Disease Control Priorities Project
Working Paper No. 13

Feasibility of Scaling-up Interventions: The Role of Intervention Design

September 2003

Christian A. Gericke, M.D., M.Sc., D.T.M.H.
Berlin University of Technology, Germany, and London School of Hygiene and Tropical Medicine, U.K.

Christoph Kurowski, M.D., M.Sc.
World Bank, Washington, D.C., U.S.A.

M. Kent Ranson, M.D., M.P.H., Ph.D.
London School of Hygiene and Tropical Medicine, U.K.

Anne Mills, M.A., D.H.S.A., Ph.D.
Disease Control Priorities Project and London School of Hygiene and Tropical Medicine, U.K.

Corresponding author:
Christian A. Gericke
Department of Health Care Management
Technische Universität Berlin
EB2, Strasse des 17. Juni 145
D-10623 Berlin
Germany
christian.gericke@tu-berlin.de

Preface

This paper was commissioned by the LSHTM to provide evidence on important cross-cutting issues for the Disease Control Priorities Project. It was funded by the DCPP grant to Professor Anne Mills, Head, Health Economics and Financing Programme, LSHTM.

Abstract

Different health interventions have very different implications for the degree of effort required to implement them. To some extent this is apparent in their cost, but in general cost is not a very effective proxy for the degree of effort or the characteristics of the resources required. The nature and availability of non-financial resources required to implement and sustain an intervention can be defined as intervention complexity.

In this paper, a conceptual framework is proposed to analyse the importance of intervention design in expanding access to and utilisation of health services. The proposed framework categorises interventions along four dimensions:

- characteristics of the basic intervention
- characteristics of delivery
- the requirements the intervention imposes on government capacity
- usage characteristics.

Potential for simplification is separately assessed along these dimensions.

Existing evidence and experiences of simplifying interventions in ways that place least burden on scarce capacity in very low resource settings are reviewed for a number of low-technology interventions. The overall purpose is to analyse interventions in a way that is useful for thinking about the feasibility of scaling up health services to meet the Millennium Goal targets.

Analysing key health interventions using the conceptual framework proved useful in categorising interventions on their degree of complexity, identifying supply and demand side constraints, and pointing to potential areas for improvement of specific aspects of each intervention. The framework could be used as a tool for policy-makers, planners, and programme managers when considering the expansion of existing projects or the introduction of new interventions. The proposed systematic approach also allows for comparison with national benchmarks or with other regions, programmes or countries. Intervention complexity thus complements burden of disease, cost, cost-effectiveness, and political feasibility considerations in health policy decision making on scaling up.

1. Introduction

The Commission on Macroeconomics and Health (CMH) recently recommended a massive, global effort to scale up priority health interventions.[1] Working Group 5 of the CMH analysed constraints to scaling up key health interventions,[2] and further work resulted in a 2003 special issue of the Journal of International Development on constraints and opportunities for scaling up health interventions in low and middle-income countries.[3] The focus of this work was on understanding the constraints to scaling up from a health system perspective, and the options available for relaxing or eliminating constraints.[4]

This article is a continuation of these efforts and has two main objectives.

The first objective is to propose a conceptual framework to analyse in a systematic way the importance of intervention design in expanding access to and utilisation of health services. We see three potential applications for this framework in policy decision-making and programme management:

1. To identify the most significant supply and demand side constraints for the scaling up of interventions.
2. To identify intervention designs which lend themselves to scaling up in the short-run versus intervention designs that require significant implementation constraints to be overcome.
3. To indicate research and development priorities in order to simplify interventions.

The second objective of this paper is to gather and analyse existing evidence and experiences of simplifying interventions in ways that place least burden on scarce capacity in low resource settings. The review of interventions is not meant to be comprehensive, but rather serves to illustrate successful case studies. We have selected interventions that are innovative and, with the exception of social marketing of condoms, are used only on a relatively small scale at present but which have considerable potential for up-scaling. We have focused on their ease of application in more highly constrained settings.

The following section describes the background to the current work. In Section 3 the conceptual framework used to categorise interventions by their degree of complexity is presented. In Section 4 the framework is applied to selected priority health interventions, which were chosen on the basis of i) their potential to improve population health in low income countries, and ii) their usefulness as examples to demonstrate different ways of simplifying interventions. In Section 5, the main conclusions and a number of research priorities are presented.

2 Background and motivation for the analysis

Different health interventions have very different implications for the degree of effort required to implement them. To some extent this is apparent in their cost, but in general cost is not a very effective proxy for the degree of effort or the nature of the resources required. For example, in some contexts availability of skilled human

resources may be a much greater constraint than financial resources. We define as intervention complexity the nature and availability of non-financial resources required to implement and sustain an intervention. A close link exists between intervention complexity and capacity to implement the intervention. Using the dimensions proposed in the conceptual framework, an intervention specific capacity profile can be elaborated to highlight particular constraints and priority areas for research and development.

If interventions can be made very simple – whether in hardware (e.g. vaccines) or software (e.g. guidelines on use) – and low cost, then they lend themselves to alternative delivery channels such as non-governmental organisations (NGOs), community-based arrangements, and the retail sector. This makes scaling up much more feasible in low capacity settings than if the intervention relies on government infrastructure.

To our knowledge, no attempt has been made to date to categorise health interventions in a systematic way by their degree of complexity. We consider this to be a critical step in addressing the challenge on how to expand access to priority health interventions. This is particularly important in very-low-income country settings where funding constraints allow implementation of only some health interventions and not others, and in settings where lack of an effective government makes it difficult to scale up through the public sector. In our view, intervention complexity should be an additional criterion to inform decisions about choice between interventions, and could guide decisions on optimal strategies to implement interventions. Intervention complexity thus complements burden of disease, cost, cost-effectiveness, and political feasibility considerations in health policy decision making on scaling up.

3 Conceptual framework for categorising interventions by their degree of complexity

Analysis of the complexity of priority health interventions requires a consistent conceptual framework for classification. Such a framework must meet two requirements. Firstly, it must be comprehensive enough to capture all major characteristics of health interventions which are possible constraints to scaling up. Secondly, it must be general enough to be applicable to a wide range of very different types of interventions, ranging from socially marketed products for use at home to tertiary care professional services. Furthermore, the framework should be policy relevant, in the sense that it helps to identify problematic characteristics of an intervention that may hinder scaling up in a given setting, and helps to identify ways in which the intervention can be simplified so as to relax intervention and context-specific constraints.

To reflect these requirements, we identified four dimensions of intervention design: characteristics of the basic intervention, characteristics of delivery, the requirements the intervention imposes on government capacity, and usage characteristics.

3.1 Intervention characteristics

The most important characteristics of the core intervention with regard to scaling up are related to basic product design, and requirements in terms of supplies and equipment.

Important basic product design features include the following:
- stability of the product in terms of usable lifetime and risk of destruction,
- the degree to which an intervention can be standardised,
- the safety profile of the intervention in terms of adverse effects, and risks associated with inappropriate use, e.g. from over-the-counter sales of prescription only medications,
- ease of storage and transport, e.g. the need for refrigeration.

Attributes of supplies include the dependency on regular supplies, and the number and type of different supplies needed.

Equipment issues include the need for high technology equipment and/or infrastructure, the number of different types of equipment, and the degree of maintenance needed.

3.2 Delivery characteristics

Delivery characteristics of interventions are analysed according to their requirements in terms of facilities, human resources, and transport and communication.

Interventions are categorised according to whether they can be delivered through the commercial retail sector, or whether they need to be delivered through public or private health facilities. Furthermore the level of health facility required is specified: outreach services, first level care, or hospital care.

Human resources are analysed according to the level of medical education and supervision of non-medical staff needed. Interventions also vary in terms of intensity of professional services, from periodic predictable services like vaccinations that can be delivered in a scheduled way to services that need to be available continuously to respond to unpredictable acute illness. To address the need for managerial staff, the level of management and planning requirements is considered.

3.3 Government capacity requirements

Requirements on scarce government capacity are often a crucial constraint for the delivery of interventions in poor countries. In this framework, they are analysed according to the requirements for legislation and regulation capacity, management systems, and dependency on collaborative action.

Some interventions require special legislation and regulation. Regulatory measures differ widely in terms of needs for monitoring and enforcement.

Dependence of intervention success on collaborative action between different government sectors, between government and civil society, or between government and external funding agencies can be an important constraint to scaling up.

3.4. Usage characteristics

Usage characteristics of interventions are analysed along three dimensions: ease of usage, pre-existing demand for the intervention, and the risk of diminished effectiveness and efficiency because of black-market activities.

Ease of usage includes requirements in terms of consumer information and of education/training needed to effectively apply the intervention. A low level of pre-existing demand requires a substantial effort to promote the intervention. Black market risk is important in so far as it affects the need for measures to prevent resale of products and counterfeiting.

3.5 Potential for simplifying interventions

In addition to considering the degree of complexity of existing interventions, an attempt is made to identify potential areas for simplification, as a guide for further research and development. In order to do this each intervention characteristic is rated as having a high (=H), medium (=M), or low (=L) potential for simplification. The rating is based on a consensus between the four authors, and provides a rough estimate of which areas might warrant a more detailed analysis. Potential for simplification depends in part on whether the intervention is already highly simplified, and the rating should be interpreted in this light.

Table 1. Categorisation of interventions

CATEGORY	CRITERIA
1. Intervention characteristics	
1.1. Basic product design	– Stability – Standardisability – Safety profile – Ease of storage – Ease of transport
1.2. Supplies	– Need for regular supplies
1.3. Equipment	– High technology equipment and infrastructure needed – Number of different types of equipment needed – Maintenance needed
2. Delivery characteristics	
2.1. Facilities	– Retail sector – Outreach services – First level care – Hospital care
2.2. Human resources	– Level of medical knowledge needed – Level of medical supervision needed – Intensity of professional services in terms of frequency or duration – Management and planning requirements

2.3. Communication & transport	– Dependency of delivery on communication and transport infrastructure
3. Government capacity requirements	
3.1. Regulation/legislation	– Need for regulation – Need for monitoring of regulatory measures – Need for regulation enforcement
3.2. Management systems	– Need for sophisticated management systems
3.3. Collaborative action	– Need for intersectoral action within government – Need for partnership between government and civil society – Need for partnership between government and external funding agencies
4. Usage characteristics	
4.1. Ease of usage	– Need for information/education – Need for supervision
4.2. Pre-existing demand	– Need for promotion
4.3. Black market risk	– Need to prevent resale/counterfeit

4 Application of the framework to key health interventions and review of the evidence on which interventions can be successfully delivered in ways that place least burden on scarce capacity

4.1. Maternal mortality

4.1.1 Training of traditional birth attendants

4.1.1.1 Application of the conceptual framework

Table 2. Application of the conceptual framework to the training of traditional birth attendants (TBAs)

CATEGORY	CRITERIA	POTENTIAL FOR SIMPLIFICATION*
1. Intervention characteristics		
1.1. Basic product design	– Need for continued education in the form of refresher courses. – Training can follow a standard curriculum, with quality assurance by training supervisors. – Safety of any interventions taught to TBAs is crucial, as some reports have shown that training can have the effect of inadvertently introducing TBAs to inappropriate, harmful practices. [5;6]	L
1.2. Supplies	– TBAs' provision with regular supplies needed for good practice is crucial for programme success.	H

