time and money needed to travel to the primary school – which may be several kilometers away – to pay the fee. However, most parents already attend several school meetings per year, and may travel to a market – often located near their child's school – regularly to trade, so we do not believe that travel costs are likely to be prohibitively large in most cases. Most importantly, 2001 treatment rates are high in the Group 3 schools, in which parents received the drugs for free but still had to visit school to sign the consent book, suggesting that the cost of visiting school is not prohibitively high.

shillings per family, regression 4), although the interpretation of this result is complicated by the fact that the treatment regime differs across these schools as well.

The reduction in cost-sharing schools is not simply a result of the fact that only the sickest pupils choose to seek treatment in these schools. In fact, contrary to the hypothesis that user fees help ensure that scarce resources are directed to those who need them most, sicker pupils were no more likely to pay for deworming drugs than healthier children: the coefficient estimate on the interaction between 2001 helminth infection status and the cost-sharing indicator is not significantly different than zero (results not shown).

These results suggest that the introduction of small positive user fees is a particularly unattractive policy in this context, since this is likely to dramatically reduce take-up while raising little revenue – especially since the collection of even low user fees typically requires a considerable administrative cost. Yet this is precisely the approach that has been adopted in the health sector by many less developed countries, including Kenya (World Bank 1994, McPake 1993). Although user fees play an important and useful role in some contexts, for medical treatments characterized by large externalities they seem likely to reduce drug treatment far below socially optimal levels.

It is worth bearing in mind the sequencing of the project in interpreting these results. Prior to the program, fewer than five percent of people reported taking deworming drugs. While many medicines, such as aspirin and anti-malarials, are cheaply available in nearly all local shops, deworming is only available in a few shops and only at high mark-ups – where the markups are high presumably because the market is quite thin; in fact, none of 64 local shops surveyed in 1999 had either albendazole (or its close substitute, mebendazole) or praziquantel in stock, though a minority of shops carried less effective deworming drugs (levamisole hydrochloride and piperazine). In the parent meetings held to introduce the project, NGO facilitators explained that deworming medicine would be provided for free during an initial introductory period, and that, following standard NGO policy, cost-sharing would be introduced later. Schools then received free treatment for two or three years, after which half the schools were assigned to cost-sharing. The rationale was that people may be more likely to spend money on a new product if they have the chance to try it out first to see its value first-hand.

On the other hand, some have argued that it is essential to introduce cost-sharing from the beginning of a project, the logic being that once people become accustomed to receiving treatment for free, they will develop a sense of entitlement to it and will refuse to pay when positive prices are subsequently introduced. Although we are unable to directly test either hypothesis here given the study design, it is worth noting that there was no significant difference in the impact of cost-sharing between Group 1 and 2 schools despite their differing length of exposure to free treatment (three versus two years, respectively), exposure that could theoretically have provided a stronger sense of entitlement to treatment or additional information on drug effectiveness. The fact that few people took drugs prior to the program suggests that even if the impacts would have been somewhat smaller with different treatment sequencing, it is likely that the drop in take-up associated with fees would still be large.[14]

Some might argue that the social benefit of the drug treatment would be internalized in a small community, where formal and informal institutions could enforce participation in the program once cost-sharing is introduced and punish free riders. The fact that the deworming program was run through local primary schools, and that meetings were held to discuss the program, provides a possible centralized mechanism for enforcing payment; in the U.S., for example, primary schools require child vaccinations for enrollment. Miguel and Gugerty (2002) find related evidence that a variety of social sanctions are employed in rural Kenyan primary schools to enforce payment of school fees and contributions to school

[14] Take-up of the deworming drugs fell somewhat in Group 1 schools between 1998 and 1999 (from 78 to 73 percent among those still enrolled in school – see Miguel and Kremer 2004). This may be due to the change from community consent to individual consent between 1998 and 1999, since in the community consent system the default was deworming treatment, while in the individual consent system the default was no treatment; in the literature on enrollment in 401(K) plans, changing from an opt-in to an opt-out system leads to much higher participation in 401(K) plans and, in addition, people who are automatically enrolled are likely to remain with the default benefit level (Madrian and Shea, 2001; Choi, Laibson, Madrian and Metrick, 2003). However, it is also possible that people learned between 1998 and 1999 that the private benefits of treatment were lower than they had anticipated, which led them to avoid taking the drug themselves in order to avoid the side effects. Of course, there may also be other reasons for year-to-year variation in take-up rates: for instance, El Niño flooding took place in early 1998 and may have affected take-up both in late 1998 and early 1999.

projects. However, through interviews with NGO field staff and program participants, we have found no evidence that this sort of community coordination took place in any primary school in the study.

