The development and implementation of a public health strategy - Cost and health system analysis of Intermittent Preventive Treatment in Infants

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Dekan

Dedicated to my family

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

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SUMMARY

The achievements of the health Millennium Development Goal of reducing child mortality (MDG 4) depend on the massive scaling-up of new and available health interventions. Evidence shows that effective interventions to attain MDG 4 are available; however coverage rates are currently low. The health systems in developing countries lack the necessary capacity to deliver the interventions to those in need. These factors among others are the cause of millions of preventable child deaths every year.

Worldwide it is estimated that there are 247 million cases of malaria and at least 1 million deaths related to malaria each year (World Malaria Report 2008). Africa bears the greatest burden of malaria – about 86% of the global burden – leading to over 800,000 deaths per annum. Children under five years of age and pregnant women are the most affected groups. Malaria-endemic countries have lower rates of economic growth. The impact of malaria is manifested through loss of working time when people are ill or taking care of family members, through loss of resources that are used to finance treatment, and through disabilities that result from severe malaria. An episode of malaria results in loss of productivity in adults and prevents children from developing to their full capacity by impairing their cognitive ability, physical development, school attendance and performance. The average growth of income per capita for countries with severe malaria in 1965-1990 was 0.4% per year compared to 2.3% for other countries. In terms of crop harvests, malaria-affected families harvest 40% that of families not affected by malaria. Malaria impacts on long term economic development in terms of impediments on the flow of knowledge, trade, foreign investment, information transfers and tourism as well as limiting the country's ability to accumulate human capital. All these imply that malaria is responsible for inflicting poverty on people in developing countries through the vicious cycle of ill-health. These human sufferings due to malaria could be averted if access to effective

preventive and treatment interventions could be made available to all affected people.

The health systems in developing countries have limited capacity to undertake appropriate health actions to improve population health. The main constraints include shortage of financial resources, lack of capacity to institutionalize health interventions into routine health care delivery, severe human resource shortages, dilapidated health facilities and lack of essential medical supplies and equipment. The distribution of health benefits provided by the health system is not fair either, as the rate of health service utilization is lower among the poorer and more vulnerable groups.

The aim of this research was to contribute to the understanding of health system issues and costs related to integrating a new strategy of Intermittent Preventive Treatment in infants (IPTi) into the routine district health system, with a focus on providing high quality but practical evidence to inform decision making and to scaling up health services. The methodology involved using a collaborative approach to develop a delivery strategy for IPTi, to implement the strategy and to evaluate the strategy in terms of equity of intervention coverage and population benefit. Researchers worked in partnership with the Ministry of Health and Social Welfare (MoHSW) to develop an IPTi strategy that could be implemented and managed by routine health services. The Behaviour Change Communication (BCC) materials for IPTi were developed by observation studies and in-depth interviews with communities and health workers. To estimate how much it takes to develop the IPTi strategy and to maintain routine implementation of the strategy, real activities costs were tracked. Also semi-structured interviews were conducted with key informants to record time and resources spent on IPTi activities. A detailed health facility survey collected data on staff employed, their availability on the day of the survey, their main tasks and reasons for their colleagues' absenteeism. Information on supervisory visits from District Health Management Teams (CHMTs) was also collected and health workers' views

solicited on how to improve the services. A time and motion study of nurses in the Reproductive and Child Health (RCH) clinics documented staff time use by task.

The present study generated important knowledge to enable integration of health interventions into routine delivery by frontline health workers and managed by Council Health Management Teams. Using the collaborative approach, the IPTi strategy was developed to ensure that IPTi behaviour-change communication (BCC) materials were available in health facilities, that health workers were trained to administer and to document doses of IPTi so that the necessary drugs were available in facilities and that systems were in place for stock management and supervision. A brand name (MKINGE in Swahili, which means protect him or her) and two posters were developed as BCC. The posters contained key public health messages and images that explained the IPTi intervention itself, how and when children receive it and safety issues. The strategy was integrated into existing systems as far as possible and was well accepted by health staff. Thus, the collaborative approach effectively translated research findings into a strategy fit for broader health system implementation in Tanzania.

The costs of developing and implementing IPTi appeared to be affordable within the budget line of the Ministry of Health and Social Welfare. The estimated financial cost to start-up and run IPTi in the whole of Tanzania in 2005 was US$1,486,284. Start-up costs at the district level were US$7,885 per district, mainly expenditure on training. There was no incremental financial expenditure needed to deliver the intervention in health facilities as supplies were delivered alongside routine vaccinations and available health workers performed the activities without working overtime. The economic cost was estimated at 23 US cents per IPTi dose delivered. In terms of coverage, IPTi was not influenced by socio-economic status of a child, by ethnicity nor by child gender. However there was disparity in coverage by distance whereby children from households living more than 5 kms from the nearest health facility had lower IPTi coverage than

those living nearer (41% vs 58%, p=0.006). Efforts to scale-up health interventions should therefore focus on increasing physical access and to monitoring equity outcomes. Vaccine coverage was more equitable across socio-economic groups than had been reported from a similar survey in 2004.

The evaluation of human resource for health in the study area revealed particular problems with staff shortages, low productivity and staff absenteeism. Only 14% of the recommended number of nurses and 20% of the recommended number of clinical staff had been assigned to the facilities. These available health workers in southern Tanzania are below the national average of 35%. Thus, the health system in the study area is working with less than a quarter of the recommended staff by MoHSW, and combined with staff absenteeism, the available working staff decreases further compared to the recommended staff numbers. The absent health workers were away for seminar sessions (38%), long term training (8%) or on official travels 25% and on leave (20%). Of those health workers present at the reproductive and child health clinic at the time of the survey, average productive working time equaled 57% of their time present at work. In terms of monthly supervision visits by the Council Health Management Teams, only 14% of facilities had received the required number of supervisory visits during the 6 months preceding the survey.

The findings of this thesis underline the importance of operational research as a systematic way to establish how new interventions work under routine health system conditions. The lessons described in this thesis have great significance for the future of public health strategies, both existing and new. The generated information on costs and experience with the issues surrounding design of the delivery mechanisms, training, supervision and development of implementation guidelines created a strong institutional framework that could speed up implementation at country level whenever there is a policy recommendation. It is expected that the experience generated and the evidence gathered as part of this thesis can contribute to an improved understanding of the issues that need to

be considered and tackled in order to spearhead routine implementation of malaria interventions and potentially other diseases to achieve high health service access and improved quality care that is a foundation for improved population health.

This study recommends increased resources for funding operational studies to provide evidence of how proven effective tools to fight diseases of the poor work under real life application through routine health delivery system. Other recommendations of this thesis are related to the need to strengthen supervision of health facilities by CHMTs and by higher levels to supervise the district supervisors. There is also an urgent need to develop and test incentive packages in local settings. These measures are necessary to increase health workers productivity, increase staff moral and retention, curb absenteeism and realize health workers balance between urban and rural health facilities in developing countries. Only by exploring many of the factors highlighted above, and throughout this thesis, can the timely and high scale-up of health interventions be achieved.

ZUSAMMENFASSUNG

Das Erreichen des Millenium-Entwicklungsziels (MEZ) zur Senkung der Kindersterblichkeit (MEZ 4) basiert auf dem massiven „upscaling“ von neuen und bereits bestehenden Gesundheitsinterventionen. Studien zeigen auf, dass zwar effiziente Interventionen zur Erreichung des vierten MEZs vorhanden sind, die von ihnen abgedeckten Bereiche aber gering sind. Gesundheitssysteme in Entwicklungsländern verfügen nicht über die notwendigen Kapazitäten, Interventionen für diejenigen zu schaffen, die diese am meisten benötigen. Diese Faktoren – im Zusammenspiel mit anderen – führen jedes Jahr zum Tod von Millionen von Kindern.

Nach Schätzungen des Welt-Malaria-Berichts 2008 verursacht Malaria jedes Jahr weltweit rund 247 Millionen Krankheitsfälle und führt in mindestens einer Million Fällen zum Tod. Mit etwa 86% der weltweiten Malariaerkrankungen – und damit über 800’000 Todesfällen pro Jahr – ist Afrika ist am stärksten betroffen, wobei Kinder unter fünf Jahren und schwangere Frauen das grösste Risiko tragen. Malaria-endemische Länder verfügen über ein vergleichsweise geringes ökonomisches Wachstum. Die Auswirkungen von Malaria zeigen sich einerseits am Ausfall von Arbeitskräften aufgrund der Krankheit selbst oder der Pflege anderer Kranker, anderseits am Ressourcenverlust, der durch die Behandlungskosten entsteht, aber auch an körperlichen und geistigen Behinderungen, die Folge schwerer Malariaerkrankungen sein können. Malariaepisoden führen bei Erwachsenen zu einer geringeren Produktivität, und bei Kindern zu einer verminderten Entfaltung ihrer Fähigkeiten durch die Beeinträchtigung ihrer körperlichen und kognitiven Entwicklung, sowie durch reduzierte Schulbesuche und -leistungen. Das Durchschnittswachstum des Pro-Kopf-Einkommens zwischen 1965-1990 in Ländern, in denen schwere Formen von Malaria auftreten, lag bei 0.4% pro Jahr verglichen zu 2.3% in anderen Ländern. Familien, die von Malaria betroffen sind, erzielen nur 40% der Ernteerträge von gesunden Familien. Malaria wirkt sich negativ auf den Wissens-

und Informationenfluss, den Handel, Auslandsinvestitionen, den Tourismus und die Akkumulation von Humankapital aus, und damit langfristig auf die ökonomische Entwicklung eines Landes. Dies bedeutet, dass Malaria zu einem Teufelskreis aus Armut und Krankheit in Entwicklungsländern beiträgt. Das durch Malaria verursachte Leid kann nur vermieden werden, wenn der Zugang zu bereits vorhandenen effizienten präventiven und kurativen Interventionen so verbessert wird, dass alle Betroffenen erreicht werden.

Gesundheitssysteme in Entwicklungsländern verfügen nur über eingeschränkte Kapazitäten und Handlungsspielräume, um die Gesundheit der Bevölkerung zu verbessern. Die Haupteinschränkungen umfassen limitierte finanzielle Ressourcen, sowie die fehlende Fähigkeit, gesundheitsorientierte Interventionen zu institutionalisieren und in die bestehende Behandlungsroutine zu integrieren. Weitere Faktoren sind Personalmangel und marode Gesundheitsinstitutionen, in denen es am notwendigen medizinischen Zubehör fehlt. Das Gesundheitsystem ist ungleich und ungerecht in seiner Verteilung, so dass arme und vulnerable Gruppen am wenigsten von Gesundheitsdienstleistungen profitieren.

Das Ziel dieser Studie ist es, zum Verständnis von Gesundheitssystemen und den Kosten beizutragen, die mit der Integration einer neuen IPTi-Strategie ins bestehende Gesundheitssystem auf Distriktebene verbunden sind. Die Arbeit konzentriert sich darauf, durch Erkenntnisse von hoher Qualität und Praxisrelevanz einen Beitrag zum Entscheidungsfindungsprozess und dem „upscaling“ der Intervention zu leisten. Methodologisch wurde ein auf Zusammenarbeit basierender Ansatz gewählt, um eine IPTi-Abgabe-Strategie zu entwickeln und zu implementieren, aber auch um die Abdeckung zu evaluieren und damit herauszufinden, wie die verschiedenen Segmente der Bevölkerung von der Intervention profitieren. Die Wissenschafter arbeiteten partnerschaftlich mit dem Ministerium für Gesundheit und sozialem Wohlergehen zusammen. Dabei wurde eine IPTi-Strategie entwickelt, die von den bereits bestehenden Gesundheitsdiensten implementiert und gehandhabt werden kann.

Kommunikationsmaterial, das auf eine Verhaltensänderung im Bezug auf IPTi hinwirken soll, wurde aufgrund von Beobachtungen und Tiefeninterviews mit der Bevölkerung und dem Gesundheitspersonal entwickelt. Um abzuschätzen, wie viel es kosten würde, eine IPTi-Strategie zu entwickeln, umzusetzen und aufrechtzuerhalten, wurden die in der alltäglichen Praxis anfallende Kosten analysiert. Ausserdem wurden halb-strukturierte Interviews mit Schlüsselinformanten geführt, um die für die IPTi-Abgabe aufgewendete Zeit und Ressourcen zu erfassen. Anhand einer detaillierten Studie in den Gesundheitszentren wurden Daten zum Personal, dessen Anwesenheit am Tag der Studie, dessen Hauptaufgaben und Gründe für Abwesenheit erhoben. Informationen zu den Supervisions-Besuchen der Distrikt-Gesundheitsteams wurden gesammelt und das Gesundheitspersonal nach ihrer Meinung befragt, wie die Dienstleistungen verbessert werden könnten. Eine Arbeitsablaufsstudie unter Krankenschwestern von Mutter-Kind-Kliniken zeigte die Zeit auf, die pro Dienstleistung aufgewendet wird.

Die vorliegende Studie erbrachte wichtige Erkenntnisse, um Gesundheitsinterventionen gemeinsam mit dem Gesundheitspersonal mit direktem Kundenkontakt und den sogenannten Council Health Management Teams (CHMT) ins normale Gesundheitssystem integrieren zu können. Mithilfe des gemeinschaftlichen Ansatzes wurde eine IPTi-Strategie entwickelt, die die Verfügbarkeit von Kommunikationsmaterial, das auf eine Verhaltensänderung im Bezug auf IPTi hinwirken soll, in den Gesundheitszentren sicherstellt. Des weiteren wurde hiermit gewährleistet, dass Gesundheitspersonal für die Abgabe und Dokumentation von IPTi-Dosen geschult wurde, die notwendigen Medikamente in den Gesundheitszentren erhältlich sind, und ein System für die Verwaltung der Medikamentenvorräte und Supervision vorhanden ist. Ein Markenname (MKINGE auf Suaheli, was so viel bedeutet wie „beschütze ihn/sie“) und zwei unterschiedliche Plakattypen wurden als Kommunikationsmaterial entwickelt. Die Plakate enthalten zentrale Gesundheitsbotschaften und Bilder, die einerseits die IPTi-Intervention selbst

erklären, andererseits aber auch vermitteln, wie und wann Kinder IPTi erhalten sollten und wie sicher die IPTi ist. Die Strategie wurde so weit als möglich in das bereits bestehende System integriert und vom Gesundheitspersonal gut akzeptiert. Der gemeinschaftliche Ansatz erlaubte es, Erkenntnisse aus der Forschung effizient in eine Strategie zu umzusetzen, die eine Implementierung durch das öffentliche Gesundheitssystem in Tansania ermöglicht.

Die Entwicklungs- und Implementierungskosten der IPTi-Strategie bewegen sich im Rahmen der Budgetvorgaben des Ministeriums für Gesundheit und sozialem Wohlergehen. Die geschätzten Implementierungs- und Laufkosten für die landesweite IPTi-Intervention beliefen sich im Jahr 2005 auf 1'486'284 USD. Implementierungskosten auf der Distriktebene lagen bei 7'885 USD pro Distrikt und entstanden hauptsächlich durch die Schulung des Gesundheitspersonals. In den Gesundheitszentren fielen durch die Intervention keine bemerkenswerten zusätzlichen Kosten an, da das benötigte Material zusammen mit den Impfungen geliefert werden konnte, und das Gesundheitspersonal die Aktivitäten innerhalb der normalen Arbeitszeit ausführen konnte. Die ökonomischen Kosten werden auf 23 USCents pro IPTi-Dosis geschätzt.
Auf die Ausbreitung vom IPTi hat weder der sozio-ökonomische Status von Kindern noch deren Ethnizität und Geschlecht einen Einfluss. Unterschiede in der Verbreitung sind jedoch hinsichtlich der Entfernung zu Gesundheitszentren erkennbar: Kinder, die weiter als 5 Kilometer von einem Gesundheitszentrum entfernt leben, erhielten weniger IPTi im Vergleich zu Kindern, die näher an Gesundheitszentren wohnen (41% vs 58%, p=0.006). Bemühungen, das „upscaling“ der Intervention voranzutreiben, sollten daher auf geographische Faktoren und die Sicherstellung der Verteilungsgerechtigkeit bedacht sein. Es zeigte sich, dass Impfungsraten gerechter verteilt waren als in einer vergleichbare Studie von 2004.

Die Evaluierung der Humanressourcen im Studiengebiet zeigte Problembereiche vor allem hinsichtlich des Mangels an Personal, niedriger Produktivität und

Personalabsenzen auf. Nur gerade 14% bzw. 20% der empfohlenen Menge an Krankenschwestern bzw. an klinischem Personal waren in den Gesundheitszentren tätig. Die Zahl des im südlichen Tansania angestellten Gesundheitspersonals liegt damit unter dem nationalen Durchschnitt von 35%. Das Gesundheitssystem im Forschungsgebiet muss somit mit weniger als einem Viertel des vom Gesundheitsministerium empfohlenen Personals auskommen, bzw. mit einer noch geringeren Menge, werden Fehlzeiten mit eingerechnet. Das abwesende Gesundheitspersonal war entweder in einer Weiterbildung (38%), in der Ausbildungen (8%), auf Geschäftsreise (25%) oder hatte Urlaub (20%). Die durchschnittliche produktive Arbeitszeit des Personals, das zum Zeitpunkt der Studie in den Mutter-Kind-Kliniken anwesend war, belief sich auf 57% der gesamten Anwesenheitsdauer. Nur gerade 14% der Gesundheitszentren erhielten die vorgeschriebene Anzahl monatliche Supervisionsbesuche durch die Community Health Management Teams (CHMT) in den letzten 6 Monaten vor der Studie.