		Examples of supplies are micronutrients (vitamin A, iron, folate) for prenatal care, clean delivery kits or at least clean cord cutting instruments and cutting surfaces,[7] essential drugs e.g. antibiotics and misoprostol for safe abortion or treatment of postpartum haemorrhage	
1.3. Equipment	–	No need for high-technology equipment.	L
2. Delivery characteristics			
2.1. Facilities	–	Home-based intervention	L
	–	Back-up facilities for emergency obstetric care greatly enhance impact of TBAs	
2.2. Human resources	–	TBAs	L
	–	Mid-level health professionals e.g. midwives for running training courses for TBAs, and monitor and supervise TBA practice	
	–	Midwives and obstetricians to develop training curricula	
	–	Good TBA practice should reduce the intensity of professional services in terms of frequency or duration	
	–	Moderate management and planning requirements	
2.3. Communication & transport	–	Crucial for prompt referrals	L
3. Government capacity requirements			
3.1. Regulation/legislation	–	Need to legalise the distribution of essential pharmaceuticals by TBAs and other unofficial health care providers in many countries where this is currently prohibited.	H
3.2. Management systems	–	No need for sophisticated management systems	L
3.3. Collaborative action	–	Need for partnership between government and NGOs, WHO, UNICEF and academic experts to develop evidence-based training curricula, and train TBAs	L
	–	No need for major donor funding.	
	–	Need for partnership with local medical and nursing associations.	
4. Usage characteristics			
4.1. Ease of usage	–	Not applicable	
4.2. Pre-existing demand	–	Use of TBAs already widespread in rural areas. Promotion of value of trained TBAs vs. untrained TBAs necessary.	L
4.3. Black market risk	–	Not applicable	

*H = high; M = medium; L = low

4.1.1.2 Review of the evidence for the effectiveness of the intervention in highly constrained settings

More than 99% of an estimated 509,000 pregnancy-related maternal deaths per year occur in developing countries.[8] For each maternal death, an estimated 15 women suffer from permanent disability in the form of urinary incontinence, uterine prolapse,

or infertility.[9] Almost all of these maternal deaths and related morbidity are preventable by skilled birth attendance and access to emergency obstetric care.[10;11] Only around half of all births in developing countries are currently delivered in the presence of a skilled health attendant[a].[12] One way to increase the number of attended deliveries is through midwifery training to traditional birth attendants (TBAs),[10] who are at present often the only help most pregnant women can count on in rural areas of many resource-poor countries.[11] Consequently, TBA training is frequently a major component of NGO projects and some countries like Bangladesh, with donor backing, have embarked on large-scale training programmes for TBAs since the 1970s.[5]

The evidence for the effectiveness of training TBAs, however, is mixed. This partly reflects the fact that studies vary widely in terms of training quality and duration, supervision and support, prior education, and research methods.[10]

Most published studies have focused on the knowledge gained through training or a change in practice after training. The majority of authors observed a positive effect of training on TBAs' knowledge and some described desirable changes in practice, such as an increase in correct immediate cord cleaning,[13] better aseptic precautions,[14] or better detection and referral of postpartum complications after training. [15] However, these studies also point to a number of difficulties with TBA training.

A common issue is that the presence of a trained TBA seems to have an undesirable effect on the number of deliveries in the formal health sector, with possibly detrimental effects on maternal mortality and morbidity. Gloyd et al[16] compared two groups of Mozambican women, one with access to trained TBAs and one without. Fifty eight percent of women without access to a trained TBA delivered in a formal health facility, compared to only 43% of women with access to a trained TBA. Another study in rural Guatemala found that the likelihood of using formal health care services for women with complications was six-fold higher (OR 6.3, 95% CI 3.9-10.5) among women who were not attended by TBAs compared to women attended by TBAs.[15] None of these studies observed a change in referrals to formal health care facilities after training.[5;6;15-17] On the other hand, a study from Fortaleza, Brazil[18] reported that TBAs did not try to manage complications they diagnosed, but preferred to make referrals to the formal health sector. In this study, nearly half of all women with complications giving birth in public hospitals had been referred by TBAs. Fifty two percent of these referrals were considered appropriate by clinical staff, whereas for self-referrals this was true in only 18%. TBAs were particularly well supported in this programme: in addition to theoretical training they received practical training in a maternity unit; they were offered periodic supervision and instruction by hospital personnel; they were given uniforms, supplies, and reimbursement for travel costs to meetings; and free transport to hospitals was offered to patients referred by TBAs.[19;20]

Another issue is the introduction by TBAs of practices commonly performed in hospitals, which are detrimental if used in home deliveries, such as vaginal examination, delivery in a horizontal position, or amniotomy.[6] In a study in rural Tanzania, trained TBAs reported many more routine vaginal examinations (80.2%) than their untrained colleagues (32.8%), and delivery in a horizontal position was also

---

[a] A skilled health attendant can be a medical doctor, nurse, trained midwife, primary health worker, or trained TBA according to a World Bank definition.[10]

more common (96.3 vs. 67.2%).[6] In a study in rural Bangladesh, trained TBAs were found to be significantly more likely to practise hygienic delivery[b] than untrained TBAs (45 vs. 19.3%, p<0.0001).[5] However, this did not translate into reduced levels of postpartum infection.[5] On the contrary, trained TBAs more often inserted their hands into the vagina during delivery compared to untrained TBAs (52.6 vs. 42%, p=0.0038), a practice which was found to nearly double the risk of postpartum infection (OR 1.93, p=0.0001).[5]

Overall, these more recent and methodologically more advanced studies replicate the earlier findings that training TBAs is successful in changing knowledge and, to a lesser extent, practices. However, these changes in practice do not appear to result in observable benefits in terms of reduced maternal or infant morbidity or mortality, neither on the small scale of these studies, nor on maternal mortality figures in developing countries overall.[12] Some practices taught to TBAs may even cause more harm than benefit.[5] Potential benefits depend to a great extent on the quality of training, the quality of the links to the formal health sector, and support, supervision and guidance of TBAs.

4.1.1.3 Potential for simplification

Two promising simple technologies that could be potentially delivered by TBAs have been identified.

Firstly, antenatal oral vitamin A and iron supplementation could be provided with minimal training through TBAs. In Nepal, supplementing pregnant women with vitamin A or beta carotene lowered pregnancy-related mortality by 44% (95% CI 37-84%, P<0.005).[21] Although this result has not yet been replicated in other settings, low-dose vitamin A supplementation in pregnancy has been shown to be safe,[22] and vitamin A deficiency is a common problem in developing countries.[23] Iron supplementation is a simple procedure with proven effectiveness in reducing maternal mortality through reducing anaemia and the associated risk of dying from postpartum haemorrhage.[24]

Secondly, misoprostol, a widely available and cheap prostaglandin, that is also used to treat gastric ulcers, has the potential to be safely delivered by trained TBAs for the treatment of primary postpartum haemorrhage.[25] A number of observational studies consistently found that 1mg of misoprostol administered per rectum could stop postpartum haemorrhage within three minutes in the majority of women treated, even after the failure of other uterotonics.[26-29] Lokumagage et al[30] compared the effect of 0.8 mg rectal misoprostol with a combination of intramuscular syntometrine and oxytocin infusion in a randomised controlled trial of 64 women with primary postpartum haemorrhage. Only 6% of women treated with misoprostol needed other interventions to control the bleeding compared to 34% in the control group (RR 0.18, 95% CI 0.04-0.67).[30] Although more controlled trials are needed to corroborate these findings,[31] rectal misoprostol could become the first line drug to treat postpartum haemorrhage, both for births in health facilities and in the home setting.

---

[b] The 'three cleans': hand-washing with soap, clean cord care, clean surface.[5]

As postpartum haemorrhage is estimated to cause around 25% of maternal deaths worldwide,[32] the potential impact of these two simple interventions to prevent these deaths is huge.

Another important potential strength of TBAs is to provide a link between their customers and the formal health care system, even if they themselves can only to a limited extent provide obstetric care.[23] The best way to manage obstetric complications in the home setting is often prompt referral, which is not a particular strength of TBAs even after training, as outlined above. Professional attachments of trained TBAs to the formal health facilities, and making them feel welcome there with their patients, have proved beneficial in The Gambia.[11]

4.1.2 Medical abortion provided by mid-level health professionals or TBAs

4.1.2.1 Application of the conceptual framework

Table 3. Application of the conceptual framework to medical abortion by mid-level health professionals or TBAs

CATEGORY	CRITERIA	POTENTIAL FOR SIMPLIFICATION*
1. Intervention characteristics		
1.1. Basic product design	– Treatment is highly standardisable. Major factor for choice of treatment is age of gestation. Very few real contraindications. – Excellent safety profile of all drugs currently used, even compared to state-of-the-art surgical abortion. Back-up facilities for emergency obstetric care nonetheless very desirable. But if unsafe surgical abortion is the alternative, medical abortion is preferable even without backup. – Mifepristone and most prostaglandins require refrigeration. Misoprostol is easy to store and does not need refrigeration.	M
1.2. Supplies	– No need for other supplies.	L
1.3. Equipment	– No other equipment needed.	L
2. Delivery characteristics		
2.1. Facilities	– With appropriate patient information, most medical abortions could take place at home,[33] preferably supervised by midwives or TBAs with adequate training. – First level care settings required in 2-5% for surgical abortion, mainly for treatment failure and incomplete abortion. – Hospital care rarely required for serious complications, e.g. severe post-abortion haemorrhage.	H
2.2. Human resources	– TBAs or mid-level staff need adequate training in safely and effectively administering abortion treatment. Mid-level staff and obstetricians required for emergency obstetric care. – Intensity of professional services is likely to shift from unscheduled tertiary care for treatment of complications from unsafe abortions to primary care for provision of predictable medical abortions and some unscheduled surgical abortions for treatment failure and complications. – Planning and management of a national programme to ensure regular supply with drugs and monitor and evaluate practice	H

	requires a dedicated team.	
2.3. Communication & transport	– Communication and transport mainly important for prompt referral of complications.	L
3. Government capacity requirements		
3.1. Regulation/legislation	– Making abortion legal in countries is a key prerequisite for safe abortion whether medical or surgical.[34] – The manufacturer of mifepristone makes the drug available only in countries without restrictive abortion legislation.[35]	H
3.2. Management systems	– Some need for information management for supply management, and monitoring & evaluation.	L
3.3. Collaborative action	– Need for partnership between government and external funding agencies to finance drugs is low, as misopristol is inexpensive and significant cost savings are expected from the reduced need to care for complications of unsafe abortions. Mifepristone however is more expensive, and external funding will be necessary in many settings. Public-private partnerships with manufacturers are another option. – Need for partnership with local medical and nursing associations.	L
4. Usage characteristics		
4.1. Ease of usage	– Information and education of users, mainly on availability of medical abortion possibilities. Prior information on side effects and possible treatment failure and complications is necessary, and will increase satisfaction and improved self-referral for complications. – Need for supervision by first level health staff, or at least TBAs.	H
4.2. Pre-existing demand	– In settings where women are informed of the possibility of medical abortion, demand is high. However, for a new programme, services have to be promoted.	L
4.3. Black market risk	– In countries where misoprostol is already widely available as treatment for gastric ulcer, the black market risk is minimal. In countries with restricted access, high black market risk.[35]	L

*H = high; M = medium; L = low

4.1.2.2 Review of the evidence for the effectiveness of the intervention in highly constrained settings

It has been estimated that between 13 and 20% of all maternal deaths are due to unsafe abortions.[36] This makes safe abortions probably the most predictable single means of reducing maternal deaths and morbidity, particularly among adolescent mothers.[10] Safe abortions would also save health systems the often huge costs of treating the complications of unsafe abortion.[25] In Kenya, complications of unsafe abortions accounted for over 50% of acute gynaecological admissions,[37] and in Malawi the average cost of treating one woman for complications from an unsafe abortion was US$27.4, around ten times the annual budgeted per capita health spending.[38] The risk of death from an unsafe abortion is several hundred times higher than that of abortion performed professionally under safe conditions.[25]