There are several potential reasons why use of drugs fell so dramatically with the introduction of a small fee, and why private demand for deworming drugs outside the program is so low in this area. First, the private gains from deworming may not have been larger than the private costs for many households. Miguel and Kremer (2004) estimate that the social value of increased future income generated by school participation gains due to deworming exceeds deworming costs by at least three times, using conservative assumptions. It is difficult to determine the magnitude of private gains in school participation due to deworming since untreated children in treated schools initially had lower school participation on average, and thus may have had more scope for gains in school participation.[15] (Nonetheless, deworming may affect welfare in important ways other than increasing school participation – by reducing child fatigue and abdominal pain, for instance.)

It is also possible that people simply did not recognize the benefits of deworming. In the traditional view, worms are an integral part of the human body and necessary for digestion, and many infection symptoms – including abdominal pain and malnutrition – are attributed to malevolent occult forces ("witchcraft") or breaking taboos (Government of Kenya 1986).[16] Geissler (1998a, 1998b, 2000) studies deworming take-up in a Kenyan district that borders our study area, with a nearly identical worm infection profile, and finds that, while the Western bio-medical paradigm is making inroads into traditional health views (especially among the younger and better educated), most people do not place much value on deworming treatment because worms are not seen as a pressing health problem - especially compared to malaria and HIV/AIDS.[17] As a result, there was essentially no deworming outside

[15] See Miguel and Kremer (2004).
[16] Although serious worm infection levels had fallen substantially in Group 1 and 2 schools by 2001 – several years after mass deworming began in these communities – leaving fewer heavily infected children who would gain the most from treatment (Miguel and Kremer 2004), the vast majority of children still have some level of infection.
[17] Geissler studies an ethnically Luo area (Luos speak a Nilotic language), while the majority of our sample are ethnically Luhya (a Bantu-speaking group) though Luos are a sizeable minority in our sample. However, traditional Luo views toward worms are closely related to views found among Bantu-speaking groups in other parts of Africa, including Mozambique (Green et al. 1994, Green 1997) and South Africa (Zondi and Kvalsig 1987).

the school health program Geissler studies, and most children instead relied on herbal remedies to alleviate the abdominal discomfort caused by worms.

The existence of frequent health shocks from many sources (e.g., malaria, typhoid, cholera) also complicates learning about new health treatments in this area, especially given that the costs of deworming are immediate and salient (i.e., the effort needed to obtain treatment and possible drug side effects) while benefits emerge only gradually as nutritional status improves in the months after treatment. Cost-sharing might conceivably lead to less of a drop in take-up for diseases like malaria for which health impacts are more acute.

Drug take-up may be reduced further by imperfect altruism and inefficient bargaining within households, since parents provide consent for treatment and pay for treatment in cost-sharing schools, while children benefit from deworming.

4. The Impact of Health Education

The cost of inducing behavioral change through health education appears much greater than the cost of affecting behavior through drug subsidies. Indeed, the worm prevention education program in Kenya had a minimal impact on short-run behavior: there were no significant differences across treatment and comparison school pupils in early 1999 (one year after the start of the program) on three worm prevention behaviors: pupil cleanliness (of hands and uniform) observed by enumerators[18], the proportion of pupils observed wearing shoes, or self-reported exposure to fresh water (Table 3, Panel A). The results do not vary substantially by pupil age, gender, or grade (results not shown).[19]

One hypothesis might be that some treatment school children neglected to adopt worm prevention practices precisely because they were also taking deworming drugs, and thus felt protected from infection. This does not seem to explain the lack of impact of health education, however, since there was no evidence of behavioral change even among older girls who were excluded from medical treatment (due to

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[18] This also holds controlling for initial 1998 cleanliness, or using difference-in-differences (not shown).