Die Ergebnisse dieser Dissertation unterstreichen die Bedeutung operationeller Forschung bei der systematischen Untersuchung der Alltagstauglichkeit einer neuen Intervention. Die in dieser Arbeit beschriebenen Erkenntnisse sind relevant für die Zukunft von bereits existierenden wie auch neuen Gesundheitsstrategien. Die gewonnenen Informationen zu den Kosten und die Erfahrungen hinsichtlich der Entwicklung von Abgabemechanismen, Schulung und Supervision des Personals und der Entwicklung von Leitlinien bilden einen starken institutionellen Rahmen, der es ermöglicht, Interventionen schneller zu verbreiten, wann immer das von der Politik empfohlen wird. Es wird erwartet, dass die im Zuge dieser Dissertation generierten Erfahrungen und die gesammelten Erkenntnisse zu einem verbesserten Verständnis der Faktoren beitragen, die beachtet und gelöst werden müssen, um die Implementierung von Interventionen gegen Malaria und anderen potentiellen Krankheiten voranzutreiben. Nur so kann ein allgemeiner Zugang erlangt werden, der die Basis für eine verbesserte Gesundheit der Bevölkerung bildet.

Die vorliegende Studie empfiehlt, operationelle Studien, die die Alltagstauglichkeit von erprobten und effizienten Gesundheitsstrategien zur Bekämpfung von Armutskrankheiten aufzeigen, vermehrt finanziell zu unterstützen. Des Weiteren wird eine verstärkte Supervision des Gesundheitspersonals durch die CHMTs, und auf höherer Ebene des Distrikt Supervisors, empfohlen. Um die Produktivität und die Arbeitsmoral des Gesundheitspersonals zu erhöhen, sowie Absenzen und Personalfluktuation zu senken, müssen Anreizmechanismen entwickelt und unter lokalen Bedingungen getestet werden. Es muss anerkannt werden, dass Gesundheitspersonal in Entwicklungsländern zwischen ländlichen und städtischen Gesundheitszentren abwägt. Nur durch die Untersuchung der oben und in der gesamten Dissertation diskutierten Faktoren kann ein zeitgerechtes und hohes „upscaling“ von Gesundheitsinterventionen erreicht werden.

CHAPTER 1: BACKGROUND

High population coverage of cost-effective health interventions among young children is necessary for achievement of the Millennium Development Goals to reduce child mortality. This chapter provides background information with regards to coverage of life saving interventions for under-fives and the burden of malaria in terms of public health and economics. This is followed with a discussion on the performance of the available malaria control tools and introduction of Intermittent Preventive Treatment in infant (IPTi) as a new promising tool for malaria and anaemia control. Then, a concluding remark is given at the end of the chapter.

1.1 Coverage of life saving interventions

In 2000, the UN Millennium Declaration was signed by 189 countries of the world, and then translated into eight Millennium Development Goals (MDGs) to be reached by 2015[1]. Three of the eight goals are related to improving health for all. MDG 4 aims at reducing child mortality by two thirds amongst children under-five, MDG 5 targets maternal health and aims to reduce by three quarters the maternal mortality ratio. MDG 6 emphasizes combating HIV/AIDS, malaria and major infectious diseases by halting and reversing their incidence and spread. It has been established that effective interventions to attain MDG 4 are available [2, 3]. Unfortunately, in most developing countries, coverage rates of effective services are low [4-6] leading to the death of millions of children every year [7, 8]

Low intervention coverage is more likely to affect the poorest members of the community [4, 6, 9]. Reaching the poorest populations in developing countries is a great challenge as they in most cases face financial barriers, live in the most remote areas and they are marginalized socially or culturally. Poor families live in dwellings that offer little protection against mosquitoes and are less able to afford insecticide-treated nets; also they are less likely to be able to pay either for effective malaria treatment or for transportation to a health facility capable of

treating the disease. Studies have estimated that the lowest quintile in terms of assets ownership as measured in developing countries [10] bear a higher percent of disease burden compared to other quintiles [11]. Although integrated delivery of interventions is cost effective, sometimes packaging several interventions is detrimental to the poorest especially when delivered through a single strategy [12]. To achieve intervention impact in the poorest segment of the population as well as vulnerable and marginalized (children, women and elderly), deliberate approaches are needed. This is of paramount importance in terms of designing interventions to increase coverage specific for them.

In most developing countries, mere innovation of effective means to fight diseases in terms of drugs or vaccine and subsequent delivery to the country-level does not necessarily translate into effectiveness at community level [13]. Although some countries have shown promising tendencies to attain the health-related MDGs [14], the levels of coverage for child survival to attain MDGs 4 and 6 still fall short of annual targets to 2015 in many countries [15]. Bryce and other showed that interventions that can be routinely scheduled, such as immunization and antenatal care, had much higher coverage than those that rely on functional health systems and 24-hour availability of clinical services such as management of ill children [15]. In recent years, there have been increased awareness and many calls for action to increase effort in controlling diseases in developing countries including re-evaluation of the applied strategies [16-19]. All these calls aim at reaching the health-related MDGs and alleviating the threat of malaria, tuberculosis and HIV/ AIDS through affecting mass coverage of essential health interventions to attain community and equity effectiveness. Regardless of the various initiatives taken, sadly malaria still exerts a large economic and demographic toll on the populations of developing countries. In the following sub-sections, more discussion related to the importance of malaria as a public health problem is provided.

1.2 The burden of malaria

1.2.1 Malaria global picture

Malaria is an important global public health threat across much of the planet. In 2006, it accounted to 247 million cases among 3.3 billion people at risk causing nearly one million deaths, mostly children under five years of age [20]. The World Malaria Report shows the global distribution of malaria as 86% of the cases occur in Africa and that *Plasmodium falciparum* is the type of malaria that is responsible for most deaths. The recent estimates of annual number of deaths that includes under 5 years directly due to malaria in Africa is over 800,000 [8]. In the affected areas the most vulnerable groups are children under five years of age whose immunity is still weak, and pregnant women whose immunity is temporarily impaired as a result of pregnancy.

The available evidence on the economic impact of malaria in sub-Saharan Africa can be categorized in terms of effect on labour efficiency and land use, effect on school attendance, performance and cognitive impairment as well as in terms of expenditures by households and the public health sector. In terms of malaria effect on productivity, it has been established that there is a correlation between malaria and economic growth whereby malaria-endemic countries have lower rates of economic growth [21, 22]. The impact is manifested through loss of working time when people are ill or taking care of family members, through loss of resources that are used to finance treatment, and through disabilities that result from severe malaria. An episode of malaria results in loss of productivity in adults and prevents children from developing to their full capacity by impairing their cognitive ability, physical development, school attendance and performance [23, 24].

Malaria affects long-term economic growth in African countries. Gallup and Sachs have reported that the average growth of income per capita for countries with severe malaria in 1965-1990 has been 0.4% per year compared to 2.3% for other countries [21]. In terms of crop harvests, malaria-affected families harvest

only 40 per cent that of families not affected by malaria [25].Through a variety of mechanisms, therefore malaria impacts on long term economic development in terms of impediments on the flow of knowledge, trade, foreign investment, information transfers and tourism as well as limiting the country's ability to accumulate human capital [22, 26]. All these imply that malaria is responsible for inflicting poverty on people in developing countries through the vicious cycle of ill-health. These human sufferings due to malaria could only be averted if access to the available effective preventive and treatment interventions could reach all affected people.

1.2.2 Malaria in Tanzania

Tanzania is subject to intense, perennial *P falciparum* malaria transmission. It is estimated that 11.5 million malaria cases occurred in 2006 and 15 000–20 000 deaths were reported annually between 2003 and 2006 [20]. Malaria accounts for 39% of the national disease burden, 43% of under-five outpatient attendance, 35% of under-five hospital admissions and 37% of under-five hospital deaths [27]. Malaria is also a cause of severe anaemia among the under-fives [28]. Among pregnant women, malaria and anaemia are responsible for 25% of all maternal deaths [29]. Disability Adjusted Life Years (DALYs) are a measurement of how many years are lost by premature death and ill health due to an illness. On an illness scale, for the leading causes of DALYs lost worldwide, malaria is the eighth most important factor. In Tanzania in 2002, the estimated total DALY rate due to malaria was 5687 per 100,000 populations [30]. As a country, Tanzania loses 3.4% of its GDP estimated at US$240 million as direct and indirect costs of malaria [31]. Jowett and others estimated that malaria related expenditures in Tanzania is 1.1% of Gross Domestic Product (GDP) representing US$2.2 per capita, and 39% of total national health expenditure[32]. The household bears the greatest burden of malaria expenditures (71%) in the formal and informal private sector while the government contributes 20% and donors 9%[33]. One-third of total malaria expenditure is on anti-malarial drugs. As such malaria is affecting Tanzanians' life and their economic well being.

1.3 Malaria control tools and performance

In the previous sub-section, the burden of malaria in terms of public health and its impact on economies has been explained. In the current sub-section, outline of strategies and targets of malaria control will be given followed by explanation of the extent to which the various target have been reached (as a performance indicator) based on available literatures.

1.3.1 Global fight against malaria

The progress of scientific knowledge in the recent past has led to a number of effective health interventions being available for the priority health problems in low income countries [3]. With regards to malaria, there are a number of control tools in place as identified by the Roll Back Malaria (RBM) Partnership. These include prompt access to effective treatment using ACTs; use of long lasting insecticide-treated nets (LLINs) and early detection of and response to malaria epidemics; as well as prevention and treatment of malaria in pregnant women in highly endemic areas (IPTp) using SP. There is not yet a malaria vaccine. The main health targets of the Partnership are to halve malaria-associated mortality by 2010 and by 2015 to reverse the incidence of malaria. According to the World Health Assembly description, the specific set targets are to reduce the malaria burden at least 50% by 2010 and 75% by 2015 as well as increase to 80% the coverage of curative and preventive measures [34]. The year 2005 was set as a reference for measuring the changes in malaria morbidity and mortality. In recent years, the “Global Malaria Action Plan” was endorsed with goals to eliminate and eradicate malaria [35]. The earmarked strategies include sustained coverage of available malaria control to reduce the current burden, to eliminate malaria transmission over time and moving towards eradication through research on new tools and approaches. The performance of the outlined tools towards the set targets is provided in the following paragraphs.

Prompt malaria treatment in Africa is one of the principal strategies for the control of the disease. Its performance is hampered by high resistance level of

Plasmodium falciparum to the most affordable drugs such as chloroquine and sulfadoxine-pyrimethamine [36] as well as logistic difficulties in supply. Availability of artemisinin-based combination therapy (ACT), a highly effective treatment against falciparum malaria, was expected to improve treatment outcomes, but again its cost is very high compared to the drugs it replaces [37, 38]. According to WHO report, the procurement of antimalarial medicines through public health services increased by 2006, but access to treatment, especially of ACT, was inadequate in many countries [20]. The report further showed that in 18 African countries, 38% of children with fever were treated with antimalarial drugs, but only 3% with ACT. Weak health systems fail to deliver drugs on time posing more challenges to prompt malaria treatment [39, 40]. For example, in Tanzania road is the main distribution channel, some of them are impassable during rainy season to distribute drugs, vaccines and medical supplies from a port city of Dar es Salaam to 8 zonal offices throughout the country, to districts headquarters and then to health facilities. Other constraints to prompt malaria treatment is related to shortages of trained health workers to deliver the services and also delays on the part of health consumers in seeking care associated with their perception of the disease [41-44] and the sometimes long distances to health facilities. Thus both socio-cultural and health system factors are responsible for delaying access to prompt malaria treatment.

Insecticide-treated nets (ITNs) and the increasing use of long lasting treated nets (LLINs) represent a practical means to prevent malaria as it is the most cost effective method for malaria vector control [45]. Widespread use of LLINs reduces mosquito density and biting intensities [46]. In terms of global performance, the coverage is still low. The surveys conducted worldwide from 1999 to 2004 have shown that the median proportion of children under 5 years of age using ITNs was only 3%, ranging from 0.1% to 63% across 34 countries [47]. In recent years, LLIN coverage has improved. Surveys in 18 African countries found that 34% of households owned an ITN; 23% of children and 27% of pregnant women slept under an ITN. This implies more work needs to be done to

increase coverage to the 80% set goal and to change people's behaviour to more encourage use of the owned nets.

The malaria community has been debating on what should be the appropriate delivery mechanism to increase the coverage rates of ITNs [48, 49]. Although use of cost sharing methods combined with targeted public subsidies alongside social marketing has been successful in some parts of the world [50, 51], intensive promotion through mass distribution on National Immunization Days (NID) achieve the most rapid increases in coverage [52]. Other experiences have shown that the distribution of free nets to be a good way to reach all social groups and good results have been documented in some parts of developing countries [49]. However, Integrated approaches that include mass distribution, routine delivery and creation of enabling environment has high potential for coverage increases, guarantees sustainability of net availability and strengthens the overall health delivery system [48, 53]. Under integrated service delivery more child health interventions could be scaled up, efficiently utilize available human and infrastructure resources and hence realize good health outcomes.

Insecticides Residual Spraying (IRS) using DDT for malaria control had been used since 1940's to eradicate malaria in developed countries. There are many success stories in malaria reduction using IRS [54]. In recent years there has been renewed interest to apply IRS for malaria vector control especially following the recent agenda on malaria eradication [35], but its implementation has been adopted very slowly. The World Malaria report in 2008 showed that only 5 African countries had IRS coverage sufficient to protect at least 70% of people at risk of malaria [20]. Concern over the insecticide side effects and resistance raises challenge over IRS long term application. More research is needed for an alternative insecticide [55, 56]. The use of IRS needs to be associated with resistance monitoring of the insecticides and research to develop alternative effective and cheap insecticides.

Overall, there is a positive trend in adopting the available malaria control tools, but the coverage is still low to attain the set goals by RBM initiatives due to challenges related to health system. In the World Malaria Report 2005, it was reported that implementation of malaria control strategies by most countries was not undertaken as recommended by RBM until 2000 [47]. Initially the implementation was limited by a shortage of resources for procurement of commodities such as drugs and ITNs. With the recent increase in global funds for malaria, the progress to scale up the malaria interventions is encouraging, but household surveys and data from national malaria control programmes (NMCPs) show that the coverage of all interventions in 2006 was far lower in most African countries than the 80% target set by the World Health Assembly [20]. In terms of the impact of the interventions to fight malaria, few countries have recorded reduced malaria cases and deaths by 50% or more between 2000 and 2007 [20]. Countries from the African region that have achieved this degree of success are characterized by relatively small populations, and they already had good surveillance and high intervention coverage. Therefore health system research is paramount to find ways to ease challenges in the implementation of malaria control strategies.

In recent years, Intermittent Preventive Treatment in infant (IPTi) has been developed as a new promising tool for malaria and anaemia control. IPTi is the delivery of a treatment dose of an antimalarial at a pre-specified time, regardless of the presence of symptoms or P falciparum parasitaemia. It involves administration of a dose of sulphadoxine–pyrimethamine to children when they attended routine vaccination clinics at 2, 3 and 9 months of age regardless of whether or not a child has symptoms or parasitaemia. Efficacy evidence on IPTi was available from 2001 [47] and more evidence has been generated in recent years [48-54]. The results of these various trials suggested that IPTi delivered through the Expanded Program on Immunization, might be a useful approach to controlling malaria in countries where it is endemic.

1.3.2 Malaria control in Tanzania

The key strategies to control malaria in Tanzania include effective treatment, vector control using ITNs and LLINs, prevention in pregnant women using Intermittent Preventive Treatment in pregnancy (IPTp), and emergency preparedness and response in highland areas with seasonal transmission. Recently, Insecticide Residual Spraying has been introduced in only a few regions in the country. The next paragraphs present the implementation of each tool, its success and obstacles.

Tanzania changed malaria drug policy twice between 2001 and 2006. She changed from chloroquine to SP in 2001 and again SP to Artemisia-based Combination therapy (ACTs) in 2006 following increased levels of drug resistance. Cost is the main challenge in the deployment and use of ACTs in Tanzania as in other African countries. The ACTs are over 10 times more expensive than the conventional monotherapy drugs used. The cost is relatively low in public outlets but in Tanzania over 80% of malaria cases are treated either at home or in private facilities where over the counter drugs are used [57]. Over the counter prices of antimalarial in Tanzania differ depending on the manufacturing country. Drugs from European countries are more expensive, followed by those from India and then locally-produced drugs. In this manner coartem is sold at US$6-10, SP at US$0.5-1.5 and chloroquine at below US$0.1 per dose. The funds available from global health initiatives especially GFATM has helped to assure supply of ACTs in developing countries.

The efficient implementation of prompt malaria treatment in Tanzania is constrained by many factors. In the peripheral health facilities, diagnostic tools and expertise are very limited [58]. Malaria diagnosis is usually made on clinical grounds when a child presents with fever. It was reported that one-fourth of children under age five had a fever in the two weeks preceding a Demographic and Health survey (DHS) in 2004-5. Among those sick with fever, 58 percent received antimalarial drugs, and less than half of these received prompt

treatment as recommended within 24 hours of the fever onset and 3 percent of the sick children received home treatment [59].