It is now well established that medical abortion is a safe and highly effective alternative to professional surgical abortion methods.[39] The best researched medical abortion regimen consists of administration of a single dose of oral mifepristone (200 to 600 mg) followed by oral, sublingual, or vaginal misoprostol, but either agent is efficacious on its own.[39] Several studies have now demonstrated that 200 mg mifepristone is the dosage of choice because it has been proved to be as effective as 600 mg.[25] Potentially life-threatening complications of medical abortion are excessive bleeding and incomplete abortion.[40] In a large study in 1373 women from China, India, and Cuba evaluating an oral regimen of mifepristone-misoprostol[c] induced abortions, the only serious complication was excessive bleeding in one patient who needed a transfusion[d].[41] Failure rates of the combined mifepristone-misoprostol regimen are below 2%.[25] In the case of an ongoing pregnancy, there is some concern about teratogenicity, which is not well established.[25]

Experience from a number of developing countries has shown that mid-level, non-medically qualified health staff, such as midwives and other skilled health workers, can be trained to provide good-quality surgical abortion care.[25;33;42] In Western Kenya a network of private physicians providing post-abortion care including manual vacuum aspiration (MVA) for incomplete abortion expanded to include non-physician health workers to cover rural areas underserved by physicians.[37] Midwives with 160 hours[e] special training in abortion services in South Africa were found to provide high-quality surgical abortion care, mainly MVAs, in the absence of physicians.[43]

Because medical abortion requires a less extensive infrastructure than surgical abortion, medical abortion offers great potential for improving abortion access and safety in developing countries.[44] In India, Coyaji et al[45] demonstrated that medical abortion can be delivered safely and effectively using the existing village health infrastructure. Village health workers with minimal training played a key role in educating, supervising, and referring patients in this study, although treatment per se was administered by formal health staff in the outpatient family planning department of a rural hospital.[45]

The techniques involved in offering medical abortion are well suited to provision by non-physician health workers.[46] In Sweden, all medical abortions are administered by midwives.[47] However, published reports from developing countries are limited to the use of mifepristone or misoprostol for cervical preparation in combination with MVA in South Africa[47] and Mozambique[48]. Unpublished experiences of mid-level staff administering both drugs have also been reported from India and Vietnam. Crucial constraints reported in these settings have been the cost of mifepristone, the necessity of two patient visits, and how to ensure appropriate follow up.[49] Interestingly, safety did not appear to be a major issue.

4.1.2.3 Potential for simplification

---

[c] 600 mg mifepristone followed after 48 h by 400 microgram of misoprostol.[41]

[d] Two other patients received transfusions, but the authors provided convincing evidence that these had not been indicated[41]

[e] 80 hours theoretical training, and 80 hours clinical training under supervision of experienced physicians.[43]

Mifepristone is expensive and is not available in many countries.[50] Therefore, misoprostol-only regimens are perhaps the most promising strategy for home-based medical abortion in very-low income countries. Misoprostol is already widely available, cheap, and does not need cool storage like other prostaglandins.[51] The effectiveness of misopristol-only regimens is comparable to the mifepristone-misoprostol regimen, even in second trimester abortions.[50] The main difference between the two is a prolonged induction to abortion interval with misoprostol-only and an increased frequency of non-life-threatening side effects.[50-52] In Brazil, the informal use of misoprostol is thought to have already contributed to a decrease in complications from unsafe abortions, but quantitative data are lacking.[53]

Simpler methods of delivery are currently being explored. Home-based self-administration of oral or vaginal misoprostol following mifepristone given at a health facility has been found to be safe and highly acceptable to patients, both in developed[54] and developing countries.[55] A pilot study from Hong Kong showed that a sublingual misoprostol-alone regimen[f] was efficacious for abortion up to 12 weeks gestation and highly acceptable to users, avoiding painful vaginal administration and providing more privacy.[56] In very constrained settings, sublingual administration has the added advantage of reducing the risk of uterine infection because repeated, potentially unclean, vaginal manipulations are avoided.

4.2 Diarrhoea

4.2.1 Solar disinfection of drinking water

4.2.1.1 Application of the conceptual framework

Table 4. Application of the conceptual framework to solar disinfection of drinking water

CATEGORY	CRITERIA	POTENTIAL FOR SIMPLIFICATION*
1. Intervention characteristics		
1.1. Basic product design	– Used, transparent PET plastic bottles. Only heavily scratched or old, blind bottles have to be replaced.[57] – Process is highly standardisable. Type of bottle depends on local availability, but many types of containers with demonstrated effectiveness. – Excellent safety profile. Concerns over chemicals leaking into water during solar exposure have not been corroborated.[57;58] – Water treatment and storage in same re-sealable container is a definitive advantage of the method, as recontamination risk is minimised.[59]	L
1.2. Supplies	– No need for regular supplies.	L
1.3. Equipment	– Apart from plastic bottles, and depending on climate conditions and roofing type, black paint; no other equipment, infrastructure, or maintenance needed.	L

[f] 0.6 mg every 3 h for a maximum of 5 doses.[56]

2. Delivery characteristics			
2.1. Facilities	–	Plastic bottles from domestic refuse.	L
2.2. Human resources	–	No medical knowledge needed.	L
	–	Initial training, monitoring & guidance can be delivered by community development volunteers, who themselves can be trained by development agency or NGO[57]	
2.3. Communication & transport	–	No dependence of delivery on communication and transport infrastructure apart from very remote, rural commodities where purchase & transport of used bottles from the city has to be organised.	L
3. Government capacity requirements			
3.1. Regulation/legislation	–	No need for regulation	L
3.2. Management systems	–	No need for sophisticated management systems	L
3.3. Collaborative action	–	Eventually some partnership requirements in promotion and IEC campaigns required.	L
4. Usage characteristics			
4.1. Ease of usage	–	Basic information/education on how to use solar disinfection needed. Best results if integrated in wider sanitation & hygiene strategy, e.g. accompanied by simultaneous education on hand washing with soap.	M
	–	Some need for monitoring of practice to correct mistakes during first months of use.[57]	
4.2. Pre-existing demand	–	Pre-existing demand in most settings is low, therefore substantial need for initial promotion. However, pilot projects have shown that once introduced, villagers keep it in high esteem and sustain practice over years.[57;60;61]	M
4.3. Black market risk	–	None.	L

*H = high; M = medium; L = low

4.2.1.2 Review of the evidence for the effectiveness of the intervention in highly constrained settings

An estimated 1.1 billion people still depend on rivers, streams, and other unsafe surface sources for drinking water.[59;62] Even if municipal piped water is available, it is often unsafe because of inadequately maintained pipes, low pressure, intermittent delivery, lack of chlorination, or clandestine connections.[59] Water from clean water sources is often transported and stored at home in faecally contaminated containers, e.g. earthen jars.[59] Contaminated drinking water is one of the main routes of transmission for diarrhoeal diseases, which cause an estimated 2.2 million deaths annually,[63] mostly among children. This makes diarrhoeal diseases one of the top three killers of children in the world today.[63] Despite major efforts to deliver safe community water to the world's population, the reality is that water supplies delivering safe water will not be available to all people in the near future.[62] In the meantime, a number of household water treatment and storage systems are capable of providing a means to render contaminated water safe at the point of consumption in very constrained settings, as reviewed by Sobsey.[62]

An inexpensive and simple method to produce safe drinking water at the point of consumption is solar disinfection, pioneered by Acra and colleagues[64] at the American University of Beirut. In fact, exposure of water to sunlight for its purification, prior to filtration through charcoal, is an ancient art believed to have been practised in India about 2000 B.C.[65] The simplest and cheapest application of the method consists of storing drinking water in transparent containers, which are then placed in direct sunlight.[58] In a trial in Kenya, plastic bottles from urban school children's own domestic refuse were used, and drinking water was exposed to sunlight on the top of trial children's huts.[58]

Two synergetic mechanisms are responsible for the inactivation of pathogenic organisms during solar disinfection. Solar radiation in the ultraviolet and early visible range (300-450 nm) produces lethal DNA strand breakages and replication-blocking DNA mutations through the production of highly reactive oxygen radicals and hydrogen peroxide.[57;58;64] This is sufficient to kill pathogenic viruses and bacteria. During exposure to sunlight, the water temperature in bottles can reach 55ºC.[58] Optical and thermal inactivation of pathogens shows a strong synergy and has been shown to reliably destroy all waterborne bacterial and viral pathogens that have been tested, including poliovirus, rotavirus, *Escherichia coli*, *Vibrio cholerae*, *Salmonella,* and *Shigella* species.[58] Techniques to boost the thermal effect, like the blackening of the bottle's base or putting bottles on a piece of black painted corrugated zinc roofing sheet, can dramatically increase the efficiency of the method.[57] The approach also offers the added advantage of inactivating many enteropathogenic protozoa and helminth eggs which are more thermoresistant than bacteria and viruses.[57;58]

Some key factors for solar disinfection application relate to: i) weather and climate, ii) water turbidity, iii) material and shape of containers, and iv) the oxygen content of the water.[57] The most favourable regions for solar disinfection lie between latitudes 35ºN and 35ºS, characterised by high solar radiation.[57;66] In bright sunshine, the water container needs to be exposed to the sun for 6 hours; if the sky is clouded exposure for 2 consecutive days is recommended.[57] In regions with less solar radiation, thermal boosting as outlined above is recommended.[57] Solar disinfection requires relatively clear water[g], and settling or plain sedimentation: fibre, cloth or membrane filtration, granular media filtration,[62] or traditional clarification methods like the utilization of Nirmali tree seeds in India, can be used to clarify turbid waters before solar disinfection.[65] The best results are achieved with PET plastic bottles with a capacity of 1-2 litres.[65] Solar disinfection is more efficient in water with a high oxygen content, which can easily be achieved by shaking the ¾ filled bottle for 20 seconds before filling it completely.[57]

The health impact of solar disinfection was studied by Conroy et al[60;61;67] in a series of randomised controlled trials in Kenya. In the first study, 206 school-aged children were instructed to drink water from transparent plastic bottles either kept in full sunlight on the roof of the hut (intervention group), or kept indoors in the shade (control group).[67] After an adjustment for age, solar treatment of drinking water was associated with a statistically significant reduction in the number of diarrhoea episodes by 34% (OR 0.66, 95% CI 0.50-0.87) and of severe diarrhoea episodes by

[g] with a turbidity less than 30 NTU.[57]

35% (OR 0.65, 95% CI 0.50-0.86).[67] In a subsequent study, using the same trial design, 349 children aged under 6 years were followed over one year.[60] Children drinking solar disinfected water had a significantly lower risk of severe diarrhoea with a two week period prevalence of 48.8% compared with 58.1% in controls, and this reduction was sustained over the whole year.[60] A cholera outbreak occurring shortly after the end of this trial offered the opportunity to investigate the protective action of solar disinfection on the risk of cholera.[61] Although there was no significant difference in the risk of cholera in adults or in older children in households randomised to solar disinfection, there were only 3 cases of cholera in the 155 children aged under 6 years drinking solar disinfected water compared with 20 cases among 144 controls.[61]

The Swiss Federal Institute for Environmental Science and Technology (EAWAG) has conducted extensive laboratory and field tests of solar water disinfection in a number of developing countries, and coined the acronym and label SODIS.[57] They also provide information and technical support to local institutions in developing countries for the promotion and dissemination of solar disinfection. EAWAG highlights a number of lessons from the field trials[57]:

- The best approach is to integrate solar disinfection into existing projects of community health and hygiene practices education.
- Local availability of plastic bottles is crucial for sustainability. In a trial in rural Indonesia, the amount of water that could be treated was limited by the number of plastic bottles available. This constraint was overcome by a community scheme to buy and transport used bottles from the city to the villages.
- Initially, villagers, local community health workers and educated people often do not trust the method. Carrying out bacteriological tests and communicating results was effective in convincing users and opinion leaders in Kenya.
- Dissemination of solar disinfection should be concentrated on regions where people drink untreated water.
- A number of mistakes made by users were seen frequently: exposing bottles in a vertical position, exposing the black side on top, not exposing bottles to full sunlight, and storing purified water in dirty containers. This demonstrated that although the method is simple, users need training and some monitoring and guidance for several months after training.
- Mass media and good quality promotion material play a significant role in the implementation process, as does the relationship between development workers and the communities. Local leaders were found to be very effective in disseminating the method.