[19] Our results are consistent with Pant et al's (1996) study in Nepal, which shows that hygiene education for mothers is considerably less cost-effective than Vitamin A capsules in reducing infant morbidity and mortality.

its potential embryotoxicity, Table 3, Panel B). It also seems implausible that the older girls in treatment schools neglected to adopt better worm prevention practices because they realized that they were benefiting from treatment spillovers, First, the lack of even basic knowledge regarding worm infection symptoms and transmission among most residents in this area makes this possibility seem remote: the median resident in this area is able to name just one of ten common worm infection symptoms, and fewer still can accurately describe transmission mechanisms (Miguel and Kremer 2003). Second, there is no evidence that other children benefiting from treatment spillovers changed their prevention behavior: children attending comparison (Group 2) primary schools located near deworming treatment schools in early 1999 showed large reductions in worm infection levels (Miguel and Kremer 2004) but did *not* receive health education, and there was no significant change in their worm prevention behaviors (Table 3, Panel C) – although these effects are imprecisely estimated statistically.

The attractiveness of health education versus indefinitely subsidizing inputs depends not only on the relative cost and effectiveness of subsidies and of health education activities on immediate recipient behaviors (discussed above), but also on the rate at which health education depreciates and the rate at which new practices spread to others through social learning. Other researchers find that depreciation of health education knowledge and practices is substantial, even in settings where the direct short-run program impact was positive (see Haggerty et al 1994, Aziz et al 1990, and Hoque et al 1996). Miguel and Kremer (2003) find no evidence of the diffusion of health knowledge and behaviors – children whose parents have (randomly) more social links to early treatment schools are themselves significantly *less* likely to take deworming drugs.[20]

[20] If treating (or educating) children in certain families leads to higher deworming rates among their social contacts, social learning might eventually lead to high take-up without large subsidies. However, we find no evidence of this. In the deworming program, "early" and "late" treatment schools were randomly selected, producing exogenous variation in the proportion of children in schools exposed to deworming medicine and health education, and allowing credible estimation of social effects. In Miguel and Kremer (2003), we collected survey data on social networks to explore how variation in social contacts' program exposure affected individuals' own adoption, and find that children whose parents have (randomly) more social links to early treatment schools are themselves significantly *less* likely to take deworming drugs: for each additional social link a parent has to an early treatment school, her child is 3.2 percentage points less likely to take the drugs. Treatment externalities provide an explanation: private deworming benefits are considerably smaller than social benefits. Parents with better information on the drugs through their social network learn this fact; in essence, learning promotes free-riding.

5. The Impact of Verbal Commitments

Advocates of sustainability often argue that local "ownership" is important for sustainable development projects. At a minimum, development projects should only take place if beneficiaries are willing to make an affirmative commitment to them. In the deworming project we study, for instance, treatment only took place only after a community collectively decided to participate during a large village meeting.

This notion of community ownership is also related to the claim in social psychology that asking individuals if they plan to take an action can make it much more likely that they carry through with it, the so-called "self-prophecy" or "commitment" literature. For example, Greenwald et al. (1987) asked U.S. university students whether they would vote in an upcoming election. All voters in the sample were reminded that Election Day was coming up, and a random half of these voters were also asked if they intended to vote; all answered that they did. Using county election records, Greenwald et al. found that 81 percent of the voters who made the verbal commitment actually did vote in the election, compared to only 57 percent of those just reminded about Election Day. In a closely related study, Cioffi and Garner (1998) find large impacts of such commitments on blood donation in a U.S. university campus.

In an application of this technique, a random subsample of pupils in PSDP schools were asked whether they would take deworming drugs in the upcoming treatment round. During 2001 Pupil Questionnaire administration, all children were told that worms and schistosomiasis can lead to poor health and nutrition and make children feel weak and tired, but they were also told that drugs can eliminate the worms and were given the date of the ICS intervention. A random subsample of pupils were then asked whether they were planning to come to school on the treatment day and whether the PSDP workers should bring pills for them on that day; ninety-eight percent of children answered "Yes" to both questions. All pupils selected for the Pupil Questionnaire – including both those offered the opportunity for verbal commitment and those not offered this opportunity – were provided the information on the upcoming date of medical treatment and the effects of deworming (all were of course informed that participation in data collection and treatment was completely voluntary).