Intermittent preventive treatment during pregnancy (IPTp) using SP is a policy in Tanzania to protect women against malaria. It is reported in a survey conducted in 2004-5 that 53 percent of pregnant women have taken at least one dose of SP during their pregnancy for prevention of malaria. However, only 22 percent received the recommended two doses and those in urban areas were more likely to receive IPTp (29%) than women in rural areas (20%).There has been constraints related to IPTp delivery including lack of management system that lead to difficulties in counting women with IPTp, women's late booking, understaffing, inadequate skills of most health workers and their poor motivation as well as problems of unreliable supply of SP following changes of the recommended first line malaria treatment [60, 61]

According to Cochrane database of systematic reviews, ITNs reduced the incidence of uncomplicated malarial episodes by 50% compared to no nets [45] where it is estimated that 5.5 lives could be saved each year for every 1,000 children protected with ITNs. In Tanzania, ITN coverage is increasing but the overall coverage rate is still low. Results from a 2004-5 Demographic and Health Survey (DHS) in Tanzania showed that although half of Tanzanian households reported owning a mosquito net, only 23 percent own an ITN. ITN use a night before the survey was only 16% for under-fives and the same for pregnant women on mainland Tanzania. This shows that there is a long way to realize high ITN use and efforts are required to change behaviour with regard to ITN usage. Discount vouchers for insecticide-treated nets have been used in Tanzania to deliver a targeted subsidy for pregnant women and their infants with support of funds from the Global Fund to Fight AIDS Tuberculosis and Malaria while at the same time providing support to the development of the commercial ITN distribution system. This strategy has helped increase net ownership and coverage whereby commercial sales of ITNs in 2005 reached over 2.4 million, an

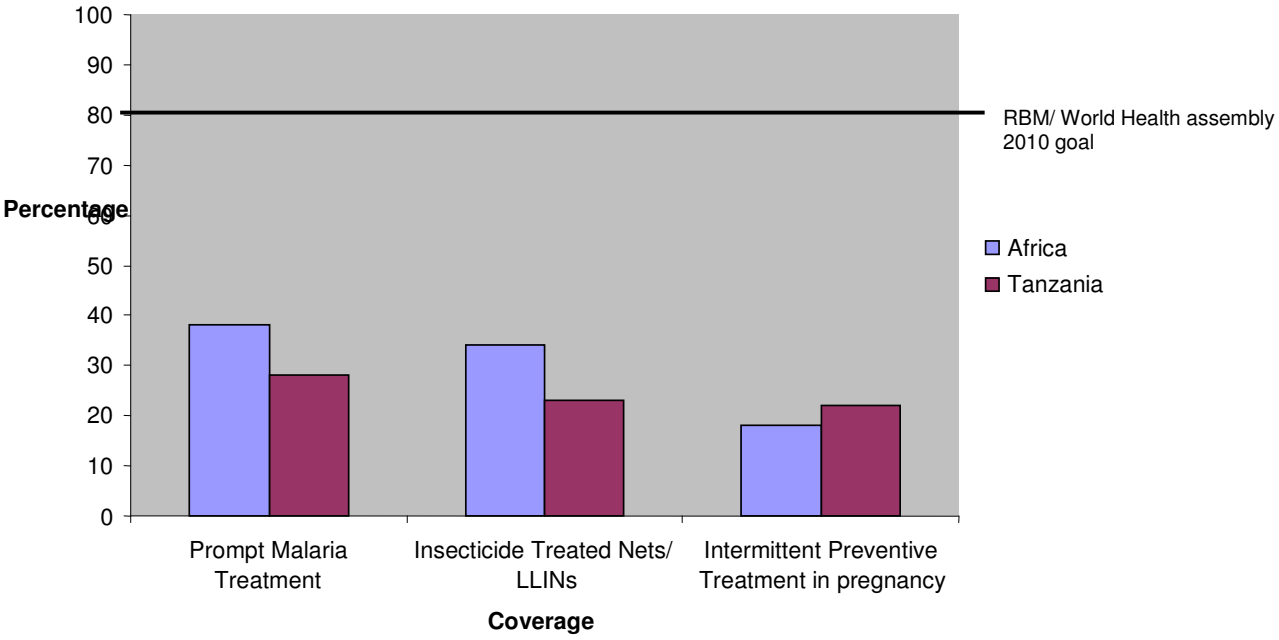
increase of 34 percent over the previous year 2004 [62]. Employment of mass distribution campaigns has contributed to increasing ITN coverage in Tanzania[52]. In effect the National Malaria Control Programme (NMCP) in Tanzania promotes multiple approaches in ITN delivery that include commercial delivery, use of discount vouchers and mass distribution to achieve high coverage and sustainability. Regarding the impact of malaria control strategies in Tanzania, the numbers of cases and deaths have been significantly reduced in Zanzibar, linked to high coverage of LLINs and ACT [20]. On the mainland, the NMCP distributed more than 2 million ITNs annually in 2005, 2006 and 2007, and IRS began in 2007. Thus, the progress in the fight against malaria in Tanzania is encouraging, but there remain obstacles related to health system hampering Tanzania from reaching 80% LLIN coverage and treat more children with antimalarial within 24 hours of malaria onset.

Malaria epidemics prevention and control is taking place in 25% of the districts in Tanzania which are prone to malaria epidemics. In these districts Malaria Epidemic Early Detection system (MEED) has been established to mitigate epidemics [63]. The mechanism is being supported by an integrated disease surveillance and response strategy which is based on plotting weekly and monthly malaria cases on a monitoring chart designed with a threshold representing alert and action lines derived from retrospective data for each health facility. The system enables districts to note, take action and report any drastic increase in the number of malaria cases and deaths. Unfortunately the global change of weather has increased malaria in the highlands which were previously not affected and the surveillance system is not working very well due to health workers failure to interpret and use collected data. As a result some districts in the north west part are frequently affected by malaria outbreak due to presence of underdeveloped health management information system [64].

With regards to adoption of the available malaria control tools, Tanzania is making reasonable progress, however major system constraints still remain thus

preventing the country from attaining the international malaria control targets. These include inadequate human, financial, material resources and limited capacity to generate and use information to make decisions and set priorities, thus leading to stagnation over time.

Figure 1.1: Coverage of malaria control tools 2006



1.4 Conclusion

In this chapter, the burden of malaria has been presented which showed that malaria is still causing a high degree of human suffering as well as causing significant economic toll, particularly in developing countries. The coverage of available effective malaria interventions in Africa in general and Tanzania specifically are still falling short of the 80% RBM and World Assembly goals to be reached by 2010 as in Figure 1. This translates into low prospects for progress towards set malaria targets and international health goals. There is room to do more. Particular attention needs to be paid to the range of challenges that have been compromising optimal programs implementation and preventing to translate

into effectiveness at community-level. The success of sustainable malaria control and any move towards eradication depends on the functioning of the health system. First is the use of integrated approach tailored to a specific setting and second a sound health system delivery approach whereby integration is achieved not only through a combination of malaria control tools but these tools embedded into the health systems context. In the next chapter, the health system concept is introduced and challenges are discussed in relation to attainment of malaria control targets and health improvements.

References:

1. United Nations: **Millennium Declaration: United Nations General Assembly Resolution 55/2. New York. [http://www.un.org/millennium]**. 2000.
2. Darmstadt GL, Bhutta ZA, Cousens S, Adam T, Walker N, de Bernis L: **Evidence-based, cost-effective interventions: how many newborn babies can we save?** *Lancet* 2005, **365**(9463):977-988.
3. Jones G, Steketee RW, Black RE, Bhutta ZA, Morris SS: **How many child deaths can we prevent this year?** *Lancet* 2003, **362**(9377):65-71.
4. Mahmud Khan M, Hotchkiss DR, Berruti AA, Hutchinson PL: **Geographic aspects of poverty and health in Tanzania: does living in a poor area matter?** *Health Policy Plan* 2006, **21**(2):110-122.
5. Onwujekwe O, Malik el F, Mustafa SH, Mnzavaa A: **Do malaria preventive interventions reach the poor? Socioeconomic inequities in expenditure on and use of mosquito control tools in Sudan**. *Health policy and planning* 2006, **21**(1):10-16.
6. Victora CG, Wagstaff A, Schellenberg JA, Gwatkin D, Claeson M, Habicht JP: **Applying an equity lens to child health and mortality: more of the same is not enough**. *Lancet* 2003, **362**(9379):233-241.
7. Black RE, Morris SS, Bryce J: **Where and why are 10 million children dying every year?** *Lancet* 2003, **361**(9376):2226-2234.
8. Rowe AK, Rowe SY, Snow RW, Korenromp EL, Schellenberg JR, Stein C, Nahlen BL, Bryce J, Black RE, Steketee RW: **The burden of malaria mortality among African children in the year 2000**. *International journal of epidemiology* 2006, **35**(3):691-704.
9. Gwatkin DR, Bhuiya A, Victora CG: **Making health systems more equitable**. *Lancet* 2004, **364**(9441):1273-1280.
10. Nathan R, Masanja H, Mshinda H, Schellenberg JA, de Savigny D, Lengeler C, Tanner M, Victora CG: **Mosquito nets and the poor: can social marketing redress inequities in access?** *Trop Med Int Health* 2004, **9**(10):1121-1126.
11. Gwatkin DR: **Health inequalities and the health of the poor: what do we know? What can we do?** *Bulletin of the World Health Organization* 2000, **78**(1):3-18.
12. Victora CG, Fenn B, Bryce J, Kirkwood BR: **Co-coverage of preventive interventions and implications for child-survival strategies: evidence from national surveys**. *Lancet* 2005, **366**(9495):1460-1466.
13. Amin AA, Hughes DA, Marsh V, Abuya TO, Kokwaro GO, Winstanley PA, Ochola SA, Snow RW: **The difference between effectiveness and efficacy of antimalarial drugs in Kenya**. *Trop Med Int Health* 2004, **9**(9):967-974.
14. Masanja H, de Savigny D, Smithson P, Schellenberg J, John T, Mbuya C, Upunda G, Boerma T, Victora C, Smith T *et al*: **Child survival gains in Tanzania: analysis of data from demographic and health surveys**. *Lancet* 2008, **371**(9620):1276-1283.

15. Bryce J, Daelmans B, Dwivedi A, Fauveau V, Lawn JE, Mason E, Newby H, Shankar A, Starrs A, Wardlaw T: **Countdown to 2015 for maternal, newborn, and child survival: the 2008 report on tracking coverage of interventions**. *Lancet* 2008, **371**(9620):1247-1258.
16. Claeson M, Gillespie D, Mshinda H, Troedsson H, Victora CG: **Knowledge into action for child survival**. *Lancet* 2003, **362**(9380):323-327.
17. Evans DB, Lim SS, Adam T, Edejer TT: **Evaluation of current strategies and future priorities for improving health in developing countries**. *BMJ (Clinical research ed* 2005, **331**(7530):1457-1461.
18. Molyneux DH, Hopkins DR, Zagaria N: **Disease eradication, elimination and control: the need for accurate and consistent usage**. *Trends in parasitology* 2004, **20**(8):347-351.
19. Travis P, Bennett S, Haines A, Pang T, Bhutta Z, Hyder AA, Pielemeier NR, Mills A, Evans T: **Overcoming health-systems constraints to achieve the Millennium Development Goals**. *Lancet* 2004, **364**(9437):900-906.
20. WHO: **World Malaria Report 2008. [http://www.who.int/malaria/wmr2008/malaria2008.pdf]**. Geneva; 2008.
21. Gallup JL, Sachs JD: **The economic burden of malaria**. *The American journal of tropical medicine and hygiene* 2001, **64**(1-2 Suppl):85-96.
22. Sachs J, Malaney P: **The economic and social burden of malaria**. *Nature* 2002, **415**(6872):680-685.
23. Sauerborn R, Shepard DS, Ettling MB, Brinkmann U, Nougtara A, Diesfeld HJ: **Estimating the direct and indirect economic costs of malaria in a rural district of Burkina Faso**. *Trop Med Parasitol* 1991, **42**(3):219-223.
24. Shepard DS, Ettling MB, Brinkmann U, Sauerborn R: **The economic cost of malaria in Africa**. *Trop Med Parasitol* 1991, **42**(3):199-203.
25. WHO: **Commission on macroeconomics and health. At http://whqlibdoc.who.int/publications/2001/924154550X.pdf**. 2001.
26. Malaney P, Spielman A, Sachs J: **The malaria gap**. *The American journal of tropical medicine and hygiene* 2004, **71**(2 Suppl):141-146.
27. Ministry of Health and Social Welfare. Tanzania: **Africa Malaria Day supplement. Free Africa from malaria now.**: MediaNet Ltd; 2007.
28. Schellenberg D, Schellenberg JR, Mushi A, Savigny D, Mgalula L, Mbuya C, Victora CG: **The silent burden of anaemia in Tanzanian children: a community-based study**. *Bulletin of the World Health Organization* 2003, **81**(8):581-590.
29. Steketee RW, Nahlen BL, Parise ME, Menendez C: **The burden of malaria in pregnancy in malaria-endemic areas**. *The American journal of tropical medicine and hygiene* 2001, **64**(1-2 Suppl):28-35.
30. WHO: **Department of measurement and health information.[http://www.who.int/healthinfo/statistics/bodgbdeathdalyestimates.xls]**. 2004.
31. National Bureau of Statistics: **Tanzania Household Budget Survey 2000/01. Government of Tanzania 2003, 1-115.** .

32. Jowett M, Miller NJ: **The financial burden of malaria in Tanzania: implications for future government policy**. *The International journal of health planning and management* 2005, **20**(1):67-84.
33. Ministry of Health. Tanzania: **National Health Accounts. Available at http://www.afro.who.int/dsd/nha/country-nha/tanzania-nha.pdf**. 2001.
34. World Health Assembly: **Fifty-Eighth World Health Assembly: Malaria Control. In vol Resolution 55/284 World Health Organization; 2005**. 2005.
35. Roll Back Malaria Partnership: **Global Malaria Action Plan. [http://www.rollbackmalaria.org/gmap/.pdf]**. 2008.
36. McIntosh H, Olliaro P: **Artemisinin derivatives for treating uncomplicated malaria. Cochrane Database of Systematic Reviews 1999, Issue 2. Art. No.: CD000256. DOI: 10.1002/14651858.CD000256.** 1999.
37. Mutabingwa TK: **Artemisinin-based combination therapies (ACTs): best hope for malaria treatment but inaccessible to the needy!** *Acta Trop* 2005, **95**(3):305-315.
38. Yeung S, Pongtavornpinyo W, Hastings IM, Mills AJ, White NJ: **Antimalarial drug resistance, artemisinin-based combination therapy, and the contribution of modeling to elucidating policy choices**. *The American journal of tropical medicine and hygiene* 2004, **71**(2 Suppl):179-186.
39. 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):1-14.
40. Moerman F, Lengeler C, Chimumbwa J, Talisuna A, Erhart A, Coosemans M, D'Alessandro U: **The contribution of health-care services to a sound and sustainable malaria-control policy**. *The Lancet infectious diseases* 2003, **3**(2):99-102.
41. Okeke TA, Okafor HU: **Perception and Treatment Seeking Behavior for Malaria in Rural Nigeria: Implications for Control**. *J Hum Ecol* 2008, **24**(3):215-222.
42. Nsimba SE, Kayombo EJ: **Sociocultural barriers and malaria health care in Tanzania**. *Evaluation & the health professions* 2008, **31**(3):318-322.
43. Tarimo DS, Urassa DP, Msamanga GI: **Caretakers' perceptions of clinical manifestations of childhood malaria in holo-endemic rural communities in Tanzania**. *East African medical journal* 1998, **75**(2):93-96.
44. Hetzel MW, Iteba N, Makemba A, Mshana C, Lengeler C, Obrist B, Schulze A, Nathan R, Dillip A, Alba S *et al*: **Understanding and improving access to prompt and effective malaria treatment and care in rural Tanzania: the ACCESS Programme**. *Malaria journal* 2007, **6**:83.

45. Lengeler C: **Insecticide-treated bed nets and curtains for preventing malaria**. *Cochrane database of systematic reviews (Online)* 2004(2):CD000363.
46. Killeen GF, Smith TA, Ferguson HM, Mshinda H, Abdulla S, Lengeler C, Kachur SP: **Preventing childhood malaria in Africa by protecting adults from mosquitoes with insecticide-treated nets**. *PLoS medicine* 2007, **4**(7):e229.
47. WHO, Roll Back Malaria, UNICEF: **World Malaria Report 2005. At http://www.globalpolicy.org/socecon/develop/africa/2005/05malariareport.pdf** In *WHO/HTM/MAL/20051102*. 2005.
48. Lengeler C, Grabowsky M, McGuire D, deSavigny D: **Quick wins versus sustainability: options for the up scaling of insecticide-treated nets**. *The American journal of tropical medicine and hygiene* 2007, **77**(6 Suppl):222-226.
49. Teklehaimanot A, Sachs JD, Curtis C: **Malaria control needs mass distribution of insecticidal bed nets**. *Lancet* 2007, **369**(9580):2143-2146.
50. Killeen GF, Tami A, Kihonda J, Okumu FO, Kotas ME, Grundmann H, Kasigudi N, Ngonyani H, Mayagaya V, Nathan R *et al*: **Cost-sharing strategies combining targeted public subsidies with private-sector delivery achieve high bed net coverage and reduced malaria transmission in Kilombero Valley, southern Tanzania**. *BMC Infect Dis* 2007, **7**:121.
51. Kikumbih N, Hanson K, Mills A, Mponda H, Schellenberg JA: **The economics of social marketing: the case of mosquito nets in Tanzania**. *Social science & medicine (1982)* 2005, **60**(2):369-381.
52. Skarbinski J, Massaga JJ, Rowe AK, Kachur SP: **Distribution of free untreated bed nets bundled with insecticide via an integrated child health campaign in Lindi Region, Tanzania: lessons for future campaigns**. *The American journal of tropical medicine and hygiene* 2007, **76**(6):1100-1106.
53. WHO: **Insecticide-Treated Mosquito Nets: a WHO Position Statement. Geneva , WHO; 2007**. 2007.
54. Curtis CF: **Should the use of DDT be revived for malaria vector control?** *Biomedica* 2002, **22**(4):455-461.
55. Himeidan YE, Chen H, Chandre F, Donnelly MJ, Yan G: **Short report: permethrin and DDT resistance in the malaria vector Anopheles arabiensis from eastern Sudan**. *The American journal of tropical medicine and hygiene* 2007, **77**(6):1066-1068.
56. Matambo TS, Abdalla H, Brooke BD, Koekemoer LL, Mnzava A, Hunt RH, Coetzee M: **Insecticide resistance in the malarial mosquito Anopheles arabiensis and association with the kdr mutation**. *Medical and veterinary entomology* 2007, **21**(1):97-102.
57. Jowett M, Miller N, Mnzava N: **Malaria expenditure analysis. Tanzania case study. Prepared for DFID-EA (Tanzania) and the Roll Back Malaria Initiative. [**Error! Hyperlink reference not valid.. 2000.