Limitations of solar water disinfection are, therefore, the availability of used plastic bottles in some rural communities, and the dependence on climate conditions, which makes its use above 35º latitude impracticable. Solar water disinfection is not a panacea for preventing all diarrhoeal disease as it cannot address other modes of transmission, notably direct person-to-person spread. However, it could be part of a wider strategy to combat diarrhoeal diseases. Probably the biggest impact on the incidence of diarrhoeal diseases could be achieved if solar water disinfection is combined with another simple and effective intervention, hand washing with soap, reviewed by Curtis and Cairncross.[68] Ideally, this should be complemented by safe stool disposal, which represents the other key primary barrier to transmission.[68]

4.2.1.3 Potential for simplification

Solar disinfection uses material commonly found in domestic refuse in developing countries, and has absolutely no running costs.[58;67] After very basic and brief training the method is very simple to use, even by children, as demonstrated during field trials in Kenya.[60;67] Because the method is already so simple, it does not offer much scope for simplification. Eventually, the dissemination process, promotion material, monitoring, and guidance could be simplified, building on the experience already acquired by the EAWAG programme.

4.3 Malaria

4.3.1 Social marketing of insecticide-treated nets

4.3.1.1 Application of the conceptual framework

Table 5. Application of the framework to socially marketed insecticide-treated nets

CATEGORY	CHARACTERISTICS	POTENTIAL FOR SIMPLIFICATION*
1. Intervention characteristics		
1.1. Basic product design	– Robust material with on average 3-5 years of life.[69] However, holes and tears seriously affect efficacy. Robustness is higher for synthetic vs. cotton nets. Long lasting, permanently-treated nets are already available, but currently at a much higher cost than standard nets.[70] – Highly standardisable. – No risk of adverse events for nets. Low risk of side effects from improper handling of pyrethroid insecticides during home-based reimpregnation.[69] – Bulkiness may be an issue for small village shops and low turn-over rates,[69] otherwise easy to store. Rodent protection needed for cotton nets. – Slightly bulky, otherwise easy to transport.	M
1.2. Supplies	– Insecticides for home-based reimpregnation every 6-12 months.[69] – Repair material.	M
1.3. Equipment	– No high technology equipment or infrastructure needed. – No other equipment needed. – Regular home-based checks and repairs. Reimpregnation can be home-based or community-based.	L
2. Delivery characteristics		
2.1. Facilities	– Provided through basic retail sector.	L
2.2. Human resources	– Untrained retail sector staff sufficient. Minimal training for net reimpregnation personnel needed.[69]	M
2.3. Communication & transport	– No special requirements.	L
3. Government capacity requirements		
3.1. Regulation/legislation	– Need to register insecticides with national pesticide authority to prevent ineffective and unsafe products being used.	L

3.2. Management systems	–	No need for sophisticated management systems.	L
3.3. Collaborative action	–	Need to ensure equitable pricing and distribution through subsidies or public provision for the poorest groups. Retreatment services often have to be organised and provided free of charge to achieve a significant uptake.	M
4. Usage characteristics			
4.1. Ease of usage	–	Only basic, easy to understand information on net usage and maintenance. Reimpregnation procedure is more complex and in case of home-based dipping, good information is needed.	M
	–	No need for supervision. Regular, external controls of condition of nets desirable but not required.	
4.2. Pre-existing demand	–	In some countries, e.g. India, substantial need for promotion, as benefits of nets are not well known and nets are seen as inconvenient/uncomfortable when the weather is hot and humid. In sub-Saharan Africa low need for promotion of nets but high need of promotion for regular insecticide reimpregnation.[69;71]	M
4.3. Black market risk	–	Variable risk of resale, misuse, or theft, depending on the existence of a subsidy scheme and how it is operated.[69]	L

*H = high; M = medium; L = low

4.3.1.2 Review of the evidence for the effectiveness of the intervention in highly constrained settings

Insecticide-treated mosquito nets (ITNs) are considered by many authors in the field to be the most efficacious, currently feasible intervention to prevent morbidity and mortality due to malaria, particularly in sub-Saharan Africa.[72] They offer individual protection to the net user, with a 19% reduction of all cause childhood mortality as defined by a recent meta-analysis of randomised clinical trials.[73] They also have a mass effect in communities where they are widely used,[74] because occupied nets act like baited traps for mosquitoes.[72] Their cost-effectiveness in preventing deaths and morbidity from malaria is in the same range as that of measles vaccination, with a cost of US$19-85 per DALY averted for the provision of nets and insecticide treatment.[75]

Despite some uncertainty about the long-term effects[h] of widespread use of ITNs, the current consensus among experts is that scaling up is desirable.[72;76] This is expressed in the target of 60% of populations at risk sleeping under ITNs by 2005, set by African Heads of State at the Abuja Summit in April 2000.[77]

However, there is controversy on how to scale-up net usage while ensuring equitable and comprehensive coverage. The two main options are a social marketing approach, with provision through the retail sector, and public provision free of charge.

[h] Concerns surround the effect of ITNs on the acquisition of natural immunity to malaria, and the implications of a subsequent loss of effectiveness on morbidity, and the extent to which mosquito resistance to pyrethroid insecticides might reduce the effectiveness of ITNs.

Proponents of the social marketing[i] approach, among them WHO,[78] consider that the public sector capacity in much of Africa is too weak to support wide-scale ITN procurement and distribution,[72] and consequently recommend that ITNs are provided through the commercial retail sector which is present even in remote rural areas of the poorest countries.[71] This approach more often than not includes some form of subsidy scheme targeted at the very poor or high risk groups such as young children and pregnant mothers who cannot afford market prices.[69]

Proponents of free provision argue that the public sector in Africa has demonstrated its ability to achieve equitable and comprehensive coverage for vaccines.[72] They recommend that ITNs should be provided in the same way, as user charges are likely to deter usage among the most vulnerable groups who also carry the highest burden of disease.[72] A detailed discussion of the advantages and disadvantages of each distribution model can be found elsewhere.[69;72]

We will focus here on the social marketing approach, as its benefits have been demonstrated in a large-scale programme[71;79] and it acknowledges that in many tropical regions bednets are already a widespread commodity with established private, commercial distribution systems.[69] Of the two options, the social marketing approach clearly places a lesser burden on scarce government capacity. It is also likely to be more sustainable in low resource settings than free provision. Another advantage is that it can be employed in difficult political circumstances, as demonstrated in a very successful small-scale project of social marketing of ITNs in rural Eastern Afghanistan between 1995 to 1997, where a coverage was achieved of 59% of families, with an associated relative risk reduction of *Plasmodium falciparum*[j] infection (OR 0.41, 95% CI 0.25-0.66).[80] The main disadvantage of social marketing is that the poorest, who are often the high risk groups, are left out by a commercial approach,[72] and targeting them may be very demanding on government capacity and costly. It requires the setting up and running of a subsidy scheme which needs promotion, and a number of safeguards and regular monitoring to prevent abuse and ensure equitable access. If vouchers are used, the main risks are forgery, theft, and that retailers accept them for other goods.[69] An alternative to subsidy schemes is a combination of public provision for the poor and social marketing for those who can afford to buy nets. Direct delivery of nets to scattered rural communities or door-to-door in towns, however, is very time-consuming and demanding in terms of logistics.[69] Possibly NGOs are better suited to supply free nets to the poorest in highly constrained settings. Another way of obtaining a segmented market would be through different branding of nets according to target group and affordability. However, to our knowledge this approach has not yet been investigated for socially marketed ITNs.

To date, two large-scale projects on the effectiveness of ITNs have been completed in Africa: the KINET project in Tanzania and the national insecticide treaded bednet programme (NIBP) in The Gambia.

---

[i] Social marketing is used here in its broader sense, i.e. including the commercial sector and building on market growth supplemented with targeted subsidies; it is not restricted to the traditional notion of buying commodities and selling them at reduced prices.

[j] A comparable risk reduction in *Plasmodium vivax* infection (OR 0.5, 95% CI 0.17-1.49) was also observed, but this effect was not statistically significant.

The KINET project has promoted the use of ITNs through social marketing for a population of 480,000 in rural Tanzania through a partnership between the public sector (educating and subsidising) and the private sector (educating, distributing, and selling, in particular through private retailers) since 1997.[71;81] Pre-treated nets and insecticide kits for net treatment at home were packaged and branded according to local preferences based on previous market research.[71;82] Nets were sold in each village by a variety of sales agents including health workers, shopkeepers, religious leaders, and village government leaders.[71] Interestingly, shopkeepers and a few health personnel were found to be most successful.[71] An information, education, and communication (IEC) campaign focused on the promotion of the reimpregnation insecticide kit as nets proved already very popular, a finding well known from other African settings and studies.[69;71] In 1997, retail prices were US$5 for a treated net and US$0.42 for the insecticide kit, representing subsidies of 25% of ex-factory prices for nets and 90% for treatment kits.[71] When ex-factory prices fell in 2000, nets were sold without subsidy and treatment kits were subsidised at 40% to maintain stable prices throughout the study. Meanwhile in the rest of Tanzania, commercial retail prices had been declining, and by 2000 were comparable or lower than the project price of US$5.[83] The IEC campaign and distribution to wholesalers was about US$1.70 per treated net or insecticide treatment kit. A voucher system for mothers of young children and pregnant women was also set up, so they could buy ITNs at a lower price.[79]

Within 3 years, coverage of children under 2 years of age with ITNs rose from 10% (95% CI 9-15) to 54% (95% CI 51-57).[71] This was associated with a 27% (95% CI 3-45) increase in survival in children aged 1 month to 4 years using a ITN,[71] a 62% (95% CI 38-77) reduction in the frequency of parasitaemia, and a 63% (95% CI 27-82) reduction of anaemia in children under 2 years of age.[79] Coverage with ITNs was significantly higher in areas with longer access to the programme.[71] Social market prices were in general adhered to by retailers and perceived as fair by customers in this study. Likely reasons for the good price adherence were widely advertised prices and the fact that there was usually more than one retail outlet per village.[71] Although the rapid uptake of ITNs despite low incomes and a particular economic hardship due to a famine at the time were very encouraging, the results were less favourable for the uptake of insecticide retreatment kits. Despite massive promotional activities and high subsidies, only one third of ITN users had treated their nets in the previous 6 months.[71]

The national insecticide treated bednet programme (NIBP) in The Gambia provided insecticide treatment to existing users of bednets free of charge in the first year in all villages with a population of 400 people or more.[84] They achieved 80% coverage, and a 25% decrease in all cause mortality in children under 10 was observed over the same time period.[82] When a user fee was introduced for net treatment in the second year, coverage dropped to 14% and there was no impact on mortality.[82;85]

It has to be stressed that social marketing was not employed in the NIBP and the project did not evaluate coverage with nets but only reimpregnation uptake. Nets and insecticide treatment have very different product characteristics, as demonstrated in the KINET project and in many small-scale studies reviewed by Lines.[69] However, Snow et al[86] obtained very similar results in a smaller scale study in Kilifi, Kenya. After obtaining excellent coverage rates (97 to 99%) using cost-free house-to-house

delivery of net dipping, coverage fell to 61 to 67% when delivery was switched to a cost-free sentinel site dipping, and there was a further reduction of coverage to 7% when user fees for cost recovery were introduced for the sentinel site dipping service.[86] This happened despite a social marketing campaign, which was successful in raising awareness as only 6% of mothers were unaware of dates and positions of sentinel dipping stations.[86] The reason for not bringing their children's nets for retreatment, maintained by 87% of mothers, was that they could not afford it.[86] The level of user fee charged for dipping was not stated. Interestingly, after a transition at the end of the project to an entirely entrepreneurial approach with a more flexible approach to financing and decision making, net retreatment sales jumped from 5-8 nets per week to 30-50 nets per week.[86] This observation might indicate that delivery through the commercial channel is more effective if a form of cost recovery is part of the scheme, and that the distribution channel for ITN or retreatment kits is perhaps more important than the social marketing programme *per se*.