The verbal commitment intervention appears to have failed, reducing drug take-up by one percentage point in 2001, although this effect is not statistically significant (Table 4, regression 1). This result is robust to controls for pupil age and gender (regression 2), and the impact of the intervention did not vary significantly with age or sex (regression 3). The effect is somewhat more negative for pupils in cost-sharing schools and those with moderate-to-heavy worm infections – although in neither case are the coefficient estimates on these interactions significantly different than zero at traditional confidence levels (results not shown).

These results suggest that mobilization or marketing techniques found to be effective in the U.S. may fail in other contexts. The reason is unclear. One hypothesis is that students interpreted the fact that the interviewer felt it necessary to urge them to participate in the project as a negative signal about deworming. However, if the verbal commitment intervention was perceived as providing negative information, this effect should be smaller for pupils who knew more about deworming already; in fact, we find that there is no significant difference in the effect of the intervention on pupils in the three program treatment groups, with their varying years of exposure to deworming (results not shown).

6. The Impact of Latrines and Borehole Wells

Two additional interventions advocated by Utzinger et al (2003) as important elements of "sustainable" schistosomiasis control are constructing additional latrines, and digging borehole wells.

Although the PSDP project did not include either of these two interventions, it is useful to examine the observed relationship between latrines, wells, and worm infection. It is problematic to interpret the relationship between latrine ownership and worm infections (or borehole well density and infection) as a causal effect. For example, unobservably wealthier or more health-conscious individuals may both have fewer worms and build more latrines without any causal link between the two – in which case the observed correlation would overestimate the impact of infrastructure on worm infections. There are also potential biases that could go in the other direction, for instance, if individuals (or communities) construct latrines and wells in response to serious worm and other health problems.

Children in households with a latrine at home are statistically significantly less likely to have moderate-heavy worm infections (Table 5), with a reduction of nearly 10 percentage points, both in specifications without (regression 1) and with (regression 2) extensive individual and community controls. In contrast, the impact of latrines in the local primary school community on moderate-heavy infection is never statistically significant, and has positive or negative signs depending on the specification; we thus do not consider these effects in the cost-effectiveness calculations below. The lack of a community latrine density effect also suggests that the household latrine results may be driven in part by omitted variable bias – i.e., households where parents are unobservably more interested in child health issues, or wealthier, have more latrines. If this is indeed the case, the household latrine ownership estimates would constitute upper bounds on the true latrine effects. The coefficient estimates on other terms largely have the expected signs: cleaner children are significantly less likely to have moderate-heavy worm infections (regression 2), while wearing shoes is negatively, but insignificantly, related to infection. Reported days of contact with fresh water is not strongly associated with infection.

Having more borehole wells nearby does not have any substantial association with worm infection rates (Table 5, regressions 1 and 2). The correlation of borehole wells and geohelminth infection is unexpectedly *positive* in some specifications – suggesting that omitted variable bias may be substantial – although the association with schistosomiasis infection is negative, but typically not statistically significant (results not shown). The results are similar if we restrict attention to the density of wells with "normal" water flow (results not shown).

We use the regression estimates from Table 5 to calculate the cost-effectiveness of latrines in reducing moderate-heavy worm infections, interpreting the estimates as causal impacts (although as we argue above, these estimates may overstate true causal effects due to omitted variable bias). The construction cost of a high-quality two-hole latrine in rural western Kenya is approximately US$600, including labor costs. We estimate that such a latrine lasts for approximately ten years before it either fills up, or the water table rises and thus the latrine ceases to be useable. (Cheaper low-quality latrines are available, but these would have shallower holes and would likely last for fewer years.) Under the assumption that two households share the latrine, and that each household has three primary-school age children (the approximate number of schoolchildren in our dataset), a total of six children would benefit from the latrine construction. Ignoring intertemporal discounting, the rough cost of latrine construction is US$10 per child-year, and thus the cost per moderate-heavy worm infection eliminated is $10/0.096 = $104 per child-year.

As discussed in Miguel and Kremer (2004), the cost per moderate-heavy infection eliminated in the original deworming project in this area was only $0.93 per child-year, and thus the home latrine cost figure is 110 times greater than the cost of drugs. Even if our household latrine impact estimates suffer from severe omitted variable bias, latrine construction would be considerably less cost-effective than free deworming drugs: for instance, if latrine construction reduced the rate of moderate-heavy infection by 40 percentage points – a truly massive effect, with infection rates dropping to near zero – the cost per child-year of infection eliminated would still be over 20 times the cost per child-year with deworming drugs.