58. Makundi EA, Mboera LE, Malebo HM, Kitua AY: **Priority setting on malaria interventions in Tanzania: strategies and challenges to mitigate against the intolerable burden**. *The American journal of tropical medicine and hygiene* 2007, **77**(6 Suppl):106-111.
59. National Bureau of Statistics Tanzania: **Tanzania Demographic and health Survey 2004/05. [http://www.nbs.go.tz/DHS/index.html]**. 2005.
60. Crawley J, Hill J, Yartey J, Robalo M, Serufilira A, Ba-Nguz A, Roman E, Palmer A, Asamoa K, Steketee R: **From evidence to action? Challenges to policy change and programme delivery for malaria in pregnancy**. *The Lancet infectious diseases* 2007, **7**(2):145-155.
61. Mubyazi GM, Bygbjerg IC, Magnussen P, Olsen O, Byskov J, Hansen KS, Bloch P: **Prospects, achievements, challenges and opportunities for scaling-up malaria chemoprevention in pregnancy in Tanzania: the perspective of national level officers**. *Malaria journal* 2008, **7**:135.
62. Hanson K, Marchant T, Mponda H, Nathan R, Bruce J: **Report on 2006 TNVS household, facility services and facility users surveys. Ifakara Health Research and Development Centre/ London School of Hygiene and Tropical Medicine; 2006.** . 2006.
63. Mboera LE, Makundi EA, Kitua AY: **Uncertainty in malaria control in Tanzania: crossroads and challenges for future interventions**. *The American journal of tropical medicine and hygiene* 2007, **77**(6 Suppl):112-118.
64. Nsubuga P, Eseko N, Tadesse W, Ndayimirije N, Stella C, McNabb S: **Structure and performance of infectious disease surveillance and response, United Republic of Tanzania, 1998**. *Bulletin of the World Health Organization* 2002, **80**(3):196-203.

CHAPTER 2: HEALTH SYSTEM FUNCTIONING

The delivery of malaria interventions – curative through prompt antimalarial treatment or preventive like long-lasting nets or a promising tool, for example Intermittent Preventive Treatment in Infants (IPTi), requires health system to deliver to the population in need. In this chapter, the operation of the health system is described. The chapter starts with the theoretical layout of the health system in section 2.1, followed by the explanation of health system limitations to attain its objectives in section 2.2. Available suggestions to overcome health system constraints are explored in section 2.3. Then in section 2.4, the way forward for public health action is explained.

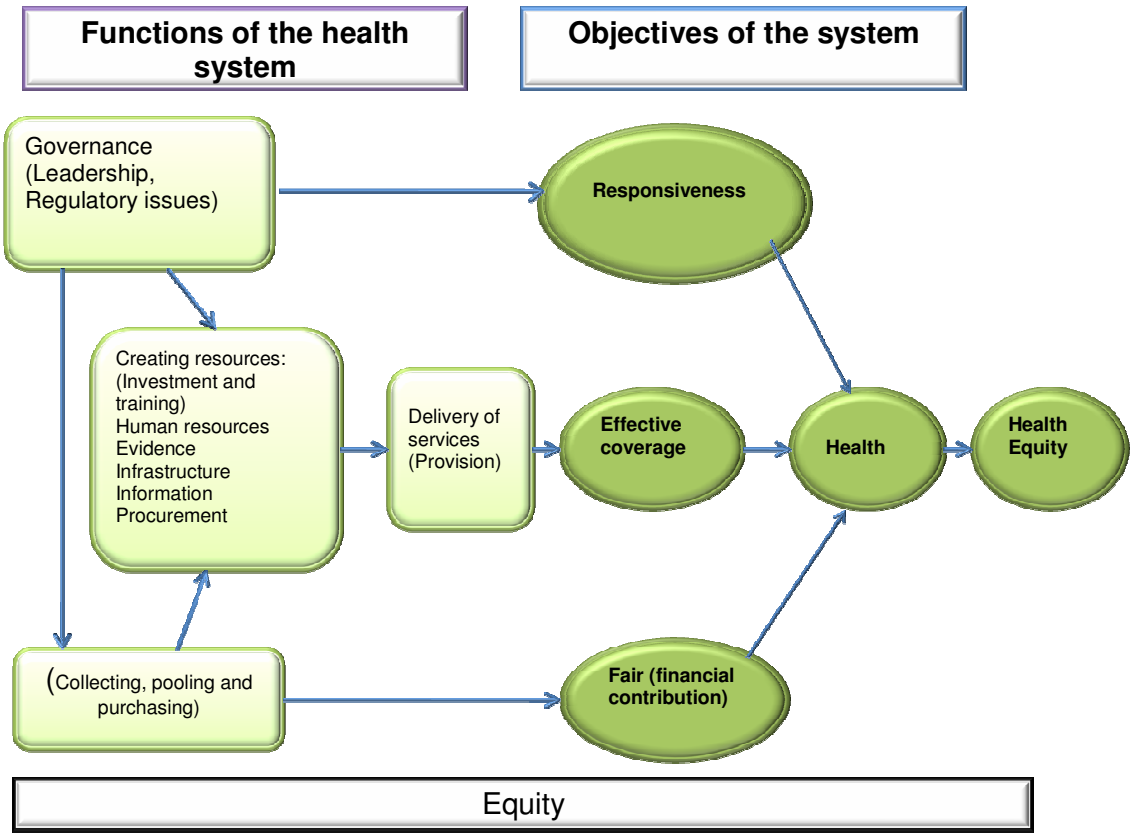
2.1 Functions of the health system

Health systems are defined as comprising all the organizations, institutions and resources that are directed to producing health with the purpose of improving health [1]. The health system functions include: delivery of health care services in terms of prevention and cure; financing in terms of raising, pooling and allocating resources to purchase services; creating resources in terms of investing in human resource, creating evidence, research, information system, buildings and equipment; as well as governance in terms of making overall oversight (stewardship) of the resources, providing leadership and regulatory services [1, 2]. The health system functions are intended to accomplish three main objectives namely improving the health and health equity of the population; responding to people's expectations and providing financial protection against the costs of ill-health.

The health system's functions are interlinked to one another and to its objectives as shown in Figure 2.1. In the framework, governance occupies a central position because it involves organization and leading of all the other functions. This is done through providing leadership, regulatory services, priority-setting and service delivery, thus contributing to the attainment of the health system goals to

improve health, to be financially fair and to respond to peoples' medical and non-medical expectations.

Figure 2.1: Relations between functions and objectives of a health system



Source: World Health Report, 2000, modified to state other goals and include equity as a crosscutting issue (following (Braveman et al. 2001; Hanson et al. 2003; Wagstaff et al. 2004) [3-5]

The conceptual framework of health system presented in the World Health Report of 2000 is very general to the extent that some important functions are not stated clearly making it difficult to assess their contributions to the attainment of improved health. For example, some components of the health system that were omitted include (1) information systems, which are important for management; (2) monitoring and evidence-based decision making; (3) human resources for service delivery; and (4) equity aspects, which is an important gauge of population health improvements [3-6]. The modified model in figure 1 mentioned the aspects whereby equity is placed as a cross-cutting factor following Wagstaff and others (2004) and the Commission on Social Determinant of Health (2001) that emphasized the need for equity consideration from the design stage of executing health systems functions up to the stage of measuring health outcomes.

In order for the health system to attain the goal of improving health, it is required that the available proven cost effective health interventions are implemented to reach all people in all segments of the population. To what extent are the health systems on track to attain improved health outcome for the people they serve? Investigation of the magnitude of scaling-up of health interventions is necessary in order to account for the level of success in efforts to improve people's health. In the next sub-section it is described how scale-up of health interventions are constrained by functioning of the health systems.

2.2 Health system challenges to scale-up interventions

Population health status and protection continue to be a matter of concern at both national and international levels due to rampant threat of diseases including malaria, tuberculosis and HIV-AIDS. In developing countries innocent lives are lost regardless of the existence of effective interventions to fight the conditions [7, 8]. Studies have reported a number of constraints hampering the functioning of the health system, thus limiting the expansion of priority health interventions [1, 9-11]. These are associated with workforce development and retention; health

delivery, health information management, financing, and government stewardship.

Financial input is important to deliver health services, but most developing countries are heavily constrained. This makes it difficult to secure Artemisin-based combination therapies (ACTs) for malaria treatment, to provide health services in dilapidated facilities and to fail to motivate the health workers. However, in recent years the contributions of Global Fund to Fight AIDS, Tuberculosis and Malaria (GFATM), the Global Alliance for Vaccines, and Immunization (GAVI) and other funding agencies have helped to provide more funding for health and hence scale-up is potentially achievable. However, challenge still remained to provide right estimates of funding required to deliver new and existing health interventions [12-14]. Furthermore, an evaluation of cost effectiveness is also necessary to inform policy decisions to allocate scarce resources efficiently. Studies to estimate financial resources to increase uptake and scale-up interventions are highly demanded at this time to complement the global efforts to attain the health-related Millennium Development Goals.

Human resources are vital for health services delivery both curative and preventive. It accounts for a large percent of health budgets and are key to the attainment of health goals [1]. The developing countries with great disease burden face severe shortages of human resource, when compared with the number and skill mix required to undertake interventions to reach the millennium development goals [15] as well as address rural-urban imbalances [16]. Undertaking studies to evaluate human resources issues is important not only for scale-up of health interventions but also to challenge the capacity of medical schools to produce health workers. Mitigating the human resources problem is of crucial due to urgent need to alleviate a considerable burden of disease which can be averted with delivery of proven cost effectiveness and efficacious interventions. More Studies are need to evaluate the capacity of existing staff to uptake new life saving interventions, to test the performance and applicability of

human resources management and incentive schemes and also to find out how can the medical schools create new skilled workforce.

How best to deliver cost effective interventions and tools to fight diseases? It is well recognized that health is a universal human right, but available evidence has shown that the poorest group of society are not reached [5, 17]. The poorest people live in geographically isolated areas where it is difficult to access quality health services, they lack financial capabilities to pay for services and are less likely to benefit from effective interventions[18-20]. Equity evaluation of new health interventions to establish how various groups benefit from the onset of strategy design is important [21, 22]. The outcome of the equity evaluations is necessary to feed the policy making processes and for fine tuning program implementations and scale-up effort as well as to influence special focus for hard to reach groups.

Categorization of health system obstacles to scale-up health interventions into levels can help to inform choice of strategies for strengthening health systems [4]. In this way, Hanson and others explained a range of factors hamper the widespread implementation of health interventions including problems of demand, weak service delivery systems, policies, governance, corruption and geography. Thus, meaningful research on implementation designs and support for new and existing interventions is crucial to address weaknesses in scale-up in order to achieve high and equitable coverage with essential health interventions through learning from the experiences.

Lack of utilization of scientific evidence and limited operational research contributes to the constrained health systems as it limits the ability of innovative approaches to be established as viable systems or methodology [23]. Experience has shown that 5-10 years can elapse before scientific evidence is translated into policy and practice. For example Insecticide Treated Nets (ITNs) was reported to be saving lives in 1991 [24], but by 2001, ITNs use for children under 5 years

was less than 2% in Africa[25]. Another example is vitamin A supplementation - mortality impact was documented in Ghana in 1993 [26], and WHO advocated using immunization contacts as a gateway to eliminating vitamin A deficiency in 1994 [27], but in 1999 vitamin A coverage was 16% in southern Tanzania [28]. A change in delivery approach of vitamin A by using mother and child clinics was associated with drastic coverage increase [29]. In fact, the delays in taking action often affect many effective health interventions. Therefore the challenge facing health systems now is how best new and available interventions and tools could be scaled-up? Undertaking field studies is necessary to establish how interventions work in real life under the routine delivery mechanisms.

The scale-up of health interventions in some individual countries have experienced health systems constraints in various forms: either in the process of service delivery or during policy formulation. In Peru, implementation of Integrated Management of Childhood Illnesses (IMCI) strategy at national scale was hampered by lack of strategy institutionalization that led to poor strategy management, lack of political commitment and hence the project launching was done without a clear administrative structure at the national and district levels [30]. Consequently, budgeting, training, supervision, health facility support and other health systems aspects were not systematically planned and implemented. However, such lessons learnt informs scaling-up efforts in other places. This calls for engagement of all stakeholders in programme design in order to come out with the best health outcomes.

In Tanzania, Munishi described financial and non financial constraints facing the country's health sector [31]. He pointed out that the legislative and regulatory framework needed for policy of decentralization to operate effectively developed slowly. Specifically, the incentive structure in publicly-owned health facilities remained extremely weak while vertical programmes dominated service delivery. He concluded that adopting decentralizing alone to tackle management and financing constraint could not address constraints related to policy. Choice of

delivery approach needs to be thoroughly thought through, so as not to distort the routine delivery activities. Piloting studies are paramount to provide evidence to inform scale-up efforts.

The choice of appropriate delivery mechanism is not always straightforward. There is no one size fits all in service delivery; but accounting for context specific factors is important. Making decisions on the appropriate approach to deliver health interventions requires consideration of a number of factors which include nature and size of the disease problem, resources availability and the ultimate goals of the health system at a given time and in the longer term [32, 33]. The strategies range from a vertical approach (campaign), horizontal (routine) system and something in between (indirect vertical). Each of these has advantages and limitations.

Vertical programmes operate in parallel and outside the general health system. It has been established that vertical programmes are useful to deal with health problems that are widespread and affecting a high proportion of the population and hinder the social and economic development of the country [32]. Vertical programmes are attractive to donor funding, as they are quick to attain goals and attain high technical efficiency. While in the past they succeeded to eliminate public diseases like smallpox, currently they have importance in the control of diseases too rare for general health professionals to maintain the necessary specialist skills and outreach to specific risk groups [33]. However, the vertical programmers have disadvantages of having a separate management structure that do not result in strengthening the health system in a holistic way but has high risk of increasing stress on the already constrained health system [32, 34]. This is due to addressing specific health demand and are not compatible with decentralized health system [32, 33]. Approaches that promote routine delivery systems are more likely to be more sustainable in improving the health status of majority of their populations.

Routine health care delivery is an integrated diseases control strategy that supports decentralization whereby health managers can set priorities and decide on resource allocation and coverage. Although horizontal programmers have disadvantages of being slower to attain coverage [33], they are sustainable and they can speed up progress in the long run. The "indirect vertical" programmers operates in between the vertical and horizontal programmers. These are operationally integrated with the general health system but have a separate management [33]. They have high potential to become fully integrated in the health system [35].

To sum up, the health systems in developing countries are constrained with regard to taking prompt public health actions to alleviate health problems in their communities. The identified constraints include financial problems, failure to institutionalize health programmes, uncertainty in priority setting due to severe funding limitations and limited investment in resources – human, buildings and equipments. Other constraints include low quality of care, constrained demand, challenges in choosing appropriate delivery mechanisms, inequality and limited development of scientific evidence.

Here we have presented mounting evidence on the weaknesses of the health systems to deliver interventions in an adequate way. However, a major question for countries is how to strengthen them? The debate on the right approach to fix the health systems is ongoing not only in developing countries but in developed world as well [36]. In the following sub-section, suggestions for fixing the problems are proposed.

2.3 Overcoming health system constraints – what should be done?

There are many suggestions available to strengthen health systems to eliminate diseases of the poor in Africa and other developing countries. These include increased investment in staff training, development of medicines and health information system. The success of these solutions depends on better

management of research, health services, political commitments and multicultural approaches.

The “World Report on Knowledge for Better Health” builds on reviews of global health research and extensive consultations with key stakeholders [37], and identified science as a key ally in the effort to attain health MDGs. The report argues that through better management of health research and increased investment in health system research, it is feasible to achieve more health equity; and that the use of research can strengthen human resources, health financing, health management information and delivery of health services.

Political commitment is important in undertaking the strategies to fight diseases. The meeting in 2001 on “Health Care for All” in Antwerp, Belgium, aimed to establish political commitment for strengthening of health-care services [38], and elaborated the roles in multicultural approaches. To accomplish health care for all, the meeting called for all stakeholders to unite their forces in social investment, in particular health systems, to attain substantial improvements in global health, fighting diseases and reducing poverty. Whereas governments have been argued to provide necessary stewardship by creating optimal policy frameworks and conditions for all stakeholders in the health system; international community has the duty to provide the necessary financial investments and technical support to low income countries; and health research must work on the improvement of health systems.

The Mexico Ministerial Summit on Health Research brought together health ministers or their representatives from around the world to discuss how research could help strengthen national health systems and achieve the health MDGs [39]. Among the key message from the summit included the need to strengthen health system through research to increase access to interventions for the world’s poor, increase demand for research by fostering structured interactions between researchers and policy makers; to make evaluation an integral component of

health policies and programmes and that research must be embedded in the implementation of interventions and in health system themselves.

Apart from global gatherings, small groups and institutions called for the need to get effective interventions to those in need [40-43]. They have emphasized at international and local levels the need to strengthen health systems, translate scientific knowledge into action and the strengthening role of research to promote delivery of interventions at a large scale to those in need. Use of disease-specific approach is one way to tackle health system constraints, but it is more appropriate to invest on a system-wide perspective [40-45]. This contributes to overall system strengthening by tackling the root cause of the problem, thus increasing the range of solutions, benefiting many more interventions and the overall system efficiency.

Given the extent of the constraints facing the health systems, demonstration of what works is crucial especially in developing countries. Few studies have embarked to find out what works and how in real life situation. The living example on how to strengthen health system is the use “TEHIP tools”. TEHIP stands for Tanzania Essential Health Interventions project (TEHIP). The tool enables district health authorities to plan and set priorities using Burden of Diseases (BoD) profile and cost-effectiveness analysis for resource allocation [46]. The use of the tools in two districts in Tanzania resulted in gains in terms of child survival, and increased capacity to efficiently plan, choose and implement health interventions.

What are the key health system considerations when it comes to scale up a health intervention? Scale-up requires a delivery strategy, health workers to deliver it, cost estimates as a base for financing, health management information system for monitoring as well as building infrastructure for housing the intervention. In this study the intention is to demonstrate in a meaningful way how to develop and implement a public health strategy for Intermittent Preventive

Treatment in Infants (IPTi), evaluate human resources capacity, to estimate costs and assess the coverage of the intervention by an equity lens.