4.3.1.3 Potential for simplification

The most promising potential for simplification of insecticide-treated nets is probably the development of permanently-treated, long lasting nets (LLNs) using new bioactive fabric technologies.[76] These may retain their insecticidal properties for 4-5 years – the life span of a net, thus making reimpregnation unnecessary.[77] Other advantages are a reduced insecticide consumption, and a minimum environmental impact as release of insecticide in natural water bodies during washing is greatly reduced.[76]

Long-lasting nets thus have potential to simplify ITN in the following way:

- Intervention characteristics: Increase in robustness through synthetic material, and an improved safety profile as contact with undiluted insecticide takes place only at the factory. LLNs also obviate the need for regular supplies of insecticide.
- Delivery characteristics: LLNs obviate the need for training of providers/users in handling insecticide.
- Government capacity requirements: LLNs obviate the need to provide an organised net retreatment service, which is often provided by the public sector and/or which needs to be heavily subsidised.
- Usage characteristics: LLNs greatly reduce the need for education/information and promotion, as pre-existing demand for nets is much higher than for insecticide retreatment.

Strengthening of production capacity in Africa, facilitation of technology transfer, and an ensuing reduction in price through well targeted public-private partnerships is thought to be an effective way to go to scale.[76]

4.4 HIV/AIDS and STIs

4.4.1 Social marketing of condoms

4.4.1.1 Application of the conceptual framework

Table 6. Application of the framework to condom social marketing

CATEGORY	CRITERIA	POTENTIAL FOR SIMPLIFICATION*
1. Intervention characteristics		
1.1. Basic product design	– Condoms are a very stable commodity, with a duration of life of 1-2 years, and are highly standardisable. – No risk of serious side effects. However high quality standards are needed to prevent unwanted pregnancies and full protection from STIs. – Condoms do not pose special requirements for storage or transport.	L
1.2. Supplies	– No need for regular supplies	L
1.3. Equipment	– No other equipment or maintenance needed.	L
2. Delivery characteristics		
2.1. Facilities	– Condoms can be safely and effectively provided by the existing retail sector and alternative distribution channels, including bars and brothels, truckers stops etc.[87]	L
2.2. Human resources	– No medical or para-medical staff needed for distribution. Training of educational and sales agents is needed, but this can be effectively provided by non-professionals. Preparation of training material needs some professional input. – Management and planning requirements of condom procurement, stocking, and distribution to sales agents.	L
2.3. Communication & transport	– CSM programmes can be an effective means of getting round communication and transport infrastructure constraints, as demonstrated post-civil war in Mozambique and rural Haiti[87]	L
3. Government capacity requirements		
3.1. Regulation/legislation	– No need for special regulation. On the contrary CSM programmes can circumvene some regulatory constraints.[88]	L
3.2. Management systems	– No need for sophisticated management systems	L
3.3. Collaborative action	– Collaborative action is required between national and local government, local and international NGOs, and donors. In particular, approaches not using the commercial approach to CSM, but targeted delivery to the poorest, require substantial subsidies and collaborative action. – Collaboration with religious groups and support of opinion leaders is crucial for successful implementation.	L
4. Usage characteristics		
4.1. Ease of usage	– Easy to use household commodity.	L
4.2. Pre-existing demand	– In many settings, substantial need for promotion using mass media and interpersonal communication strategies, in particular to reach poor and high risk groups.	M
4.3. Black market risk	– Low risk of resale of subsidised condoms, when they are widely available.	L

*H = high; M = medium; L = low

4.4.1.2 Review of the evidence for the effectiveness of the intervention in highly constrained settings

Condom use forms the core measure of all safer sex strategies, and is probably the single most effective intervention to prevent sexual transmission of the human immunodeficiency virus (HIV). "100% condom use" programmes targeted at commercial sex workers have shown impressive results in Thailand and Cambodia in reducing HIV infection prevalence.[2] In countries where the HIV/AIDS epidemic has spread far beyond vulnerable groups, a national approach is necessary.[2] The effectiveness of condom social marketing (CSM) in increasing availability and use of condoms on a large scale has been demonstrated in a number of studies since their start in the mid-1980s.[87] CSM can be applied to both target high-risk groups and to increase condom availability and use at the general population level. In 1999, around 900 million condoms were distributed through CSM in 59 developing countries.[87]

The most common approach to CSM is the "traditional" or "own-brand model", where standard commercial marketing and sales techniques are used to promote and distribute own-brand condoms through wholesale and retail sellers to the mass market.[87] This requires the development of a professional in-country sales force and management structure.

For situations where difficult-to-access population groups need to be targeted, four alternative distribution systems have been developed, recently reviewed by UNAIDS[87] :

- "Community-based distribution" involves the recruitment of non-professional sales agents from among the target groups, who receive training and are rewarded with small margins on their sales. This approach is particularly effective in reaching groups who are otherwise hard to access for geographical or socio-cultural reasons. A good example is a CSM programme in Mozambique after the civil war, where the lack of transport and communication infrastructure precluded a commercial approach and community agents were very effective in raising demand and supplying condoms.
- "Community-based social marketing" is similar, but adds a network component by rewarding sales agents financially if they recruit others to act as educational and sales agents. This model has been shown to attain particularly rapid community penetration and involvement. An example is the International Family Health/Indian Institute of Community Health project in Chennai, India.
- In the "manufacturer's model", support is provided for promotion and distribution of brands owned by a manufacturer or importer of condoms, resulting in a significantly reduced price for the consumer compared to the usual market price. This approach has been successfully applied in Kenya, where reproductive health "kiosks" staffed by specially trained midwives, and operating on market days in rural market towns, were able to reach people from under-served, remote rural areas and met with enthusiastic public support. Condoms and medical supplies for the project were procured at negotiated prices from manufacturers. Salary supplements for the otherwise low-paid midwives were found to be a strong motivator, encouraging their active participation.
- "Targeted service delivery" entails planning of CSM activities to reach particular high risk or other priority groups not adequately served by other distribution models, including the wider commercial approach. It is often used to complement

the latter. In Cameroon, the "horizons jeunes" project was very effective in reaching young people and influencing behaviour change, particularly through peer education.

The Indian NGO Janani combines social marketing techniques with a social franchising concept for promoting reproductive health services and distributing condoms and oral contraceptives, and currently achieves a coverage of 1.2 million couples per year in three of India's poorest states, Bihar, Jharkhand and Madhya Pradesh.[89] The social franchising part of the approach involves the training of rural health practitioners (RHP) and women health partners (WHP) who are often their wives. RHP/WHP allocate a separate room in their house to function as the village reproductive health centre, under Janani's logo Titli (butterfly).[89] RHP couples are regularly supplied with Janani's own brand and the Government of India's brand condoms, contraceptive pills, pregnancy test kits and educational material. They also receive training in basic hygiene and healthcare protocols, including when and how to refer patients to qualified doctors, situated in Janani's own referral clinics in small towns. This adds to the credibility of the RHPs. Condoms and contraceptives are also distributed using a traditional, commercial approach through private stockists, pharmacies and retailers.[89]

The main criticism related to social marketing programmes is that they do not reach the poorest population groups, who cannot even afford the offered commodities at subsidised prices. The effectiveness of CSM in reaching the poor and vulnerable has recently been reviewed by Price[88]. He concluded that CSM programmes are unlikely to be pro-poor in their early stages in terms of the distribution of benefits, but as programmes mature, inequities in access diminish, and are followed by reduced inequities in condom use.[88] Programmes with a cost-recovery focus were found to exclude the poorest. Convenience and access were significantly improved for those who can afford to pay, and CSM can address some of the regulatory constraints to access, such as regulation inhibiting advertising or use of condoms in certain age groups, the unmarried, or restrictions on the type of outlets offering condoms.[88] Social constraints can also be effectively addressed, as the anonymity of the commercial transaction is particularly attractive to women and young people buying condoms.[87]

4.4.1.3 Potential for simplification

Condoms made available through the retail sector or through community sales agents are certainly among the most simple health interventions, which limits the potential for simplification of the basic interventions. However, there might be some scope to simplify the management and planning of a national delivery system. Likewise collaboration between the various agencies offers some scope for improvement, through clarifying responsibilities and avoiding duplication of effort. The methods used to promote condom use and safe sexual health behaviour vary widely between programmes, and there is a lack of evidence of what works best. The most common indicator for success of CSM programmes is still the number of condoms sold. Only a limited number of studies have investigated the impact of CSM on actual health behaviour.[88] In order to be successful, CSM programmes have to be adapted to local circumstances.[87] These settings vary widely between countries and even within countries, which makes the application of simple blueprint solutions for scaling up impossible.

On the other hand various international agencies, like Population Services International, DKT, and the Futures Group among others, have accumulated expertise in social marketing for over 30 years. One approach to simplifying CSM expansion might be to classify these experiences according to the settings in which they have been used, together with indicators of their success and costs. This would make it easier for new programmes, including local NGOs or government programmes in developing countries, to choose the most appropriate approach. It would also decrease developing countries' dependency on international NGOs for technical guidance and support, and thus increase self-sufficiency and sustainability of CSM projects.

Another promising strategy is the integration of CSM into a wider reproductive health services perspective, as exemplified by the Janani project. This approach offers the potential of economies of scale and scope, and possibly increases the effectiveness and acceptability of both safer sex messages and other reproductive health services. For example, the Janani Titli centres also offer advice at the village level about safe abortion, and can refer women to Janani Surya clinics, where safe abortions are offered at subsidized rates. This move, from vertically organised, pure CSM programmes to horizontally integrated reproductive and possibly wider health services, holds some potential for scaling up, but to date this has not been investigated in comparative studies.