Since household and community members may benefit from latrine construction along a variety of other health dimensions – for instance, through reductions in diarrhea – we are not arguing against well or latrine construction, but simply that the case should be made on grounds other than helminth control.

7. Conclusion

This paper provides several lessons regarding the design of public health programs. Providing deworming drugs for free led to high drug take-up, large reductions in moderate-heavy worm infections, and increased school participation. In contrast, in the context we examine, the "sustainable" approaches of health education, individual mobilization, and cost-recovery were ineffective. Latrine and water well construction appear far less cost-effective than subsidized deworming drugs in combating worm infections.

Of course, it remains possible that different community mobilization interventions could be developed that are more effective than the ones evaluated in this study, or that health education would have been more successful had it been implemented differently. However, in our opinion it is unlikely that most developing country governments' programs would implement those programs as effectively as the NGO we studied. Moreover, given that proven health interventions, with strong rationale in terms of externalities – from vaccinations to control of sexually transmitted diseases to deworming – are currently unfunded, we feel that advocates of sustainable programs should be expected to demonstrate their effectiveness through randomized evaluations before donors fund them on a large scale.

Given the paucity of evidence in support of the idea that programs can become sustainable through local fund raising or community education, a natural question is why aid agencies fund "sustainable" programs while leaving one-quarter of the world's population infected with easily treated worm infections. One possibility is that aid agencies are stuck in a rat race with each other for limited donor funds, and try to outdo each other in extravagant claims about what can be achieved through “sustainable” programs. If the donors lack information, they may find it difficult to distinguish between genuine claims of temporary health benefits from providing deworming medicine and bogus claims of permanent benefits from a one-time investment in health education. Claims about spectacular project “bang for the buck” typically remain unchallenged since aid agencies are not directly accountable to program beneficiaries through either political mechanisms (e.g., democratic elections) or the market mechanism, and rigorous program evaluations are rare. It is also worth noting that the sustainability approach may help aid agencies maximize their jobs and influence: teaching people to fish requires many more jobs for aid workers from the developed world than handing out fish, and it is more exciting for aid workers to launch new programs than simply administer a long-standing subsidy program.

What is the way forward? We have two concrete policy alternatives. First, donors should consider sustainability not on a project-by-project basis, but rather at the level of increasing overall national income. A public health project providing heavily subsidized deworming medicine may not be sustainable in itself, but it will help children obtain education, and this will contribute to development for society as a whole.

Second, while the advocates of sustainability are correct that many development projects will fail if donors simply fund capital inputs and leave, the solution is not to create an illusion of sustainability, but rather to accept the reality of the need for continued subsidies for development projects and ensure that the necessary stream of funds for maintenance is available. One option is to endow funds earmarked for that purpose. If the water project in Western Kenya described in the introduction had not relied on training user groups, but instead had reallocated its budget to dig fewer wells but endow a maintenance fund for each well, more wells might be functioning today.

Many development professionals may feel they need to promise amazing results to appeal to a public grown weary of the failures of foreign aid. Yet opinion polls in the developed world suggest many would be willing to spend on aid if they believed it actually worked (PIPA 2001). Some of the failures of foreign aid may themselves be due to pursuing the illusion of sustainability.

8. References

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9. Tables and Figures

Table 1: Summary Statistics

	Mean	Std dev.	Obs.
Panel A: Deworming Treatment Take-up			
Took deworming drugs in 2001 (Group 2 and 3)	0.61	0.49	1690
Took deworming drugs in 2001, free treatment schools (Group 2 and 3)	0.75	043	1269
Took deworming drugs in 2001, cost-sharing schools (Group 2 and 3)	0.18	0.38	421
Panel B: Cost-Sharing and Verbal Commitment Interventions			
Cost-sharing school indicator	0.25	0.43	1690
Effective price of deworming per child (Kenyan shillings)	6.2	15.4	1690
Cost-sharing school indicator, albendazole only treatment	0.17	0.38	1690
Cost-sharing school indicator, albendazole and praziquantel treatment	0.08	0.27	1690
Verbal commitment intervention indicator	0.43	0.49	3164

Notes for Table 1: From 2001 PSDP Parent and Pupil Surveys and 2001 administrative records. The sample for the verbal commitment intervention indicator is the 2001 Pupil Survey.