2.4 The Intermittent Preventive Treatment in infants strategy: a way forward for public health action

New promising tools should be assessed for their applicability under normal life conditions and the resulting community effectiveness. Following that need, here we present the study of Intermittent Preventive Treatment in infants for malaria and anaemia control (IPTi). The aim was to understand health system issues prevailing in the development of a delivery strategy, implementation and scale-up of an intervention. This was done by demonstrating how feasible it is to deliver health intervention under field conditions using the routine health system of a developing country like Tanzania. It was done in order to inform decision-making process and scaling up.

2.4.1 The IPTi strategy, EPI platform and the Consortium

In chapter 1.3.1, it was shown that Intermittent Preventive Treatment in infants (IPTi) is a useful and promising approach for malaria control. Since efficacy information was available in southern Tanzania and more generated in recent years [47-54], the challenge was how to get more of the existing knowledge into practice and realize the potential public health benefits. In Southern Tanzania a study was undertaken starting in 2004 to evaluate community effectiveness of IPTi. It provided an ideal ground to evaluate a context-specific health system with regard to developing delivery strategy, intervention scale-up and implementation, human resources, information system, financing and policy development processes.

The Expanded Program on Immunization (EPI) has the potential to integrate other child and maternal health programmes, particularly malaria control [55]. This is because the EPI infrastructure is already developed in Tanzania and can act as a platform for delivery of malaria interventions. Through the EPI, it is feasible to carry out social mobilization and education at immunization contacts

and during pre-campaign mobilization. Similarly, the EPI management tools could be used to document information at health facilities and make coverage assessment at the household level. Finally, training and supervision can be done jointly – the tools and methodologies developed by EPI could be adapted to include malaria control.

Through the IPTi consortium, studies are undertaken to generate more safety and efficacy data in a range of settings to provide robust and compelling evidence to guide policy (www.ipti-malaria.org). Working as a consortium there is an advantage to harmonize designs, methodologies and outcome measures to a great extent using working groups to coordinate evaluation of statistics, drug resistance, acceptability and cost-effectiveness.

References:

1. WHO: The World Health Report 2000. Health Systems: Improving Performance. Geneva. At http://www.who.int/whr.; 2000.
2. The Global Fund: The Global Fund's approach to health systems strengthening. Global Fund Fact Sheet Series, 5 of 5. 1 March 2008. [http://www.theglobalfund.org/documents/rounds/8/R8HSS_Factsheet_en.pdf] 2008.
3. Braveman P, Starfield B, Geiger HJ: World Health Report 2000: how it removes equity from the agenda for public health monitoring and policy. BMJ (Clinical research ed 2001, 323(7314):678-681.
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 Development2003, 15(1):1-14.
5. Wagstaff A, Bustreo F, Bryce J, Claeson M: Child health: reaching the poor. American journal of public health 2004, 94(5):726-736.
6. WHO: Commission on Social Determinants of Health. FINAL REPORT .Closing the gap in a generation Health equity through action on the social determinants of health. [http://www.who.int/social_determinants/en/]. 2008.
7. Black RE, Morris SS, Bryce J: Where and why are 10 million children dying every year? Lancet 2003, 361(9376):2226-2234.
8. Lawn JE, Cousens S, Zupan J: 4 million neonatal deaths: when? Where? Why? Lancet 2005, 365(9462):891-900.
9. World Health Organization: The World Health Report 2000. Health Systems: Improving Performance. Geneva. At http://www.who.int/whr.; 2000.
10. Kager PA: Malaria control: constraints and opportunities. Trop Med Int Health 2002, 7(12):1042-1046.
11. WHO: Commission on macroeconomics and health. At http://whqlibdoc.who.int/publications/2001/924154550X.pdf. 2001.
12. Johns B, Sigurbjornsdottir K, Fogstad H, Zupan J, Mathai M, Tan-Torres Edejer T: Estimated global resources needed to attain universal coverage of maternal and newborn health services. Bulletin of the World Health Organization 2007, 85(4):256-263.
13. Kiszewski A, Johns B, Schapira A, Delacollette C, Crowell V, Tan-Torres T, Ameneshewa B, Teklehaimanot A, Nafo-Traore F: Estimated global resources needed to attain international malaria control goals. Bulletin of the World Health Organization 2007, 85(8):623-630.
14. Stenberg K, Johns B, Scherpbier RW, Edejer TT: A financial road map to scaling up essential child health interventions in 75 countries. Bulletin of the World Health Organization 2007, 85(4):305-314.
15. Kurowski C, Wyss K, Abdulla S, Mills A: Scaling up priority health interventions in Tanzania: the human resources challenge. Health policy and planning 2007, 22(3):113-127.

16. Barden-O'Fallon J, Angeles G, Tsui A: Imbalances in the health labour force: an assessment using data from three national health facility surveys. Health policy and planning 2006, 21(2):80-90.
17. Schellenberg JA, Victora CG, Mushi A, de Savigny D, Schellenberg D, Mshinda H, Bryce J: Inequities among the very poor: health care for children in rural southern Tanzania. Lancet 2003, 361(9357):561-566.
18. Mahmud Khan M, Hotchkiss DR, Berruti AA, Hutchinson PL: Geographic aspects of poverty and health in Tanzania: does living in a poor area matter? Health Policy Plan 2006, 21(2):110-122.
19. McIntyre D, Muirhead D, Gilson L: Geographic patterns of deprivation in South Africa: informing health equity analyses and public resource allocation strategies. Health policy and planning 2002, 17 Suppl:30-39.
20. Khan M, Hotchkiss DR, Berruti AA, Hutchinson PL: Geographic aspects of poverty and health in Tanzania: does living in a poor area matter? Health policy and planning 2006, 21(2):110-122.
21. Barat LM, Palmer N, Basu S, Worrall E, Hanson K, Mills A: Do malaria control interventions reach the poor? A view through the equity lens. The American journal of tropical medicine and hygiene 2004, 71(2 Suppl):174-178.
22. Victora CG, Wagstaff A, Schellenberg JA, Gwatkin D, Claeson M, Habicht JP: Applying an equity lens to child health and mortality: more of the same is not enough. Lancet 2003, 362(9379):233-241.
23. Hall JJ, Taylor R: Health for all beyond 2000: the demise of the Alma-Ata Declaration and primary health care in developing countries. Med J Aust 2003, 178(1):17-20.
24. Alonso PL, Lindsay SW, Armstrong JR, Conteh M, Hill AG, David PH, Fegan G, de Francisco A, Hall AJ, Shenton FC et al: The effect of insecticide-treated bed nets on mortality of Gambian children. Lancet 1991, 337(8756):1499-1502.
25. WHO: African Malaria Report. at http://www.rbm.who.int/amd2003/amr2003/amr_toc.htm. 2003.
26. Ghana VAST Study Team: Vitamin A supplementation in northern Ghana: effects on clinic attendances, hospital admissions, and child mortality Lancet 1993, 3(342(8862)):7-12.
27. WHO: Using immunization contacts as the gateway to eliminating vitamin A deficiency - a policy document. WHO EPI/GEN/94.9. Geneva. Volume 1994.
28. Armstrong Schellenberg JR, Adam T, Mshinda H, Masanja H, Kabadi G, Mukasa O, John T, Charles S, Nathan R, Wilczynska K et al: Effectiveness and cost of facility-based Integrated Management of Childhood Illness (IMCI) in Tanzania. Lancet 2004, 364(9445):1583-1594.
29. Masanja H, Schellenberg JA, Mshinda HM, Shekar M, Mugyabuso JK, Ndossi GD, de Savigny D: Vitamin A supplementation in Tanzania: the impact of a change in programmatic delivery strategy on coverage. BMC Health Serv Res 2006, 6:142.

30. Huicho L, Davila M, Gonzales F, Drasbek C, Bryce J, Victora CG: Implementation of the Integrated Management of Childhood Illness strategy in Peru and its association with health indicators: an ecological analysis. Health policy and planning 2005, 20 Suppl 1:i32-i41.
31. Munishi GK: Intervening to address constraints through health sector reforms in Tanzania: some gains and the unfinished business. Journal of International Development 2003, 15(1):115-131.
32. Mills A: Mass campaigns versus general health services: what have we learnt in 40 years about vertical versus horizontal approaches? Bulletin of the World Health Organization 2005, 83(4):315-316.
33. Unger JP, De Paepe P, Green A: A code of best practice for disease control programmes to avoid damaging health care services in developing countries. The International journal of health planning and management 2003, 18 Suppl 1:S27-39.
34. Tanner M: Strengthening district health systems. Bulletin of the World Health Organization 2005, 83(6):403.
35. Victora CG, Hanson K, Bryce J, Vaughan JP: Achieving universal coverage with health interventions. Lancet 2004, 364(9444):1541-1548.
36. WHO Europe: Strengthened health systems save more lives. An insight into WHO's European Health Systems' Strategy. [http://www.euro.who.int/document/hsm/healthsys_savelives.pdf]. 2005.
37. WHO: World Report on Knowledge for better health. strengthening health system. Geneva: World Health Organization. http://www.who.int/rpc/meetings/en/world_report_on_knowledge_for_better_health2.pdf. 2004a.
38. International Conference Health Care for All – Antwerp: Meeting and declaration on "Health Care for All", Antwerp, Belgium, 25-26 October 2001. At http://www.itg.be/hca. 2001.
39. WHO: Ministerial Summit on Health Research. The Mexico Statement on health research November 16-20. At http://www.who.int/rpc/summit/en/index4.html. 2004b.
40. Bryce J, el Arifeen S, Pariyo G, Lanata C, Gwatkin D, Habicht JP: Reducing child mortality: can public health deliver? Lancet 2003, 362(9378):159-164.
41. Bryce J, Roungou JB, Nguyen-Dinh P, Naimoli JF, Breman JG: Evaluation of national malaria control programmes in Africa. Bulletin of the World Health Organization 1994, 72(3):371-381.
42. Claeson M, Gillespie D, Mshinda H, Troedsson H, Victora CG: Knowledge into action for child survival. Lancet 2003, 362(9380):323-327.
43. Travis P, Bennett S, Haines A, Pang T, Bhutta Z, Hyder AA, Pielemeier NR, Mills A, Evans T: Overcoming health-systems constraints to achieve the Millennium Development Goals. Lancet 2004, 364(9437):900-906.
44. Jha P, Mills A, Hanson K, Kumaranayake L, Conteh L, Kurowski C, Nguyen SN, Cruz VO, Ranson K, Vaz LM et al: Improving the health of the global poor. Science (New York, NY 2002, 295(5562):2036-2039.

45. Moerman F, Lengeler C, Chimumbwa J, Talisuna A, Erhart A, Coosemans M, D'Alessandro U: The contribution of health-care services to a sound and sustainable malaria-control policy. The Lancet infectious diseases 2003, 3(2):99-102.
46. de Savigny D, Kasale H, Mbuya C, Reid G: in_focus: FIXING HEALTH SYSTEMS. 2nd edition.: The International Development Research Centre. PO Box 8500, Ottawa, ON, Canada K1G 3H9; 2008.
47. Schellenberg D, Menendez C, Kahigwa E, Aponte J, Vidal J, Tanner M, Mshinda H, Alonso P: Intermittent treatment for malaria and anaemia control at time of routine vaccinations in Tanzanian infants: a randomised, placebo-controlled trial. Lancet 2001, 357(9267):1471-1477.
48. Kobbe R, Kreuzberg C, Adjei S, Thompson B, Langefeld I, Thompson PA, Abruquah HH, Kreuels B, Ayim M, Busch W et al: A randomized controlled trial of extended intermittent preventive antimalarial treatment in infants. Clin Infect Dis 2007, 45(1):16-25.
49. Chandramohan D, Owusu-Agyei S, Carneiro I, Awine T, Amponsa-Achiano K, Mensah N, Jaffar S, Baiden R, Hodgson A, Binka F et al: Cluster randomised trial of intermittent preventive treatment for malaria in infants in area of high, seasonal transmission in Ghana. BMJ (Clinical research ed 2005, 331(7519):727-733.
50. Macete E, Aide P, Aponte JJ, Sanz S, Mandomando I, Espasa M, Sigauque B, Dobano C, Mabunda S, Dgedge M et al: Intermittent preventive treatment for malaria control administered at the time of routine vaccinations in mozambican infants: a randomized, placebo-controlled trial. The Journal of infectious diseases 2006, 194(3):276-285.
51. Massaga JJ, Kitua AY, Lemnge MM, Akida JA, Malle LN, Ronn AM, Theander TG, Bygbjerg IC: Effect of intermittent treatment with amodiaquine on anaemia and malarial fevers in infants in Tanzania: a randomised placebo-controlled trial. Lancet 2003, 361(9372):1853-1860.
52. Grobusch MP, Egan A, Gosling RD, Newman RD: Intermittent preventive therapy for malaria: progress and future directions. Current opinion in infectious diseases 2007, 20(6):613-620.
53. Grobusch MP, Lell B, Schwarz NG, Gabor J, Dornemann J, Potschke M, Oyakhirome S, Kiessling GC, Necek M, Langin MU et al: Intermittent preventive treatment against malaria in infants in Gabon--a randomized, double-blind, placebo-controlled trial. The Journal of infectious diseases 2007, 196(11):1595-1602.
54. Mockenhaupt FP, Reither K, Zanger P, Roepcke F, Danquah I, Saad E, Ziniel P, Dzisi SY, Frempong M, Agana-Nsiire P et al: Intermittent preventive treatment in infants as a means of malaria control: a randomized, double-blind, placebo-controlled trial in northern Ghana. Antimicrobial agents and chemotherapy 2007, 51(9):3273-3281.
55. World Health Organization and UNICEF: Malaria Control and Immunization: a sound partnership with great potential. Joint statement. [WHO/HTM/RBM/2004.52]. 2004.

CHAPTER 3: STUDY GOAL AND OBJECTIVES

In this chapter the study goal and objectives are presented.

The objectives are rooted from the need to scale-up health interventions to improve the health of the people and community at large. Policy makers need quality evidence based information to make decisions. What are the health system considerations that should be taken into account by policy makers when attempting to scale-up health interventions? Basic questions are related to how to deliver an intervention to reach all segments of the population, what is the budget implication of the intervention delivery and is there capacity available to deliver the intervention in terms of human resources? Practical and meaningful responses to these challenges can be provided through the platform of effectiveness studies like Intermittent Preventive Treatment in infant (IPTi) evaluation. That is why, this work has been undertaken to contribute to generate knowledge for evidence-based decision making.

3.1 Study Goal

To contribute to the understanding of health system issues and costs related to integrating into the routine district health system a new strategy of IPTi for malaria and anaemia control in infants with a focus on informing the decision-making process and intervention scale-up.

3.2 Study objectives

The study has four main objectives; their details are provided in the coming chapters. The objectives include:

1. To describe the public health delivery strategy for IPTi for malaria and anaemia control. In this objective two things are dealt with:
   1.1. To describe the process of the development and implementation of a public health delivery strategy for IPTi.

1.2. To describe the development of behaviour change communication strategy for vaccination linked malaria control strategy.

2. To estimate the financial and economic resources of developing and implementing a public health strategy for malaria and anaemia control. Here the cost of developing and implementing IPTi in a rural district are estimated.
3. To assess the quantity, availability and productivity of human resources in primary facilities and in order to be able to say if there present capacity to deliver IPTi.
4. To evaluate the coverage of IPTi strategy by socio-economics status (SES), sex and distance from nearest health facility.

3.3 Conclusion

The four objectives are linked together to provide a basis to better respond to the challenges for integrating a new intervention into the health delivery system [1-3]. Since the goal of this thesis is to increase knowledge about prompt scaling up of effective health interventions particularly in developing countries, the thesis objectives are important because at present the methods for conducting real life application of new interventions are underdeveloped. Further research is urgently required that tests the feasibility of scaling-up new health interventions to draw conclusions about the experiences in reducing the knowledge gap and inform their applicability in other settings. Field testing studies is an important health system area to research at present because it is a priority of many countries and international organizations to establish how to operationalise new cost-effective interventions, but there have been limited studies and investments done to date to guide policy makers prioritizes based on evidence of what works well through routine health systems, how, and under what context [4, 5].

Therefore these four thesis objectives are linked together to generated the much needed evidence to inform how health interventions can be integrated into the routine health system and avoid fragmented health service delivery. It is important for policy implementers and policy makers to understand how to institutionalize the delivery of a new intervention, and this thesis brings together many of these dimensions: the design of a delivery strategy (including the management systems, trainings and behaviour change communication messages), the evaluation of capacity in-terms of human resources, the estimation of costs and the equity impact.

Reference:

1. Bryce J, el Arifeen S, Pariyo G, Lanata C, Gwatkin D, Habicht JP: Reducing child mortality: can public health deliver? Lancet 2003, 362(9378):159-164.
2. WHO: Ministerial Summit on Health Research. The Mexico Statement on health research November 16-20. [http://www.who.int/rpc/summit/en/index4.html. 2004b].
3. Travis P, Bennett S, Haines A, Pang T, Bhutta Z, Hyder AA, Pielemeier NR, Mills A, Evans T: Overcoming health-systems constraints to achieve the Millennium Development Goals. Lancet 2004, 364(9437):900-906.
4. Claeson M, Gillespie D, Mshinda H, Troedsson H, Victora CG: Knowledge into action for child survival. Lancet 2003, 362(9380):323-327.
5. Leroy JL, Habicht JP, Pelto G, Bertozzi SM: Current priorities in health research funding and lack of impact on the number of child deaths per year. American journal of public health 2007, 97(2):219-223.

CHAPTER 4: STUDY METHODS

This chapter provides explanation of the study area, study design and methods for each study objective.

4.1 Study area

The study area is located in the southern part of Tanzania in 2 regions of Lindi and Mtwara (Figure 4.1). Five districts were included namely Nachingwea, Lindi Rural and Ruangwa (in Lindi region) and Tandahimba and Newala districts (in Mtwara region) as shown in Figure 4.2. The description of the study area and health system functioning is given by Armstrong Schellenberg and others [1]. Briefly, the five study districts have 24 divisions with about 900,000 people[2]. A division is a local administrative area comprising a number of villages: there are between 3 and 10 divisions in each district. Child survival is poor in the study area; under-five mortality rate was 153/1000 compared to national average 123/1000 [3]. The health system comprises a network of dispensaries, health centres and hospitals.