4.5 Blindness

4.5.1 Trachoma surgery

4.5.1.1 Application of the conceptual framework

Table 7. Application of the framework to trachoma surgery

CATEGORY	CRITERIA	POTENTIAL FOR SIMPLIFICATION*
1. Intervention characteristics		
1.1. Basic product design	– Operating technique manuals can help to standardise the operation to a certain extent. Some variation is likely to remain, as basic training of ophthalmic nurses and equipment will vary between settings. – The surgical procedures are relatively simple, and very low rates of adverse events have been reported from community settings. The most frequently reported failure is recurrence of trichiasis. – All equipment needed can be carried on a motorcycle by the ophthalmic nurse.	M
1.2. Supplies	– Need for regular supplies of ophthalmic nurses with standard surgical material, e.g. suture material, local anaesthetic etc	L
1.3. Equipment	– Only very basic surgical equipment needed. Sterilisation of surgical equipment is the only maintenance needed, which can pose a logistic problem for community-based programmes.	L
2. Delivery characteristics		

2.1. Facilities	–	Surgery can be provided by outreach services in the community or at first level care centres.	L
2.2. Human resources	–	Major constraint in many settings is the need for properly qualified ophthalmic nurses (1 year ophthalmic training) who can learn the method in two weeks.	L
2.3. Communication & transport	–	Low dependency of delivery on communication and transport infrastructure.	L
3. Government capacity requirements			
3.1. Regulation/legislation	–	No need for specific regulation.	L
3.2. Management systems	–	No need for sophisticated management systems.	L
3.3. Collaborative action	–	No need for intersectoral action within government. – In many settings, need for partnership between government and NGOs, who employ the ophthalmic nurses or assistants. Co-ordination between different NGOs and donors is needed.	L
4. Usage characteristics			
4.1. Ease of usage	–	Not applicable.	L
4.2. Pre-existing demand	–	Substantial need for promotion/education campaigns on benefits and good safety profile of the procedure as acceptance rates are a particular problem with trachoma surgery.	H
4.3. Black market risk	–	No black market risk.	L

*H = high; M = medium; L = low

4.5.1.2 Review of the evidence for the effectiveness of the intervention in highly constrained settings

With around 6 million people blind due to trachoma, representing 15% of world blindness, and another 10 million at risk of blindness or severe visual impairment, trachoma is the world's leading cause of preventable blindness.[90;91] Repeated infection of the conjunctival lining of the eyelids by the bacterium *Chlamydia trachomatis* leads to marked inflammation and subsequent scarring, shortening of the lid and in-turning of the eyelashes (trichiasis)[k] that rub on the cornea and cause blindness.[91] Most cases now occur in poor, rural, arid areas of developing countries, such as the Sahelian region of Africa, where access to clean water limits personal and community hygiene.[90] Blinding trachoma is 2-3 times more common in women,[93] resulting from recurrent infection through close contact with young children, in whom the prevalence of active trachoma peaks between ages 2 to 5 years.[92]

In 1997, a new international initiative aimed at the global elimination of blinding trachoma was set up by WHO.[94] Key to the new initiative is the SAFE strategy, integrating four elements for trachoma control: surgery for trichiasis, antibiotic treatment, facial cleanliness, and environmental improvement.[91]

Since people with trachomatous trichiasis are at high risk of becoming blind, surgical treatment of these people is the first priority of the SAFE strategy.[92] It usually results

[k] If the whole lid margin is turned in, the condition is called entropion.[92]

in immediate and dramatic relief of discomfort and is often important in gaining support for other elements of the SAFE strategy, which are not perceived to offer equally obvious and immediate benefits.[95] The surgical approach recommended by WHO is bilamellar tarsal rotation[l], a simple surgical technique which can be performed by ophthalmic nurses or assistants.[91] In a randomized trial, bilamellar tarsal rotation achieved a success rate[m] of 80% at 9-21 months follow up compared to 40% seen with other surgical procedures.[96] However, similar success rates have been described in several case series and one randomised trial using an anatomically similar operation but which leaves the skin intact; these have been reviewed by Kuper et al.[92] Success rates were similar for community- or hospital-based surgery, and for doctor or nurse operators.[92] An example of such a technique is the tarsal rotation procedure, which is performed under local anaesthetic and takes about 15 minutes.[97] Tarsal rotation was found to be safe and effective when performed by an ophthalmic nurse in the community.[98] Ophthalmic nurses or assistants only need two weeks training to learn the procedure.[97]

Low uptake is a major obstacle to successful implementation of trachoma surgery,[92] with less than half of all eligible patients accepting surgery in most programmes.[95] Barriers to acceptance of trachoma surgery that have been identified include constraints of duties such as child care, lack of time, perceived cost of surgery, lack of an escort, distance to travel to surgery, and fear of the operation.[92]

A cluster randomised trial from The Gambia showed that uptake rates were higher for surgery offered in villages (66%) as compared to health centres (44%), although the result was not significant because of insufficient sample size (p=0.15).[95] In this trial, a tarsal rotation procedure was performed by ophthalmic nurses, who had one year of training in ophthalmic nursing after their basic nursing course of 3 years duration, or by ophthalmic assistants who had an additional 2 years of ophthalmic training.[95] All the surgical equipment needed could be carried by the ophthalmic nurse or assistant on a motorcycle.[95]

A traditional alternative treatment to surgery is epilation, which is often self-administered.[92] However, the efficacy of epilation for symptom relief or blindness prevention has not been shown in any study so far.[92] On the contrary, eye lashes often break leaving abrasive stubbles, and even if successful, re-growing lashes may be more abrasive than the original trichiasis.[92] Even for more technologically advanced eyelash follicular ablation techniques using cryotherapy, electrolysis, or lasers, high failure rates have been described for treatment of trachomatous trichiasis, and the equipment is not likely to be available in most trachoma-endemic areas.[92] Kuper et al[92] have suggested offering epilation for cases where eyelashes are not touching the cornea, as these people may be most likely to refuse surgery.

4.5.1.3 Potential for simplification

The two most promising ways to simplify treatment of trachomatous trichiasis seem to be follicular ablation techniques and an innovative treatment using a sticking-plaster.

---

[l] The main procedure of bilamellar tarsal rotation consists of a full-thickness transverse split of the upper tarsal plate with lid margin rotation, secured by sutures.[92]
[m] Success was defined as non-recurrence of trichiasis.

Eyelash follicular ablation, using lasers or cryotherapy, are unlikely options for scaling up because of technological complexity and cost. However, follicular ablation using electrolysis is a simple and inexpensive technique that could be potentially applied in villages in developing countries. Although preliminary results of various follicular ablation techniques have been rather disappointing so far, none have been investigated in a proper randomised trial. The offer of experimental follicular ablation has some potential for cases refusing surgery or for extra-corneal trichiasis. However, as the latter are not at imminent risk of corneal opacification and blindness, this will have no impact on blindness.

The other potentially more promising option is a simple treatment of trichiasis using sticking-plasters that force eyelashes back to their correct position.[99] The technique consists of placing a sticking-plaster with hypoallergenic glue on both sides of the affected lid, thus gluing in-turned eyelashes to the plaster fixed on the lid.[99] A piece of regular surgical tape of the same size is then placed over the sticking-plaster, with subsequent weekly replacement of the plasters for 3 months.[99] In a randomised controlled trial conducted in Shanghai, Graz et al[99] compared the plaster method with epilation. After 3 months, 67% of those treated by the plaster method presented a good clinical status[n] compared to none of those treated by epilation ($P < 0.001$), including 3 out of 4 cases with trichiasis major[o].[99] Around two thirds of patients who refused lid surgery offered free of charge to all patients at the end of the trial were found to be recurrence-free after another 2 to 8 months (median 7 months), and hence did not require surgery.[99] The authors suggested that patients, relatives, traditional village eye-lash pickers, or primary health care workers could all be taught to apply this method.[99] Although no attrition was described in this preliminary trial, diminishing compliance over the course of the 3 months treatment in field trials might have a negative impact on the effectiveness of the procedure compared to surgery, although patients in the initial trial seemed to get used to the plasters very quickly. In the first few days of plaster treatment, patients reported some difficulty during face washing. Otherwise they described the treatment as rather comfortable.[99]

Another potential area for improvement is the development of more effective ways to increase acceptance of surgery in communities, which has been found to be a problem even in programmes with adequate staffing levels.

5 Discussion

Analysing key health interventions using the conceptual framework proposed in this paper proved useful in categorising interventions on their degree of complexity, identifying supply and demand side constraints, and pointing to potential areas for improvement of specific aspects of each intervention. Research and development needs to simplify interventions are greatest where interventions have proved highly effective but capacity requirements are also high, best exemplified by highly active antiretroviral therapy (HAART). The framework could be used as a tool for policy-

[n] Good clinical eye status – successful outcome – was defined as: no lashes touching the eyeball, complete lid closure, no conjunctival hyperaemia, no unplanned treatment necessary during follow up.[99]

[o] More than 5 eye lashes touching the eyeball on one lid.[99]

makers, planners, and programme managers when considering the expansion of existing projects or the introduction of new interventions. It might help to identify existing gaps in the current provision of the interventions, and to identify context-specific constraints. Intervention complexity thus complements burden of disease, cost, cost-effectiveness, and political feasibility considerations in health policy decision making on scaling up.

Most of the interventions reviewed in this paper already have simplified designs compared to common practice, and therefore the scope for further simplification is relatively small in most cases. However, we think that the analysis of the potential for simplification can provide valuable insights into context-specific constraints for commonly used interventions. The proposed systematic approach also allows for comparison with national benchmarks or with other regions, programmes or countries.

The conceptual framework is, by definition, not able to assess how best to combine single interventions to deliver an integrated approach, which is often most appropriate for reducing the overall burden of a disease. For example, an integrated approach to reduce diarrhoea prevalence and mortality could consist of the combination of three inexpensive, low-technology, simple to use interventions with potential synergy:[100]

- safe drinking water produced by solar water disinfection to reduce waterborne transmission,
- handwashing with soap to reduce direct and indirect faecal-oral transmission, and
- oral rehydration therapy to reduce mortality from dehydration.

Another example is a recent WHO initiative aimed at standardising case management of patients with respiratory symptoms. Under the Practical Approach to Lung Health (PAL), multi-purpose health workers in low- and middle-income countries will be taught to recognise and treat adult respiratory diseases, mainly acute respiratory tract infections, tuberculosis, asthma, and chronic obstructive pulmonary disease (COPD).[101] This will involve the consolidation of previous guidelines for the detection and treatment of tuberculosis (DOTS), asthma and COPD. The PAL guidelines are currently undergoing studies in Chile and South Africa.[101]

The desirability of integration applies to all interventions reviewed, and reflects reality in so far as very few health interventions are or should be delivered in isolation - the only exception being some vertical programmes. Furthermore, synergies exist not only in the effects of interventions, but also in terms of capacity requirements and their potential reduction. For example, Janani rural health workers not only sell socially marketed condoms, but also offer a whole range of reproductive services, including referral to Janani clinics staffed with physicians. The NGO is thus able to provide comprehensive reproductive services to a population otherwise excluded from government provision.

The definition of what constitutes an intervention is sometimes ambiguous. For example for insecticide-treated nets, the question arose as to whether ITNs consist in fact of two interventions: the bednet itself and the reimpregnation procedure. The parts of the intervention differ substantially on a number of characteristics. For example, pre-existing demand for bednets is high in Africa, whereas demand for reimpregnation is low. Nets are easy and safe to use. Reimpregnation of insecticide

requires explanation, possibly training, and can be hazardous to health if applied inappropriately.

Another issue with regard to categorisation relates to the fact that some interventions reflect a change in the mode of delivery, e.g. midwives instead of gynaecologists providing abortion services; and others a change in technology, e.g. medical abortion regimens replacing surgical abortion. Some interventions involve both types of changes, e.g. midwives administering medical abortion. The question arises whether these different types of interventions should be analysed in the same way, or whether a further sub-classification would prove more useful.

The use of NGOs to deliver health interventions when government capacity is weak is another recurring issue. NGOs might be more suited for some roles in intervention provision rather than others. Condom social marketing projects reviewed here are good examples of the successful delivery of health interventions by NGOs on a large scale. But even for those projects managed and subsidised entirely through NGOs, national and local political support is crucial. An example is the need to relax restrictions on condom advertising and distribution outlets.