Table 2: The Impact of Cost-sharing

	Dependent variable: Child took deworming drugs in 2001 (1)	(2)	(3)	(4)
Cost-sharing school indicator	-0.62*** (0.08)	-0.47*** (0.14)	-0.62*** (0.12)	
Cost-sharing * Respondent years of education		0.005 (0.007)		
Cost-sharing * Community group member		0.022 (0.069)		
Cost-sharing * Total number of children		-0.012 (0.015)		
Cost-sharing * Iron roof at home		-0.04 (0.07)		
Effective price of deworming per child (=Cost / # household children in that school)			-0.001 (0.002)	
1 / (# household children in that school)			-0.34*** (0.07)	
Cost-sharing school indicator, albendazole treatment (30 shillings / parent)				-0.58*** (0.10)
Cost-sharing school indicator, albendazole and praziquantel treatment (100 shillings / parent)				-0.73*** (0.07)
Social links, other controls	Yes	Yes	Yes	Yes
Number of observations (parents)	1690	1690	1690	1690
Mean of dependent variable	0.61	0.61	0.61	0.61

Notes for Table 2: Data from 2001 Parent Survey, and 2001 administrative records. Marginal probit coefficient estimates are presented. Robust standard errors in parentheses. Disturbance terms are clustered within schools. Significantly different than zero at 99 (***), 95 (**), and 90 (*) percent confidence. Social links controls include total number of links, number of links to Group 1, 2, 3 schools (not own school), and number of links to non-program schools. Other controls include respondent years of education, community group member indicator variable, total number of children in the household, iron roof at home indicator variable, and distance from home to school in km, as well as the Group 2 indicator. We cannot reject that the two terms in regression 4 are equal (p-value=0.17). Summary statistics from the 2001 Parent Questionnaire (Mean [s.d]): Respondent years of education (4.6 [3.9]), Community group member indicator (0.58 [0.49]), Total number of children (5.5 [2.3]), Iron roof at home indicator (0.61 [0.49]). The social link controls are described in Miguel and Kremer (2003).

Table 3: PSDP Health Behavior Impacts (1999)

	Group 1	Group 2	Group 1 – Group 2
Panel A: Health Behaviors, all pupils (Grades 3-8)			
Clean (observed by field worker), 1999	0.59	0.60	-0.01 (0.02)
Wears shoes (observed by field worker), 1999	0.24	0.26	-0.02 (0.03)
Days contact with fresh water in past week (self-reported), 1999	2.4	2.2	0.2 (0.3)
Panel B: Health behaviors, girls ≥ 13 years old			
Clean (observed by field worker), 1999	0.75	0.77	-0.02 (0.02)
Wears shoes (observed by field worker), 1999	0.39	0.42	-0.03 (0.06)
Days contact with fresh water in past week (self-reported), 1999	2.3	2.2	0.0 (0.3)
Panel C: Health behaviors, all pupils (Grades 3-8)	Overall cross-school externality effect for Group 2		
Clean (observed by field worker), 1999	0.09 (0.21)		
Wears shoes (observed by field worker), 1999	-0.01 (0.08)		
Days contact with fresh water in past week (self-reported), 1999	0.98 (0.68)		

Notes for Table 3: These results use the data from Miguel and Kremer (2004). These are averages of individual-level data for grade 3-8 pupils; disturbance terms are clustered within schools. Robust standard errors in parentheses. Significantly different than zero at 99 (***), 95 (**), and 90 (*) percent confidence.

The effects in Panel C are the result of a regression in which the dependent variable is the change in the health behavior between 1998 and 1999 (school average), and the local density of Group 1 pupils within 3 km (per 1000 pupils), Group 1 pupils within 3-6 km (per 1000 pupils), Total pupils within 3 km (per 1000 pupils) and Total pupils within 3-6 km (per 1000 pupils) are the key explanatory variables (in a specification analogous to Appendix Table A3, as in Miguel and Kremer 2004). Grade indicators, school assistance controls (for other NGO programs), and the average school district mock exam score are additional explanatory variables.