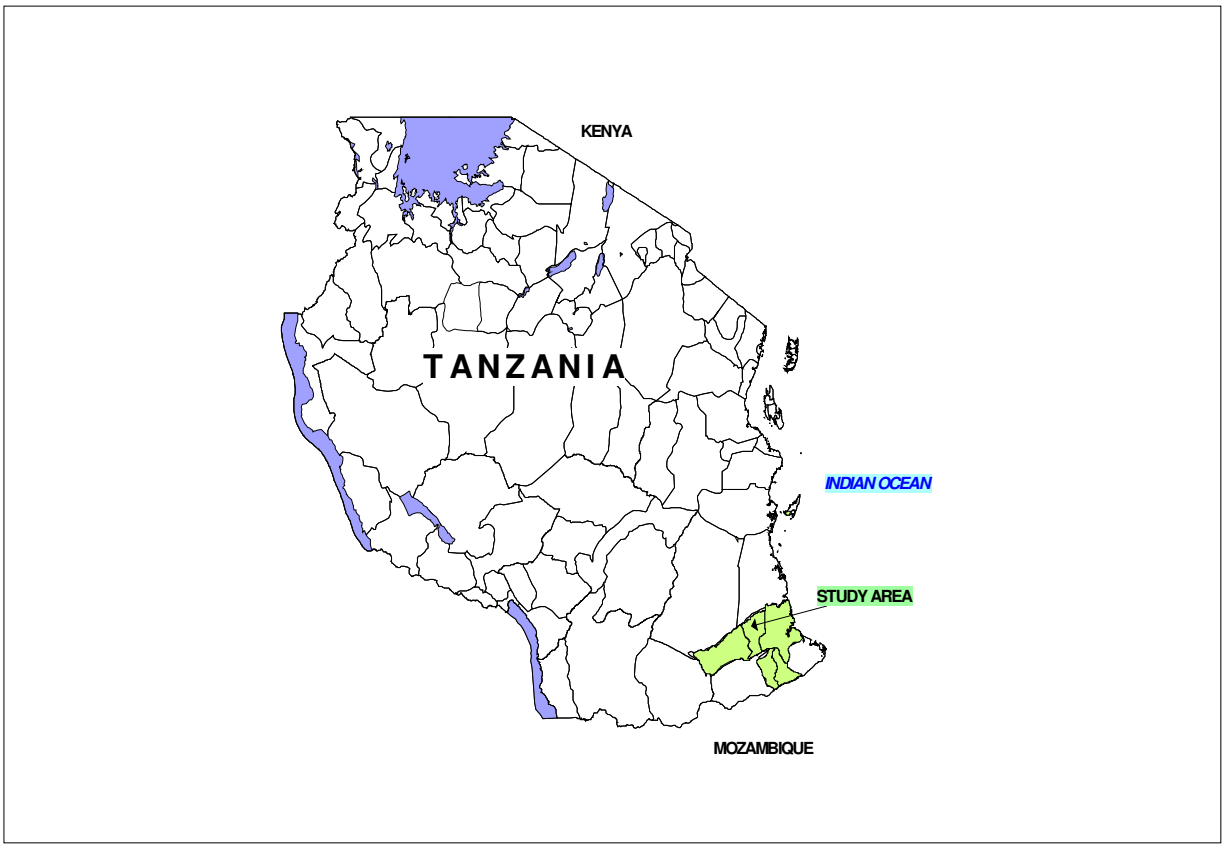


Figure 4.1 Study area - southern Tanzania

Source: Schellenberg JRMA et al. BMC Public Health 2008, 8:194

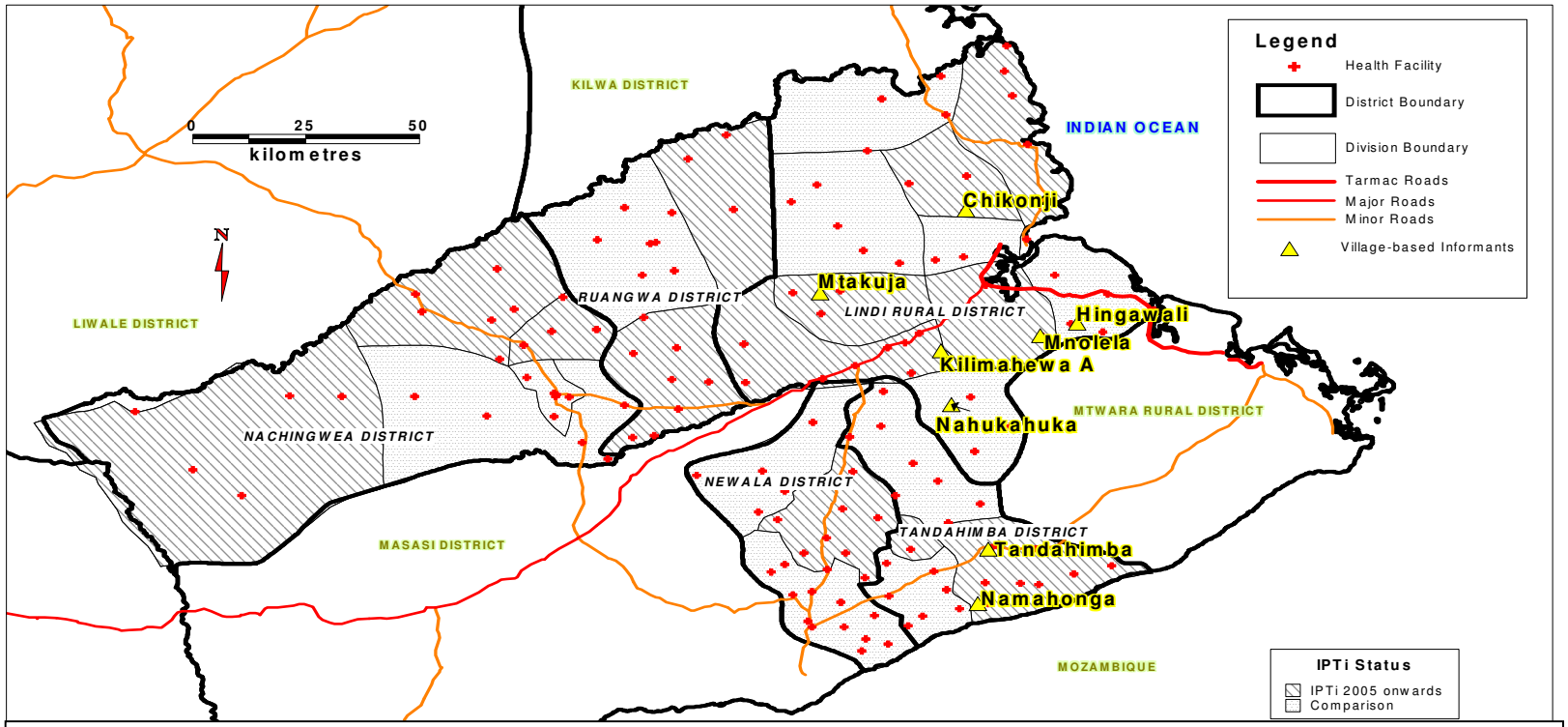


Figure 4.2 Study districts and divisions

Source: Schellenberg JRMA et al. BMC Public Health 2008, 8:194

4.2 Study design

The study was done within the framework of Intermittent Preventive Treatment for infants (IPTi) [4] .The overall objective was to evaluate the cost and effectiveness of IPTi in the community. The 24 divisions in the study area were split into half (12) intervention divisions and another half (12) into control division, as shown in Figure 2.

4.3 Method for each objective

4.3.1 The development and implementation of a public health delivery strategy for IPTi

A consultative approach was employed that involved working in partnership with Ministry of Health and Social Welfare (MoHSW) policy-makers, managers and implementers at all levels, and involved a large number of in-country stakeholders. An ad-hoc “IPTi Core Group” was formed at the national level which steered the development of the strategy and leant political support. The Core Group guided the development of a training curriculum and training materials for front-line health workers, and advised on who should be trained from each facility. They also provided critical review of draft behaviour-change communication materials and took part in piloting and training of district-level trainers.

Stakeholder meetings were conducted regularly at national, regional and district level to share progress and plans, concerns and criticisms with the aim of further strengthening the IPTi strategy. Preparation for implementation involved development and testing of awareness-raising posters, a health staff training program and development of management systems to account and estimate coverage for IPTi. This was incorporated within the routine health system. A rapid ethnographic study provided inputs for the behaviour-change communication (BCC) strategy including delivery channels, materials and a brand name for IPTi.

4.3.2 Resources needed to develop and implement a public health strategy for IPTi

This objective provided analysis of the full costs of developing and implementing IPTi as a district based strategy to control malaria under real life conditions.

The methodology involved an analysis of financial and non-financial resources of activities that led to implementation and establishment of an IPTi strategy. This generated unit cost information of providing IPTi at district level and cost per child fully covered with IPTi (child given 3 IPTi doses). A health system perspective was employed whereby all costs involved were measured and valued – costs to the health sector. These included costs of different components namely strategy development and sensitization; BCC material development; SP purchase and distribution; training; administration of the intervention in health facilities, and strategy management.

Four different health system levels were considered – national, regional, district and health facility. National level includes all activities organized under the Ministry of Health and Social Welfare (MoHSW) mainly related to policy matters. Given that a scaled up strategy would be country-wide, the estimated costs of strategy change were allocated across the total number of districts in Tanzania using the proportion of IPTi doses to be delivered based on current EPI coverage rates. The District level implementation cost includes activities undertaken at regional, district and health facility levels. These were apportioned to the five districts in the study area.

Data analysis was done in excel sheets whereby a summary sheet was used to pull together data according to the activity components and health system level with a distinction made between financial costs and non-financial 'opportunity' costs. Cost classification was based on how related activities are usually done, and value under a Ministry of Health-led program. There were no fixed assets purchased specifically for IPTi, but it accounted for hired fixed assets under transport and buildings. The costing estimates reflected a one year time frame.

4.3.3 What is the capacity of existing health workers to implement an IPTi strategy?

The aim of the human resource objective was to assess the quantity, availability and productivity of human resources. The methodology involved health facility survey to document health workers availability and requirement as per Ministry of Health and Social Welfare guideline, absenteeism patterns and a time and motion study to evaluate health workers time use in delivering various health services. A baseline health facility survey was conducted in the last quarter of 2004. A census of all 134 health facilities in five districts was conducted. The objectives included to document availability of health workers, essential drugs, vaccine supplies and transport to facilitate referrals. Analysis was done in Stata © to tabulate various indicators.

A time and motion study was conducted to evaluate the provision of health services by health workers undertaken in the reproductive and child health clinic. Health workers were followed on a typical vaccine clinic day as vaccination is not done every day. The evaluated activities include SP provision to infants, recording doses and dates in immunization cards, recording of IPTi information in Health Management Information System (HMIS) books and mothers` education sessions. A total of 24 health facilities out of 134 were sampled in the 5 study districts. Facilities were selected to ensure balance in terms of type of health facility, number of vaccinating staff and vaccine coverage between intervention facilities and control facilities. The tool was administered using handheld computers (Personal Digital Assistant)[5]. Each team of 2 interviewers spent a week at each facility to get familiar with staff and activities. A menu of nurse activities were prepared and when touched recorded end time of previous activity and start time of new activity. The data were entered directly in Pendragon forms, cleaned and analysis was done using Stata © (version 10, College Station, Texas, USA).

4.3.4 What is the coverage of IPTi

The purpose of this objective was to establish the factors underlying the coverage of IPTi. The study specifically examined whether population coverage of IPTi was different in terms of socio-economics status (SES), sex and distance from the nearest health facility. This objective was accomplished by analyzing data from a household survey conducted July-November 2007. The survey concluded the evaluation of the impact of IPTi on morbidity and mortality as well as collecting baseline information on maternal mortality. The main survey teams visited all households in the 5 districts and completed a household module. Information collected included identifiers, household assets (socio-economic status markers), education and occupation of the household head, listing of all members of the household, location of the household, using a Global Positioning System (GPS). Women aged 13-49 had a birth history module completed. Mothers of children <2 years and those who lost a child in infancy were identified and asked if they were willing to be visited by the Child Health and Verbal Autopsy teams. During a follow-up survey, a coverage and malaria survey team filled a child health module. They asked mothers of all children under 24 months in the household – including IPTi and vaccine coverage, and indicators of process and context. Blood samples were also taken to test for malaria parasites. Household heads were asked to give their written consent to participate.

All data were entered into PDAs at the point of collection [5]. Standard range, consistency and completeness checks were carried out at the time of data collection in the field. For the purpose of equity analysis data used were those related to household characteristics from the initial survey and IPTi coverage, morbidity and mortality from the follow-up survey. Analysis was done using Stata © (version 10, College Station, Texas, USA) whereby adjustments for survey design effect of clustering was done using “svy” commands. Principle component analysis was employed to generate socio-economic groups.

4.4 Conclusion

This chapter has provided an overview of the study methodology including the study area, study design and methods for each study objective.

The details of the data collection methods are given in the respective papers in the following chapters. However, in this study the various objectives employed different methods. This was due to the fact that the health system functions that impact scale-up of IPTi are not homogeneous but they are interrelated and interact to accomplish the health system goal of improving people and community health. This required employment of variety of research methods that come from a variety of disciplines to provide sufficient and relevant information to support decision-making. This made possible to acquire basic understanding of the concepts, approaches and to document the potential benefits and limitations of the research methods.

The consultative approach of developing and implementing the IPTi strategy ensured that the process is relevant and appropriate; everyone directly concerned was involved. This was critical for the research outcome to make a difference. It therefore included policymakers, policy implementers at district level and the research community. Cost estimation is an important component to inform health financing function of the health system. Tracking of real programme activities had the advantage of using less assumption and providing real program cost. The health facilities are important outlet for service delivery. Through health facility surveys it was possible to evaluate indicators related to the quality of case management, the availability of health systems support for child health, indicators of utilization, care-seeking behaviour and additional information needed to estimate costs. Time and motion observational studies provided information on the clinic organization and staff time allocation. Thus, the methods were selected to enable an assessment of the health system strategic factors that are key for health system strengthening as they have impact on the uptake and scale-up of effective health interventions. The experience is valuable in the design of scale-up of health interventions and health system evaluation.

References:

1. Armstrong Schellenberg JR, Mrisho M, Manzi F, Shirima K, Mbuya C, Mushi AK, Ketende SC, Alonso PL, Mshinda H, Tanner M *et al*: **Health and survival of young children in southern Tanzania**. *BMC public health* 2008, **8**:194.
2. National Bureau of Statistics: **Tanzania National Census. [http://www.tanzania.go.tz/census/].** 2002.
3. National Bureau of Statistics Tanzania: **Tanzania Demographic and health Survey 2004/05. [http://www.nbs.go.tz/DHS/index.html]**. 2005.
4. IPTi Consortium: **The Intermittent Preventive Treatment in Infants. [**Error! Hyperlink reference not valid.. 2008.
5. Shirima K, Mukasa O, Schellenberg JA, Manzi F, John D, Mushi A, Mrisho M, Tanner M, Mshinda H, Schellenberg D: **The use of personal digital assistants for data entry at the point of collection in a large household survey in southern Tanzania**. *Emerging themes in epidemiology* 2007, **4**:5.

CHAPTER 5: INTERMITTENT PREVENTIVE TREATMENT FOR MALARIA AND ANAEMIA CONTROL IN TANZANIAN INFANTS; THE DEVELOPMENT AND IMPLEMENTATION OF A PUBLIC HEALTH STRATEGY.

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Summary

Minimizing the time between efficacy studies and public health action is important to maximize health gains. We report the rationale, development and implementation of a district-based strategy for the implementation of Intermittent Preventive Treatment in infants (IPTi) for malaria and anaemia control in Tanzania. From the outset, a research team worked with staff from all levels of the health system to develop a public-health strategy which could continue to function once the research team withdrew. The IPTi strategy was then implemented by routine health services to ensure that IPTi behaviour change communication materials were available in health facilities, that health workers were trained to administer and to document doses of IPTi, that the necessary drugs were available in facilities and that systems were in place for stock management and supervision. The strategy was integrated into existing systems as far as possible and well accepted by health staff. Time and motion studies documented that IPTi implementation took a median of 12.4 (range 1.6-28.9) minutes per nurse per vaccination clinic. The collaborative approach between researchers and health staff effectively translated research findings into a strategy fit for public health implementation.

Keywords Intermittent Preventive Treatment in infant; malaria; child health; Expanded Programme on Immunization; health system; Tanzania

Introduction

Malaria remains a major challenge in many developing countries, with recent estimates of the annual number of deaths directly due to malaria of over 800,000, mainly in children under five years living in Africa [1]. Renewed focus and resources are being paid to malaria prevention and treatment in Africa, with major investment into the development and testing of anti-malarial drugs and a malaria vaccine. However, there has been less investment in ensuring effective systems exist for the delivery of these new, and even existing, products [2, 3]

Intermittent Preventive Treatment in infants (IPTi) is a promising tool to fight malaria in children aged under one year. IPTi consists of the delivery of three treatment doses of an anti-malarial drug alongside routine vaccinations. Most experience has been gained with sulphadoxine-pyrimethamine (SP), which has been licensed for use in children for over 30 years. Doses of IPTi are given as Directly Observed Therapy (DOT) alongside routine vaccinations against DPT/OPV (at about 2, 3 months of age) and measles (about 9 months of age). IPTi is given regardless of the presence of symptoms or parasitaemia. An initial study in Ifakara, southern Tanzania, showed that IPTi with SP was safe and reduced the incidence of clinical malaria and severe anaemia by at least 50% in the first year of life [4]. In recent years clinical trials have been conducted In a range of other settings to explore the potential value of IPTi more broadly [5-10], and a research consortium is generating additional data to inform policy makers (www.ipti-malaria.org). The new emphasis on the global research agenda to work

on operational feasibility of interventions is a catalyst to undertaking effectiveness studies [11-15]. In southern Tanzania, where initial safety and efficacy data already exists, it has been possible to address operational issues surrounding the deployment of IPTi through routine health systems.