An important issue surrounding the question of how to reduce human resource constraints is the scope to reduce the education or skills level required to provide an intervention. A successful example is trachoma surgery, traditionally performed by ophthalmologists, which can be effectively and safely provided by ophthalmic assistants or ophthalmic nurses who, on top of one year of training in ophthalmic nursing, only require two weeks of training to perform the procedure.[97] A less successful example is the training of traditional birth attendants to perform tasks normally provided by midwives, where the evidence is mixed and in some programmes training seemed to cause more harm than benefit.[5] However, as with other community health workers, the potential to deploy TBAs successfully is dependent on the tasks expected of them, and the need for a functioning support system providing TBAs with regular supplies, monitoring, supervision, and training.[102]

Perhaps one of the biggest issues emerging is that usage characteristics, and in particular "pre-existing demand", is often the category where there is greatest potential for improvement in the interventions. Unfortunately, the area of behaviour change communication (BCC)/information, education, and communication (IEC) often receives little attention in health projects. As a consequence, the evidence base on the impact of BCC/IEC strategies is weak.

6 Research Priorities

A number of research priorities have been identified during the review of the evidence for selected key interventions that can be delivered in highly constrained settings with least burden on scarce capacity.

A number of simple, low-technology, easy to use health interventions have been developed with the potential to be provided to millions of people in the poorest countries. Despite a recent surge of interest in scaling-up health interventions and a

number of well-intentioned programmes that have been in place for a number of years, such as the Program for Appropriate Technology in Health (PATH) specifically devoted to the development of simple technology, the evidence on the effectiveness and implementation characteristics of simple health interventions is scarce. For example, a simple and inexpensive alternative to trachoma surgery using sticking-plasters with the potential to be applied at the household level by patients themselves, relatives, or traditional eye-lash pickers has been developed.[99] The procedure could potentially prevent blindness in an estimated 10 million people with trachomatous trichiasis.[103] However, there have been no further trials and no operational research after the very encouraging results of a single randomised controlled trial involving 57 patients which was published in 1999.[99]

The delivery of medical abortion treatment by mid-level health care staff or traditional birth attendants has the potential to prevent mortality and morbidity of unsafe abortions. An estimated 20 million abortions are carried out under dangerous conditions resulting in 70,000 deaths per year and substantial morbidity in millions of women,[104] with enormous direct and indirect costs to health systems and society. However, the evidence for safe and effective provision of medical abortion by mid-level health care staff is limited to two developed countries, Sweden and the USA, and unpublished experiences from a few developing countries. The usefulness of training TBAs in safe abortion services, or at least in post-abortion care, has never been evaluated.

For the latter example, lack of political will due to ethical problems surrounding abortion may be partly held accountable, but this does not apply to sticking-plasters or solar water disinfection. The more general observation is that simple, low-technology, inexpensive health interventions do not usually offer an opportunity for industrial profit-making, and consequently do not obtain sufficient financial support for their further development and distribution to those in need.[105] In addition to the current emphasis on stimulating research and development for new drugs and diagnostic tests, greater attention needs to be given to the various characteristics of interventions reviewed here.

Finally, more evidence on the effectiveness of simple and inexpensive health interventions and on how best to implement them in highly constrained settings is crucially needed. This should be a priority area for funding by donors and international public or charitable organisations, and has so far been largely neglected.

References

1. Commission on Macroeconomics and Health. Macroeconomics and Health: Investing in Health for Economic Development. 2001. Geneva, World Health Organization.

2. Commission on Macroeconomics and Health. Improving Health Outcomes of the Poor: The Report of Working Group 5 of the Commission on Macroeconomics and Health. 2002. Geneva, World Health Organization.

3. Expanding Access to Health Interventions in low and middle-income countries: Constraints and Opportunities for Scaling-up . *Journal of International Development* 2003;**15**:1-131.

4. Hanson K, Ranson MK, Oliveira-Cruz V, Mills A. Expanding Access to Priority Health Interventions: A Framework for Understanding the Constraints to Scaling-Up. *Journal of International Development* 2003;**15**:1-14.

5. Goodburn EA, Chowdhury M, Gazi R, Marshall T, Graham W. Training traditional birth attendants in clean delivery does not prevent postpartum infection. *Health Policy Plan.* 2000;**15**:394-9.

6. Jahn A, Carvalho I, Kalinga MJ. Evaluating traditional midwife training programs: lessons learned from Tanzania. *Int.J.Gynaecol.Obstet.* 2001;**73**:277-8.

7. Tsu, V. Clean home delivery kit: Evaluation of the health impact. 2000. Washington, DC, Program for Appropriate Technology in Health (PATH).

8. World Health Organization. World Health Report 2002: Reducing Risks, Promoting Healthy Life. 2002. Geneva, WHO.

9. Eades CA, Brace C, Osei L, LaGuardia KD. Traditional birth attendants and maternal mortality in Ghana. *Soc.Sci.Med.* 1993;**36**:1503-7.

10. Cook CT. The effects of skilled health attendants on reducing maternal deaths in developing countries: testing the medical model. *Evaluation and Program Planning* 2002;**25**:107-16.

11. Walraven G,.Weeks A. The role of (traditional) birth attendants with midwifery skills in the reduction of maternal mortality. *Trop.Med.Int.Health* 1999;**4**:527-9.

12. World Health Organization. Reduction of maternal mortality. A Joint WHO/UNFPA/UNICEF/World Bank Statement. 1999. Geneva, World Health Organization.

13. Chongsuvivatwong V, Bucharkorn L, Treetrong R. Traditional birth attendants in an endemic area of tetanus neonatorum in Thailand: pitfalls in the control program. *J.Community Health* 1991;**16**:325-31.

14. Begum JA, Kabir IA, Mollah AY. The impact of training traditional birth attendants in improving MCH care in rural Bangladesh. *Asia Pac.J.Public Health* 1990;**4**:142-4.

15. Bailey PE, Szaszdi JA, Glover L. Obstetric complications: does training traditional birth attendants make a difference? *Rev.Panam.Salud Publica* 2002;**11**:15-23.

16. Gloyd S, Floriano F, Seunda M, Chadreque MA, Nyangezi JM, Platas A. Impact of traditional birth attendant training in Mozambique: a controlled study. *J.Midwifery Womens Health* 2001;**46**:210-6.

17. Smith JB, Coleman NA, Fortney JA, Johnson JD, Blumhagen DW, Grey TW. The impact of traditional birth attendant training on delivery complications in Ghana. *Health Policy Plan.* 2000;**15**:326-31.

18. Janowitz B, Bailey P, Comnik R, Araujo L. TBAs in rural Northeast Brazil: referral patterns and perinatal mortality. *Health Policy and Planning* 1988;**3**:48-58.

19. Koblinsky MA, Campbell O, Heichelheim J. Organizing delivery care: what works for safe motherhood? *Bull.World Health Organ* 1999;**77**:399-406.

20. Gay, J., Hardee, K., Judice, N., Agarwal, K., Fleming, K., Hairston, A., Walker, B., and Wood, M. What Works: A Policy and Program Guide to the Evidence on Family Planning, Safe Motherhood, and STI/HIV/AIDS Interventions — Module 1: Safe Motherhood. POLICY Project and Futures Group International. 2003. Washington, DC.

21. West KP, Jr., Katz J, Khatry SK, LeClerq SC, Pradhan EK, Shrestha SR *et al*. Double blind, cluster randomised trial of low dose supplementation with vitamin A or beta carotene on mortality related to pregnancy in Nepal. The NNIPS-2 Study Group. *BMJ* 1999;**318**:570-5.

22. Azais-Braesco V,.Pascal G. Vitamin A in pregnancy: requirements and safety limits. *Am.J.Clin.Nutr.* 2000;**71**:1325S-33S.

23. Liljestrand J. Strategies to reduce maternal mortality worldwide. *Curr.Opin.Obstet.Gynecol.* 2000;**12**:513-7.

24. Beard JL. Effectiveness and strategies of iron supplementation during pregnancy. *Am.J.Clin.Nutr.* 2000;**71**:1288S-94S.

25. van Look PFA,.Cottingham JC. Unsafe abortions: an avoidable tragedy. *Best Practice and Research Clinical Obstetrics and Gynaecology* 2002;**16**:205-20.

26. Abdel-Aleem H, El Nashar I, Abdel-Aleem A. Management of severe postpartum hemorrhage with misoprostol. *Int.J.Gynaecol.Obstet.* 2001;**72**:75-6.

27. O'Brien P, El Refaey H, Gordon A, Geary M, Rodeck CH. Rectally administered misoprostol for the treatment of postpartum hemorrhage unresponsive to oxytocin and ergometrine: a descriptive study. *Obstet.Gynecol.* 1998;**92**:212-4.

28. Ramsey PS,.Ramin KD. Rectally administered misoprostol for the treatment of postpartum hemorrhage unresponsive to oxytocin and ergometrine: a descriptive study. *Obstet.Gynecol.* 1999;**93**:157-8.

29. Shojai R, Piechon L, d'Ercole C, Boubli L, Ponties JE. [Rectal administration of misoprostol for delivery induced hemorrhage. Preliminary study]. *J.Gynecol.Obstet.Biol.Reprod.(Paris)* 2001;**30**:572-5.

30. Lokugamage AU, Sullivan KR, Niculescu I, Tigere P, Onyangunga F, El Refaey H *et al*. A randomized study comparing rectally administered misoprostol versus Syntometrine combined with an oxytocin infusion for the cessation of primary post partum hemorrhage. *Acta Obstet.Gynecol.Scand.* 2001;**80**:835-9.

31. Mousa HA,.Alfirevic Z. Treatment for primary postpartum haemorrhage. *Cochrane.Database.Syst.Rev.* 2003;CD003249.

32. World Health Organization and UNICEF. Revised 1990 Estimates of Maternal Mortality. 1996. Geneva, WHO/FRH/MSM/96.28.

33. Sundstrom, K. Issue Paper on Abortion. 1998. Stockholm, Swedish International Development Cooperation Agency (Sida), Health Division Document 1998:4.

34. Berer M. Making abortions safe: a matter of good public health policy and practice. *Reproductive Health Matters* 2002;**10**:31-44.

35. Arilha M,.Barbosa RM. Cytotec in Brazil: 'At least it doesn't kill'. *Reproductive Health Matters* 1993;**2**:41-52.

36. Duke RC,.Speidel JJ. The 1991 Albert Lasker Public Service Award. Women's reproductive health. A chronic crisis. *JAMA* 1991;**266**:1846-7.

37. Rogo K, Orero S, Oguttu M. Preventing unsafe abortions in Western Kenya: an innovative approach through private physicians. *Reproductive Health Matters* 1998;**6**:77-83.

38. Ewart WR,.Winikoff B. Toward safe and effective medical abortion. *Science* 1998;**281**:520-1.

39. Say L, Kulier R, Gulmezoglu M, Campana A. Medical versus surgical methods for first trimester termination of pregnancy. *Cochrane.Database.Syst.Rev.* 2002;CD003037.

40. Kruse B, Poppema S, Creinin MD, Paul M. Management of side effects and complications in medical abortion. *Am.J.Obstet.Gynecol.* 2000;**183**:S65-S75.

41. Winikoff B, Sivin I, Coyaji KJ, Cabezas E, Xiao B, Gu S *et al*. Safety, efficacy, and acceptability of medical abortion in China, Cuba, and India: a comparative trial of mifepristone-misoprostol versus surgical abortion. *Am.J.Obstet.Gynecol.* 1997;**176**:431-7.

42. Sundstrom, K. Abortion—A reproductive health issue: Background paper for a World Bank Best Practices paper on women's health. 1993. Stockholm and Washington, DC, Sida and World Bank.

43. Dickson-Tetteh K,.Billings DL. Abortion care services provided by registered midwifes in South Africa. *International Family Planning Perspectives* 2002;**28**:144-50.

44. Coyaji KJ. Early medical abortion in India: three studies and their implications for abortion services. *J Am Med Women Assoc* 2000;**55**:191-4.