Table 4: The Impact of a Verbal Commitment Intervention

	Dependent variable: Child took deworming drugs in 2001		
	(1)	(2)	(3)
Verbal commitment intervention indicator	-0.014	-0.013	-0.023
	(0.021)	(0.021)	(0.145)
Pupil age		-0.004	-0.003
		(0.006)	(0.006)
Pupil female		-0.048**	-0.050
		(0.024)	(0.035)
Commitment*Age			-0.003
			(0.010)
Commitment*Female			0.005
			(0.006)
Social links, other controls	Yes	Yes	Yes
Number of observations (pupils)	3164	3164	3164
Mean of dependent variable	0.54	0.54	0.54

Notes for Table 4: Data from 2001 Parent and Pupil Surveys, and administrative records. Marginal probit coefficient estimates are presented, robust standard errors in parentheses. Disturbance terms are clustered within schools. Significantly different than zero at 99 (***), 95 (**), and 90 (*) percent confidence. Social links controls are described in Miguel and Kremer (2003). Other controls include respondent years of education, community group member indicator variable, total number of children, iron roof at home indicator variable, and distance from home to school in km, as well as the Group 2 and Cost-sharing school indicators. Summary statistics from the 2001 Pupil Questionnaire (Mean [s.d.]): Pupil age (12.9 [2.3]), Pupil female indicator (0.23 [0.42]) (older girls were dropped from the sample because they were not eligible for deworming, due to the potential embryotoxicity of the drugs).

Table 5: The Impact of Latrines and Wells

	Dependent variable: Any moderate-heavy infection, 1998 (1)	(2)
Latrine at home, 1998	-0.099*** (0.039)	-0.096*** (0.037)
Proportion of children in the primary school with a latrine at home, 1998	-0.49 (0.40)	0.22 (0.25)
All bore-hole wells within 3 km of the child's primary school (measured in 2000)	0.001 (0.003)	0.001 (0.003)
Clean (observed by field worker), 1998		-0.035** (0.017)
Wears shoes (observed by field worker), 1998		-0.048 (0.032)
Days contact with fresh water in past week (self-reported), 1998		-0.000 (0.005)
Child grade controls; school program assistance, exam, population density, geographic controls	No	Yes
Number of observations (children)	1779	1779
Mean of dependent variable	0.37	0.37

Notes for Table 5: Data from 1998 Pupil Survey, 1998 Parasitological Survey, 2000 Kefinco Water Survey, and administrative records. Marginal probit coefficient estimates are presented. Robust standard errors in parentheses. Disturbance terms are clustered within schools. Significantly different than zero at 99 (***), 95 (**), and 90 (*) percent confidence.

Appendix

Appendix Table A1: Primary School Deworming Project (PSDP) timeline, 1998-2001

Dates	Activity
1998	
January	75 Primary schools first stratified by geographic zone, and then randomly divided into three groups of 25 schools (Group 1, 2, 3)
March-April	First round of 1998 treatment (albendazole, praziquantel) in Group 1 schools
November	Second round of 1998 treatment (albendazole) in Group 1 schools
1999	
March-June	First round of 1999 treatment (albendazole, praziquantel) in Group 1, 2 schools
October-November	Second round of 1999 treatment (albendazole) in Group 1, 2 schools
2000	
March-June	First round of 2000 treatment (albendazole, praziquantel) in Group 1, 2 schools
October-November	Second round of 2000 treatment (albendazole) in Group 1, 2 schools
2001	
January-March	2001 Parent Survey (Wave 1) data collection in Group 2, 3 schools
	2001 Pupil Survey (Wave 1) data collection in Group 2, 3 schools. Verbal commitment intervention carried out during Pupil Survey, among a random subsample of pupils.
March-June	First round of 2001 treatment (albendazole, praziquantel) in Group 1, 2, 3 schools. Cost-sharing in 25 (randomly selected) Group 1, 2 schools
May-September	2001 Parent Survey (Wave 2) and household GPS data collection in Group 2, 3 schools.
	2001 Pupil Survey (Wave 2) data collection in Group 2, 3 schools. Verbal commitment intervention carried out during Pupil Survey, among a random subsample of pupils.
October-November	Second round of 2001 treatment (albendazole) in Group 1, 2, 3 schools. Cost-sharing continues in 25 (randomly selected) Group 1, 2 schools

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