The challenge of delivering efficacious tools to their target group is increasingly recognized [16]. The translation of positive research results into policy and then public health action often follows a stuttering and uncertain path. For example, the first evidence of an impact of insecticide treated mosquito nets on child survival was published in 1991 [11] and further evidence followed from a co-ordinated series of randomized trials [13, 15, 17-19]. However the 2002 Malaria Report showed that less than 2% of African children were using ITNs [20]. The delivery of ITNs requires the establishment of a novel delivery strategy and is more complex than vaccination-linked interventions. However, even interventions delivered alongside Expanded Programme on Immunization (EPI) vaccines may face problems: vitamin A supplementation at the time of vaccination against measles was made policy in Tanzania in 1987, yet coverage in the target group 12 years later was only 14% [21]. Research into optimizing delivery strategies, exploring operational feasibility, acceptability, cost and cost effectiveness under real-life, district-based programme conditions should accelerate the process of moving from efficacy to public health action.

This paper describes our approach to the development of an IPTi strategy which could be integrated into the Tanzanian Expanded Programme on Immunization. The strategy involved development of an approach including behaviour change communication messages and materials, a training curriculum for health workers, administrative systems for SP supply and accountability and systems to enable supervision and support at district and regional levels.

Methods and Results

Study area

The IPTi strategy was developed for initial implementation in five districts in the Lindi (Lindi Rural, Nachingwea and Ruangwa) and Mtwara (Newala and Tandahimba) regions of southern Tanzania. These districts are part of the southern zone, which has the highest child mortality in Tanzania: the under-five mortality rate was reported as 153/1000 live births in the ten years period preceeding the 2004/5 survey [22]. The total population is around 900,000 (http//www.tanzania.go.tz/census). Described in detail elsewhere [23] the area is largely low lying with a broad mix of ethnic groups, though Swahili is widely spoken. Most people live in mud-walled, grass-roofed houses and depend on subsistence farming, fishing or small scale trading for their livelihood. Most rural roads are unpaved, many becoming impassable during the rainy seasons. The public health system comprises a network of dispensaries, health centres and hospitals. Malaria is the leading public health problem according to regional health reports.

The Approach to Strategy Development

We were keen to develop a strategy which could reasonably be expected to be implemented by the Ministry of Health (MoH) on withdrawal of the research team. Hence from the beginning the researchers worked in partnership with MoH policy-makers, managers and implementers at all levels, and involved a large number of in-country stakeholders. Figure 5.1 shows the approach to the development and implementation of IPTi, giving the main activities undertaken, timeline and stakeholders' involvement and interactions. The initial phase of sensitization and development of the strategy took approximately one year. However, the aim to minimize the time gap between demonstration of benefits and implementation in practice relates to policy and practice on a national scale. The policy process itself and the time it takes is beyond the scope of our paper.

At the national level we formed an ad-hoc "IPTi Core Group" which steered the development of the strategy and lent political support. The group consisted of named, mid-level managers, who were more likely than senior managers to be able to attend meetings and less likely to be replaced. The group comprised representatives from the national EPI programme, the National Malaria Control Programme (NMCP) and from the Integrated Management of Childhood Illnesses (IMCI) unit of Reproductive and Child Health (RCH) department of the MoH. WHO and UNICEF representatives were also invited to Core Group meetings. The Core Group guided the development of a training curriculum for front-line health workers, training materials and advised on who should be trained from each facility, where and by whom. They also provided a critical review of draft

behaviour-change communication materials and took part in piloting and training of district-level trainers. The overall result was an IPTi strategy readily integrated into, and accepted by, the health system.

National level stakeholders meetings were conducted regularly and involved additional staff from the EPI, NMCP and RCH/IMCI, WHO and UNICEF country offices, as well as staff from the Health Management and Information System, Medical Stores Department, Central Transport Unit of the Ministry of Health, the Tanzania Food and Drug Authority, National Bureau of Statistics, National Institute for Medical Research, Muhimbili University College of Health Sciences and the Centre for Enhancement of Effective Malaria Interventions. Progress and plans, concerns and criticisms were shared with this group, and the IPTi strategy further strengthened as a result. Although Regional Medical Officers and Reproductive and Child Health (RCH) staff sometimes joined national stakeholder meetings, a series of planning and feedback meetings were held at regional and district levels during strategy development. These provided a wealth of useful, practical feedback on strategy development, communication and training materials and approaches to documentation and delivery of IPTi.

All through strategy development we only considered options that could be sustained on a public health scale, by existing front-line health staff, without ongoing inputs from the research team. For example, we did not use community sensitization and mobilization through street theatre or mass outreach campaigns

because the costs are likely to be prohibitive in the context of routine implementation by the health system. Preparation for implementation involved two sets of activities. The first consisted of the development and testing of a brand name, messages of awareness-raising posters and a health staff training program, with relevant support materials. The second led to the development of management systems for IPTi which were incorporated within the routine health system.

Posters & Training Program

A rapid ethnographic study provided inputs for the behaviour-change communication strategy including delivery channels, materials and a brand name for IPTi [24]. In brief, socio-cultural information was collected on local messages on perceptions of malaria and anaemia, vaccination clinics, attitudes to SP as a drug to prevent and treat malaria, and communication channels for health issues. A brand name for IPTi and draft materials were pre-tested in focus groups and in-depth interviews at village level, as well as in individual consultations with national, regional, and district health staff as well as other stakeholders. The rapid ethnographic study revealed that mothers mostly learn about health issues from health workers and through informal discussions with other women. The existing posters at health facilities were seldom referred to by mothers. Nevertheless we developed two posters promoting IPTi for use in health facilities, with the aim of guiding front-line health staff and mothers about key IPTi messages as well as providing a focus for health education to mothers attending

vaccination clinic. The soliciting of comments on the draft materials was a useful mechanism to engage stakeholders at all levels.

We chose the brand name "*MKINGE"* (a Swahili word literally meaning "protect him or her") and the slogan "*MKINGE mtoto wako dhidi ya malaria"* ("protect your baby against malaria"). One of the posters shows a queue of happy women waiting for a nurse to give IPTi to their baby at a vaccination clinic. The two captions translate to "Protect your baby from malaria" and "MKINGE is a strategy to give SP to babies when they are given vaccines at 2, 3 and 9 months of age". The second poster shows a healthy mother and her child in a rural setting and is captioned "MKINGE reduces malaria and anaemia" and "Many children have already used MKINGE". The posters bear the logos of the key stakeholders, including the Ministry of Health, and the Ifakara Health Research and Development Centre.

Management Tools & Systems

IPTi is administered three times during the first year of life, at the same time as vaccines delivered by the EPI system. It thus makes good sense to take advantage of the well-developed, tried and tested and widely-understood EPI management systems. Forecasting the number of doses of SP for IPTi was based on the EPI tool used to forecast the number of doses of DPT vaccine, which is also administered three times in the first year of life. Although the research project supported implementation and delivered SP for IPTi to the

district level, the core group planned how SP for IPTi would follow the same delivery channel from national to regional level as the syringes supplied for vaccination. This approach ensures that the correct number of SP doses are supplied but without making additional demands on the relatively expensive cold chain for vaccine supply. The required numbers of doses of SP would be delivered to regional vaccine stores in response to their requests. A similar 'pull' approach was employed from regional to district vaccine stores and to individual health facilities. Delivery to health facilities of SP for IPTi was thus linked to delivery of routine vaccines, subject to the same accountability controls and the responsibility of the District Cold Chain Officer. The minimum and maximum stock levels were set in the same way as for vaccines (a minimum of one month's supply and a maximum of three months' supply). At each facility the drugs were signed for in a ledger used for all other drug and vaccine stocks, and updated to show stock used each day. At facility level, the person in charge of the RCH clinic would be given responsibility for IPTi, including the safe storage of drugs. It was decided that IPTi drugs should not be in the care of the overall facility in-charge to ensure that SP for IPTi would be available even if the facility in-charge was away. Labeled plastic boxes were given to each facility for storage of SP for IPTi.

The administration of a dose of SP for IPTi is recorded in three places. Firstly the routine tally sheet, which records the numbers of each vaccine administered, was edited to incorporate a section for IPTi. Secondly, the child's health card was also

edited so that dates of IPTi doses could be recorded in the same area as the routine vaccinations. Thirdly the register of children regularly attending the facility, which includes space to document some of the routine vaccinations, was also amended to enable recording of doses of IPTi. In practice the tally sheet is used as the basis for a monthly summary of the numbers of doses of the different vaccines administered. A specific 'EPI monthly report' is completed in each facility and sent to the District Cold Chain Officer, whose responsibility is to complete a monthly summary report of all facilities in the district and forward to the Regional Cold Chain Officer who completes and forwards to national level. By incorporating IPTi into each summary sheet a system to account for IPTi, and to estimate coverage, was established.

Implementation of the IPTi strategy

The decentralized health system in Tanzania means that health service delivery is the responsibility of district council health management teams (CHMT). As part of the IPTi strategy, the research team seconded from a CHMT an 'IPTi project implementation co-ordinator', a Clinical Officer with public health experience. In conjunction with CHMT members, he organized the training sessions, mobilized district and regional health staff for training and later supported implementation of the IPTi strategy in the five districts. Other project staff with direct experience of IPTi and development of other public health strategies provided technical support. Implementation of IPTi was done in a phased approach, with health facility staff in half of all divisions (a division being an administrative level below a

district) being selected randomly for training to implement IPTi. This cluster-randomised approach allowed robust evaluation of the IPTi strategy. Thus, staff from a randomly selected half of all health facilities were trained to implement IPTi in early 2005.

In an initial phase, lasting about one month, the IPTi strategy was piloted in two health facilities. After this, messages and materials were finalized and plans made for regional staff to train district health staff as trainers, and for the district staff in turn to train the frontline health staff as primary implementers. Materials developed to support training and implementation included an “IPTi guideline” booklet, developed to guide the training of health workers and consisting of an overview of IPTi, a section with step-by-step instructions on how to administer and record doses of IPTi and a set of frequently asked questions. A laminated, A3-size job aid contained the step-by-step instructions and was intended for use in health facilities, either on the nurse’s table or on a wall in the vaccination area. An initial stock of SP tablets for IPTi, posters, modified child health cards and tally sheets were also supplied during initial training, as were adhesive stickers to enable recording of IPTi doses on the child health cards of children who had already received health cards but who would become eligible for a dose of IPTi.

Piloting was started by a team formed by the project implementation coordinator, two other members of the project team, an NMCP representative, the Regional Reproductive and Child Health Coordinator from each of the two regions, one

District Medical Officer, one district Reproductive and Child Health Coordinator, and one District Cold Chain Officer. This team reviewed the training guidelines, discussed operational issues such as the management and storage of IPTi supplies at district and facility levels. The majority of health facilities in the area had no supply of clean water and after discussion with CHMT, it was decided to encourage health staff to purchase a socially-marketed chemical purification liquid (WaterGuard, Mukwano Industries, Kampala, Uganda), and also to buy cups and spoons where necessary, using funds generated from user charges.

Training of Health Staff

One day of training for six staff from each CHMT was done in each region, led by the two Regional Reproductive and Child Health Coordinators with technical support from the IPTi project implementer, two other members of the research team and a member of the NMCP. From each district, the District Medical Officer, District Reproductive and Child Health Coordinator, District Cold Chain Officer, Pharmacist, Nursing Officer and malaria focal person attended the training. Regional Medical Officers, Pharmacists and Cold Chain officers were also invited. Training included lectures, group discussions, practical work and a test of understanding. Following a general introduction a step by step explanation of how to administer and document IPTi was given. Before administering IPTi, health workers were reminded to check whether children had ever had an adverse reaction to any sulphur-containing drug such as co-trimoxazole or SP, and also whether they had received SP for malaria treatment in the previous 2

weeks. This was in order to avoid giving IPTi to any child with a history of an adverse reaction to a sulphur-containing drug, or who had received SP for malaria treatment in the previous 2 weeks. Other issues covered included how to order SP for IPTi, storage of SP, distribution and tracking within each district, supervision of IPTi activities and plans for training in each district. It was agreed that IPTi supervision would follow the same procedures as EPI vaccines, with district EPI staff (District Cold Chain Officer or District Reproductive and Child Health Coordinator) being responsible for delivery of supplies to each facility, checking stock, reviewing record keeping and supporting frontline health workers. Materials for training included the guideline booklet, job aid, posters, modified child health cards, stickers to record IPTi doses on the child health cards of children who already had cards, the modified vaccine tally sheets and stickers for modification of the village child health register. An initial stock of SP tablets for IPTi was also given to trainees.

In the weeks that followed, 115 front-line health staff from 61 dispensaries, health centres and hospitals attended the one day training course. The training approach followed that used to train the trainers but with more emphasis on practical activities: why, when, how and to whom IPTi should be administered, storage, record keeping and problem-solving. The training was led by three members of the CHMT (District Medical Officers, District Reproductive and Child Health Coordinators and District Cold Chain Officers) under the observation and technical support of the IPTi project implementation Coordinator. Two

participants were invited from each health facility – the overall in-charge and the in-charge of the RCH section of the facility. The overall in-charge was included so that they would support their RCH staff to administer IPTi and would know to check before prescribing SP to a young child.

As part of the training, an initial supportive supervision visit was made to all participating health facilities within the following two months. District EPI staff and the IPTi project implementer reinforced the key messages of the one-day training session and helped to solve any problems. By October 2006 92% of facilities (57/62) had started to use “WaterGuard”. A few of the front-line staff did not start implementation until after this visit, some waiting to start implementation at the beginning of a month, others wanting reassurance and benefiting from an on-site demonstration to reinforce the training on the new intervention. The main issues identified related to secure storage of the SP and adequate documentation.

After these initial visits, subsequent IPTi implementation management and support was fully integrated into the routine CHMT systems. The IPTi project implementer would sometimes join CHMT members during their routine monthly supervision visits in such a way that he visited most facilities every two months. Stock-outs of IPTi were a relatively common problem, found at roughly 13% of all visits. In the early months vaccines were sometimes delivered without SP for IPTi but as implementation continued the stock was increasingly distributed with vaccines (Figure 5.2). Coverage of each dose of IPTi at each facility each month

was estimated using the number of children recorded on the tally sheet as the numerator and the established denominator based on the estimated population aged 0-11 months in the facility catchment's area (4% of the population from the 2002 census, with adjustments for annual population growth, divided by 12 to get a monthly target population). Data were compiled at district level to generate estimates over multiple facilities or for larger periods of time; for example, in the first quarter of 2006, coverage of dose 3 of IPTi for implementing divisions of Newala District was 79% (363/462) and for implementing divisions of Tandahimba District was 78% (594/764).

Nine months after the start of implementation we did qualitative and time and motion studies of RCH nurses delivering EPI vaccines and/or IPTi. The aim was to assess acceptability of IPTi to facility staff and to document the impact on time use of the new IPTi intervention. We did in-depth interviews with the nursing staff, exploring their expectations of IPTi implementation (for nurses in comparison divisions) or their actual experience of implementing IPTi (nurses in non-IPTi implementing, comparison divisions). Pairs of interviewers spent a week at each participant health facility. Towards the end of their stay, when the staff had grown used to the presence of the interviewers, the health workers were followed on a typical vaccine clinic day. Following positive earlier experiences with the use of Personal Digital Assistants (PDAs) to capture health research data [25], we used PDAs to document the responses to direct questions and the time taken to give out IPTi health education, prepare and administer IPTi to

infants, and the time taken to record delivery of the IPTi doses in immunization cards and HMIS books. This was done by means of a menu of nurses' activities on the PDA; when an activity was selected the time was automatically recorded as the start time for that activity and the end time for the previous activity. The data were thus entered directly into Pendragon forms, synchronized into an Access database where they were cleaned before analysis using Stata.

A total of 24 health facilities were sampled in the 5 study districts, selected to ensure balance in terms of type of health facility (dispensary or health centre), number of vaccinating staff and vaccine coverage between facilities in IPTi intervention and comparison areas. In comparison areas, when health workers where asked how difficult they thought it would be to implement IPTi, most said they were ready to implement although a few were apprehensive about the anticipated increased work load and small number of staff. However, nurses in implementation areas said they had experienced no major difficulties in implementing IPTi. There were no reports of changes to the work schedules and only a few mentioned an obvious increase in the time spent on documentation. Amongst the 12 intervention facilities, nine had vaccination days with children eligible for IPTi. RCH nurses spent a median of 12.4 (n=9, range 1.6 -28.9) minutes on IPTi delivery and dose recording on a typical vaccine clinic day. There was a median of more than two hours non-productive time amongst nurses on these vaccine clinic days in both implementing and comparison facilities.

Financial costs

The study in southern Tanzania included tracking of health system and other costs of developing the strategy and maintaining routine implementation of the strategy in five districts which are described elsewhere [26]. Briefly, the estimated financial cost to start-up and run IPTi in the whole of Tanzania in 2005 was US$1,486,284. Start-up costs of US$36,363 were incurred at the national level, mainly on the development of Behaviour Change Communication (BCC) materials, stakeholders' meetings and other consultations. The annual running cost at national level for intervention management and monitoring and drug purchase was estimated at US$459,096.

Discussion and conclusion

Under the auspices of the IPTi Consortium (www.ipti-malaria.org) and other groups, IPTi safety and efficacy studies have been completed or are ongoing in Ghana, Gabon, Mozambique, Kenya Tanzania and Papua New Guinea (PNG), and large-scale, multi-district implementation of IPTi is being ongoing in six countries under programs run by UNICEF. The end product will be a detailed safety profile and an overview of the efficacy of IPTi from a range of epidemiological and geographic settings. Furthermore the Consortium will have generated experience in the development and operationalization of IPTi strategies in a variety of health systems. Hence it will be possible to make an evidence-based policy decision and then, if the recommendation is to push forward with IPTi, to facilitate rapid, large-scale implementation and public health action.