45. Coyaji K, Elul B, Krishna U, Otiv S, Ambardekar S, Bopardikar A *et al*. Mifepristone-misoprostol abortion: a trial in rural and urban Maharashtra, India. *Contraception* 2002;**66**:33-40.

46. The Population Council. Medical methods of early abortion in developing countries. Consensus statement. *Contraception* 1998;**58**:257-9.

47. Ipas and IHCAR. Deciding women's lives are worth saving: Expanding the role of midlevel providers in safe abortion care. 2002. Chapel Hill, NC, Ipas.

48. Libombo A,.Usta MB. Mozambique abortion situation: Country report. *www.ipasihcar.net/expacc/reports/MozambCR.html* 2001.(accessed 5 September 2003).

49. Sundstrom, K. Personal communication. 2003.

50. Tang OS,.Ho PC. Medical abortion in the second trimester. *Best.Pract.Res.Clin.Obstet.Gynaecol.* 2002;**16**:237-46.

51. Scheepers HC, van Erp EJ, van den Bergh AS. Use of misoprostol in first and second trimester abortion: a review. *Obstet.Gynecol.Surv.* 1999;**54**:592-600.

52. Pymar HC,.Creinin MD. Alternatives to mifepristone regimens for medical abortion. *Am.J.Obstet.Gynecol.* 2000;**183**:S54-S64.

53. Costa SH,.Vessy MP. Misoprostol and illegal abortion in Rio de Janeiro, Brazil. *Lancet* 1993;**341**:1258-61.

54. Schaff EA, Fielding SL, Westhoff C, Ellertson C, Eisinger SH, Stadalius LS *et al*. Vaginal misoprostol administered 1, 2, or 3 days after mifepristone for early medical abortion: A randomized trial. *JAMA* 2000;**284**:1948-53.

55. Elul B, Hajri S, Ngoc NN, Ellertson C, Slama CB, Pearlman E *et al*. Can women in less-developed countries use a simplified medical abortion regimen? *Lancet* 2001;**357**:1402-5.

56. Tang OS, Xu J, Cheng L, Lee SW, Ho PC. Pilot study on the use of sublingual misoprostol with mifepristone in termination of first trimester pregnancy up to 9 weeks gestation. *Hum.Reprod.* 2002;**17**:1738-40.

57. Swiss Federal Institute for Environmental Science and Technology (EAWAG). SODIS - Solar Water Disinfection. A Water Treatment Process used at Household Level. www.sodis.ch . 2003. (accessed 4 July 2003).

58. McGuigan KG, Joyce TM, Conroy RM. Solar disinfection: use of sunlight to decontaminate drinking water in developing countries. *J.Med.Microbiol.* 1999;**48**:785-7.

59. Mintz ED, Reiff FM, Tauxe RV. Safe Water Treatment and Storage In the Home: A Practical New Strategy to Prevent Waterborne Disease. *JAMA* 1995;**273**:948-53.

60. Conroy RM, Meegan ME, Joyce T, McGuigan K, Barnes J. Solar disinfection of water reduces diarrhoeal disease: an update. *Arch.Dis.Child* 1999;**81**:337-8.

61. Conroy RM, Meegan ME, Joyce T, McGuigan K, Barnes J. Solar disinfection of drinking water protects against cholera in children under 6 years of age. *Arch.Dis.Child* 2001;**85**:293-5.

62. Sobsey, Mark D. Managing water in the home: accelerated health gains from improved water supply. 2002. Geneva, World Health Organization, WHO/SDE/WSH/02.07.

63. World Health Organization. World Health Report 2000. Health Systems: Improving Performance. 2000. Geneva, WHO.

64. Acra A, Karahagopian Y, Raffoul Z, Dajani R. Disinfection of oral rehydration solutions by sunlight. *Lancet* 1980;**2**:1257-8.

65. Acra, A., Jurdi, M., Mu'Allem, H., Karahagopian, Y., and Raffoul, Z. Water disinfection by solar radiation. 1990. Ottawa, Canada, International Development Research Centre (IDRC) IDRC-TS66e.

66. Acra, A., Raffoul, Z., and Karahagopian, Y. Solar disinfection of drinking water and oral rehydration solutions: guidelines for household application in developing countries. http://ddc.aub.edu.lb/projects/health/solar-water/unesco/index.html . 1984. Department of Environmental Health, Faculty of Health Sciences - American University of Beirut, UNICEF . (accessed 6 July 2003).

67. Conroy RM, Elmore-Meegan M, Joyce T, McGuigan KG, Barnes J. Solar disinfection of drinking water and diarrhoea in Maasai children: a controlled field trial. *Lancet* 1996;**348**:1695-7.

68. Curtis V,.Cairncross S. Effect of washing hands with soap on diarrhoea risk in the community: a systematic review. *Lancet Infect.Dis.* 2003;**3**:275-81.

69. Lines J. Mosquito nets and insecticides for net treatment: a discussion of existing and potential distribution systems in Africa. *Tropical Medicine & International Health* 1996;**1**:616-32.

70. World Health Organization. Report of the Fifth WHOPES Working Group Meeting. 2003. Geneva, WHO/CDS/WHOPES/2001.4.

71. Schellenberg JR, Abdulla S, Nathan R, Mukasa O, Marchant TJ, Kikumbih N *et al*. Effect of large-scale social marketing of insecticide-treated nets on child survival in rural Tanzania. *Lancet* 2001;**357**:1241-7.

72. Curtis C, Maxwell C, Lemnge M, Kilama WL, Steketee RW, Hawley WA *et al*. Scaling-up coverage with insecticide-treated nets against malaria in Africa: who should pay? *Lancet Infect.Dis.* 2003;**3**:304-7.

73. Lengeler C. Insecticide-treated bednets and curtains for preventing malaria. *Cochrane.Database.Syst.Rev.* 2000;CD000363.

74. Howard SC, Omumbo J, Nevill C, Some ES, Donnelly CA, Snow RW. Evidence for a mass community effect of insecticide-treated bednets on the incidence of malaria on the Kenyan coast. *Trans.R.Soc.Trop.Med.Hyg.* 2000;**94**:357-60.

75. Goodman CA, Coleman PG, Mills AJ. Cost-effectiveness of malaria control in sub-Saharan Africa. *Lancet* 1999;**354**:378-85.

76. Guillet P, Alnwick D, Cham MK, Neira M, Zaim M, Heymann D *et al*. Long-lasting treated mosquito nets: a breakthrough in malaria prevention. *Bull.World Health Organ* 2001;**79**:998.

77. Roll Back Malaria Infosheet. Insecticide-treated mosquito nets. 2002. Geneva, World Health Organization.

78. World Health Organization. Scaling-up insecticide-treated netting programmes in Africa. 2002. Geneva, WHO/CDS/RBM/2002.43.

79. Abdulla S, - Schellenberg JA, Nathan R, Mukasa O, Marchant T, Smith T *et al*. Impact on malaria morbidity of a programme supplying insecticide treated nets in children aged under 2 years in Tanzania: community cross sectional study. *BMJ* 2001;**322**:270-2733.

80. Rowland M, Webster J, Saleh P, Chandramohan D, Freeman T, Pearcy B *et al*. Prevention of malaria in Afghanistan through social marketing of insecticide-treated nets: evaluation of coverage and effectiveness by cross-sectional surveys and passive surveillance. *Tropical Medicine & International Health* 2002;**7**:813-22.

81. Mathanga D,.Molyneux ME. Bednets and malaria in Africa. *Lancet* 2001;**357**:1219-20.

82. D'Alessandro U. Insecticide treated bed nets to prevent malaria : The challenge lies in implementation. *BMJ* 2001;**322**:249-50.

83. Lines, Jo. Personal communication . 2003.

84. D'Alessandro U, Olaleye BO, McGuire W, Langerock P, Bennett S, Aikins MK *et al*. Mortality and morbidity from malaria in Gambian children after introduction of an impregnated bednet programme. *Lancet* 1995;**345**:479-83.

85. Cham MK, Olaleye B, D'Alessandro U, Aikins M, Cham B, Maine N *et al*. The impact of charging for insecticide on the Gambian National Impregnated Bednet Programme. *Health Policy Plan.* 1997;**12**:240-7.

86. Snow RW, McCabe E, Mbogo CN, Molyneux CS, Some ES, Mung'ala VO *et al*. The effect of delivery mechanisms on the uptake of bed net re-impregnation in Kilifi District, Kenya. *Health Policy Plan.* 1999;**14**:18-25.

87. UNAIDS. Consom Social Marketing: Selected Case Studies. 2000. Geneva, UNAIDS. Best Practice Collection.

88. Price N. The performance of social marketing in reaching the poor and vulnerable in AIDS control programmes. *Health Policy Plan.* 2001;**16**:231-9.

89. Janani. Progress Report 2002/2003. http://www.janani.org/pdf/progressreport.pdf (accessed 13 August 2003) . 2003. 14-6-2003.

90. The Carter Center. Increase Clean Faces! Decrease Flies! Third Annual Program Review of Carter Center-assisted Trachoma Control Programs. 2002.

91. Taylor H. Towards the global elimination of trachoma. *Nat.Med.* 1999;**5**:492-3.

92. Kuper H, Solomon AW, Buchan J, Zondervan M, Foster A, Mabey D. A critical review of the SAFE strategy for the prevention of blinding trachoma. *Lancet Infect.Dis.* 2003;**3**:372-81.

93. Emerson PM, Cairncross S, Bailey RL, Mabey DC. Review of the evidence base for the 'F' and 'E' components of the SAFE strategy for trachoma control. *Trop.Med.Int.Health* 2000;**5**:515-27.

94. World Health Organization. Report of the first meeting of the WHO Alliance for the Global Elimination of Blinding Trachoma. 1997. Geneva, WHO/PBL/GET/97.1.

95. Bowman RJ, Soma OS, Alexander N, Milligan P, Rowley J, Faal H *et al*. Should trichiasis surgery be offered in the village? A community randomised trial of village vs. health centre-based surgery. *Trop.Med.Int.Health* 2000;**5**:528-33.

96. Reacher MH, Munoz B, Alghassany A, Daar AS, Elbualy M, Taylor HR *et al*. A controlled trial of surgery for trachomatous trichiasis of the upper lid. *Arch Ophthalmol* 1992;**110**:667-74.

97. International Trachoma Initiative. www.trachoma.com . 2003. (accessed 11 July 2003).

98. Bog H, Yorston D, Foster A. Results of community-based eyelid surgery for trichiasis due to trachoma. *Br.J.Ophthalmol.* 1993;**77**:81-3.

99. Graz B, Xu JM, Yao ZS, Han SR, Kok A. Trachoma: can trichiasis be treated with a sticking-plaster? A randomized clinical trial in China. *Trop.Med.Int.Health* 1999;**4**:222-8.

100. Gericke CA. An integrated strategy to reduce diarrhoea-related burden of disease in highly constrained settings. *BMJ online* 2003;**www.bmj.com/cgi/eletters/327/7405/3#34265**: (10 July 2003.

101. World Health Organization. Practical Approach to Lung Health - PAL. http://www.who.int/gtb/policyrd/PAL . 2003. (accessed 28 August 2003).

102. Oliveira-Cruz V, Hanson K, Mills A. Approaches to overcoming constraints to effective health service delivery: A review of the evidence. *Journal of International Development* 2003;**15**:41-65.

103. World Health Organization. Global Initiative for the Elimination of Avoidable Blindness. 1997. Geneva, WHO/PBL/97.61.

104. World Health Organization. Unsafe abortion: Global and regional estimates of incidence of and mortality due to unsafe abortion with a listing of available country data. 1998. Geneva, WHO/RHT/MSM/97.16.

105. Martin J. Recherche bio-médicale: intérêts privés et intérêt public. *Sante Publique* 2001;**13**:89-93.