We have described the development and early implementation of an IPTi strategy within the context of a large-scale operational research programme in southern Tanzania. Broad institutional and political support were garnered through stakeholders meetings at various levels and helped to assure the integration of the IPTi strategy into existing service delivery [27].The Core Group was an efficient mechanism to develop a robust strategy by accessing the advice of key stakeholders on the development and fine tuning of the delivery system. The establishment of this group helped maintain awareness and involvement in the process of strategy development which has previously been shown to be vital

in determining the longer-term utility of a health strategy [28]. Researchers worked in partnership with MoH representatives to deliver a new intervention over a large area in a way that could readily be scaled up nationally. In so doing we have tried to translate research findings into something that could be applied as public health action [29]. The study had an external clinical monitor for quality assurance. Among the lessons learned in this process are that considerable time is needed to prepare for public health action, in addition to evidence of benefit, a collaborative approach and adequate financial resources.

Delivery of IPTi through well-established routine systems such as EPI also increases the chance of long-term sustainability, saves on implementation costs and should make the approach relatively attractive to policy makers. The initial activities described here have generated information on costs and experience with the issues surrounding drug supply, training, supervision and development of implementation guidelines that could speed up implementation at country level. The EPI is unparalleled in its ability to deliver preventive interventions to young children in Africa. In its 30 years existence the EPI has developed into a well-respected vertical programme at national level which is fully integrated with other health services at district level and at the point of service delivery. Coverage figures in Tanzania show that 71% of all children aged 12-23 months have received all their routine vaccines by the age of 12 months, and 96% of children had received at least one vaccine [22].

Our coverage estimates are based on routine reporting and should be treated with the caution normally associated with such estimates as both numerator and denominator are prone to errors. The number of children who have received the intervention is recorded on a simple tally-sheet, and with this approach it is easy to record the same child twice and to forget to record other children. The target populations are also prone to errors due to temporary or permanent in- and out-migration, seasonal variation in births and difficulty defining target populations. Nevertheless, routine estimates of vaccine coverage match relatively well with estimates derived from a household survey in the same area [23].

Our IPTi strategy is embedded within a research study and hence the conditions under which IPTi is implemented are not exactly as they would be in a national programme. IPTi is not implemented in all health facilities, but in a randomly selected half of the divisions. Although this detracts from the 'real-life' nature of the implementation it adds considerable strength to the evaluation. A full-time IPTi project implementer accompanied Council Health Management Team members on visits to health facilities about every two months, probably increasing the frequency and focus of IPTi–related activities during routine supervision visits. This may have increased IPTi coverage beyond that gained by a national programme although follow-up visits were in the context of routine supervision by Council Health Management Team members and the approach mirrored routine implementation on a national scale.

After one full year of implementation, IPTi was nearly always distributed from district to facility level at the same time as routine vaccines, suggesting that district health staff had integrated IPTi into their usual routine. However, stock-outs of IPTi remained relatively common. For example, 10% of health facilities experienced at least one stock out in the second quarter of 2006. Although this is of concern, it should be noted that stock-outs of routine vaccines were at least as common. For example, a health facility survey done in the study area in 2004 found that only 77% (91/118) of all facilities had all vaccines in stock on the day of the survey [23]. Nevertheless, as most stock-outs were of short duration, overall vaccine coverage was greater than 80% for DPT and polio.

Staff in facilities where IPTi was not available expected to be able to implement an IPTi strategy although some expressed reservations about the increased workload. However no staff involved in IPTi implementation reported having to increase the number of vaccination days per week or re-organisation of clinic staff to accommodate the increased workload. We observed IPTi related activities taking a median time of less than 15 minutes per nurse per vaccination day and there was no evidence of health worker time constraining the delivery of IPTi or other health interventions. We were surprised to find that vaccinating nurses had a median of over two hours non-productive time per vaccination clinic day, although this is similar to other facility-based time and motion studies in Tanzania and elsewhere [30, 31]. Hence IPTi could be rolled-out in an integrated manner throughout the country by the health workers who are already available.

It is important to note that, although human resources are a major problem in Tanzania and other developing countries, many aspects of health service delivery could be improved by enhanced time management and supportive supervision at facility level.

The overall purpose of the southern Tanzania IPTi effectiveness study was to prepare for prompt public health action when and if a positive policy recommendation is made. Policy recommendation are not made on the basis of research evidence alone, but rest on other issues as well [14, 28, 32]. What are the consequences of an IPTi policy recommendation being delayed or not being made at all? In this case implementation will stop, and the lessons described here will have relevance for the future, for development of other public health strategies.

In undertaking this work, there were some negative experiences which need to be documented. Working with government employees at national, regional and district level, the research team found some individuals did not prioritize work related to IPTi, possibly because they felt they should have been paid extra to do it. At service delivery level, some staff who had received on-the-job training was not ready to administer IPTi if a colleague who had attended formal IPTi training was out of the working station. This reluctance was likely due to envy of formal trainees, who had received a travel allowance to attend the training. Supervision was an additional challenge, with infrequent visits which were rarely supportive.

These problems were tackled through communication and positive feedback for the purpose of bringing productive changes in public health delivery.

In conclusion, this study has generated useful experience on the development of a strategy for the routine delivery of IPTi. We found that combining researchers and programme implementers into a single Core Group enabled the development of a practical strategy that was readily implemented at facility and district level. The researchers led strategy development, and made the major investment in this respect, thus helping to translate research results into a strategy that could be implemented as a public health program. We believe this partnership to be novel and hope that our experience can contribute to the design of delivery strategies not only for IPTi but also for taking to scale other child health interventions.

Authors' contributions

FM conceived the idea and participated in the design of the study, conducted the analysis and writing the manuscript. JS participated in conceiving the idea, study design and writing and interpretation. YH, AM, KS, AM, AS, NR, MK participated in data analysis and interpretation. MT, PA, HM provided technical support. DS participated in the design of the study, coordinated the study, data analysis and interpretation. All authors read, commented on and approved the manuscript. FM and JAS are the guarantors of the paper.

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Ethical clearance

The study was approved by the Institutional review committees of the Ifakara Health Research and Development Centre (IHRDC), National Medical Research Coordinating Committee of Tanzania and LSHTM and that subjects gave informed consent to the work.

Conflict of interests

The authors declare no conflict of interest concerning the work reported in this paper.

Figures

Figure 5.1, the approach to the development and implementation of IPTi - the activities undertaken, timeline and stakeholders' involvement and interactions

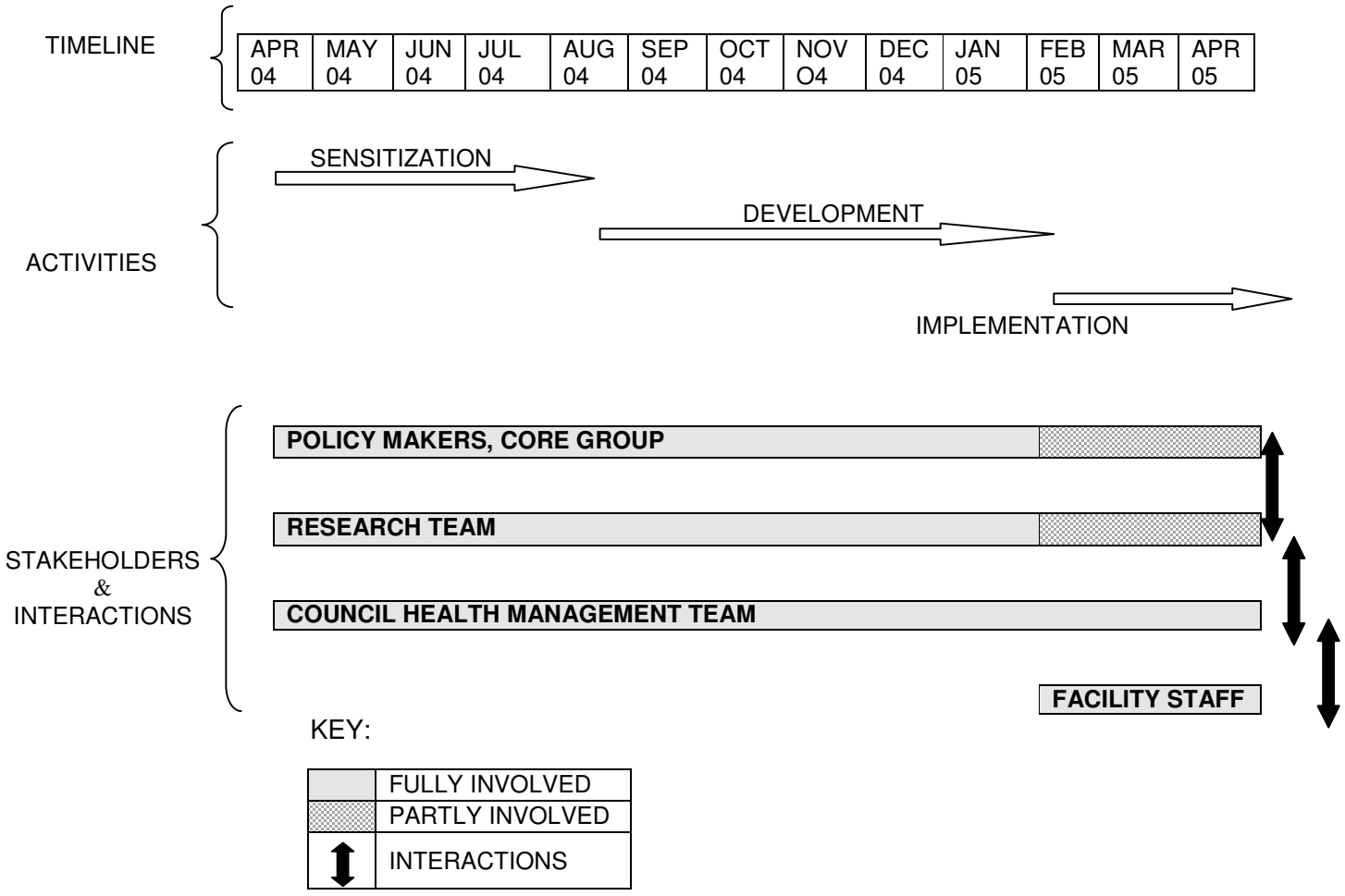
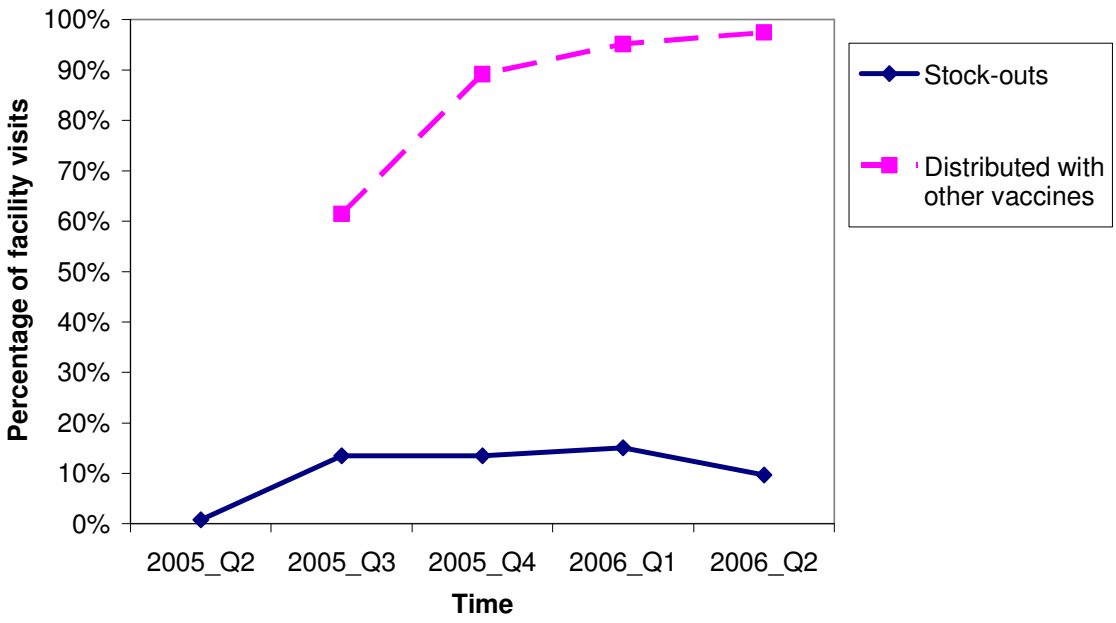


Figure 5.2: IPTi at health facilities, stock-outs and supplies of IPTi that were delivered to the facility at the same time as vaccines



References:

1. Rowe AK, Rowe SY, Snow RW, Korenromp EL, Schellenberg JR, Stein C, Nahlen BL, Bryce J, Black RE, Steketee RW: **The burden of malaria mortality among African children in the year 2000**. *Int J Epidemiol* 2006, **35**(3):691-704.
2. Jones G, Steketee RW, Black RE, Bhutta ZA, Morris SS: **How many child deaths can we prevent this year?** *Lancet* 2003, **362**(9377):65-71.
3. Leroy JL, Habicht JP, Pelto G, Bertozzi SM: **Current priorities in health research funding and lack of impact on the number of child deaths per year**. *Am J Public Health* 2007, **97**(2):219-223.
4. Schellenberg D, Menendez C, Kahigwa E, Aponte J, Vidal J, Tanner M, Mshinda H, Alonso P: **Intermittent treatment for malaria and anaemia control at time of routine vaccinations in Tanzanian infants: a randomised, placebo-controlled trial**. *Lancet* 2001, **357**(9267):1471-1477.
5. Chandramohan D, Owusu-Agyei S, Carneiro I, Awine T, Amponsa-Achiano K, Mensah N, Jaffar S, Baiden R, Hodgson A, Binka F *et al*: **Cluster randomised trial of intermittent preventive treatment for malaria in infants in area of high, seasonal transmission in Ghana**. *Bmj* 2005, **331**(7519):727-733.
6. Grobusch MP, Lell B, Schwarz NG, Gabor J, Dornemann J, Potschke M, Oyakhirome S, Kiessling GC, Necek M, Langin MU *et al*: **Intermittent preventive treatment against malaria in infants in Gabon--a randomized, double-blind, placebo-controlled trial**. *J Infect Dis* 2007, **196**(11):1595-1602.
7. Kobbe R, Kreuzberg C, Adjei S, Thompson B, Langefeld I, Thompson PA, Abruquah HH, Kreuels B, Ayim M, Busch W *et al*: **A randomized controlled trial of extended intermittent preventive antimalarial treatment in infants**. *Clin Infect Dis* 2007, **45**(1):16-25.
8. Macete E, Aide P, Aponte JJ, Sanz S, Mandomando I, Espasa M, Sigauque B, Dobano C, Mabunda S, Dgedge M *et al*: **Intermittent preventive treatment for malaria control administered at the time of routine vaccinations in Mozambican infants: a randomized, placebo-controlled trial**. *J Infect Dis* 2006, **194**(3):276-285.
9. Massaga JJ, Kitua AY, Lemnge MM, Akida JA, Malle LN, Ronn AM, Theander TG, Bygbjerg IC: **Effect of intermittent treatment with amodiaquine on anaemia and malarial fevers in infants in Tanzania: a randomised placebo-controlled trial**. *Lancet* 2003, **361**(9372):1853-1860.
10. Mockenhaupt FP, Reither K, Zanger P, Roepcke F, Danquah I, Saad E, Ziniel P, Dzisi SY, Frempong M, Agana-Nsiire P *et al*: **Intermittent preventive treatment in infants as a means of malaria control: a randomized, double-blind, placebo-controlled trial in northern Ghana**. *Antimicrob Agents Chemother* 2007, **51**(9):3273-3281.

11. Alonso PL, Lindsay SW, Armstrong JR, Conteh M, Hill AG, David PH, Fegan G, de Francisco A, Hall AJ, Shenton FC *et al*: **The effect of insecticide-treated bed nets on mortality of Gambian children**. *Lancet* 1991(b), **337**(8756):1499-1502.
12. Armstrong Schellenberg JR, Adam T, Mshinda H, Masanja H, Kabadi G, Mukasa O, John T, Charles S, Nathan R, Wilczynska K *et al*: **Effectiveness and cost of facility-based Integrated Management of Childhood Illness (IMCI) in Tanzania**. *Lancet* 2004, **364**(9445):1583-1594.
13. Binka FN, Kubaje A, Adjuik M, Williams LA, Lengeler C, Maude GH, Armah GE, Kajihara B, Adiamah JH, Smith PG: **Impact of permethrin impregnated bednets on child mortality in Kassena-Nankana district, Ghana: a randomized controlled trial**. *Trop Med Int Health* 1996, **1**(2):147-154.
14. Crawley J, Hill J, Yartey J, Robalo M, Serufilira A, Ba-Nguz A, Roman E, Palmer A, Asamoa K, Steketee R: **From evidence to action? Challenges to policy change and programme delivery for malaria in pregnancy**. *Lancet Infect Dis* 2007, **7**(2):145-155.
15. D'Alessandro U, Olaleye B, Langerock P, Bennett S, Cham K, Cham B, Greenwood BM: **The Gambian National Impregnated Bed Net Programme: evaluation of effectiveness by means of case-control studies**. *Trans R Soc Trop Med Hyg* 1997, **91**(6):638-642.
16. Victora CG, Hanson K, Bryce J, Vaughan JP: **Achieving universal coverage with health interventions**. *Lancet* 2004, **364**(9444):1541-1548.
17. Habluetzel A, Cuzin N, Diallo DA, Nebie I, Belem S, Cousens SN, Esposito F: **Insecticide-treated curtains reduce the prevalence and intensity of malaria infection in Burkina Faso**. *Trop Med Int Health* 1999, **4**(8):557-564.
18. Lengeler C: **Insecticide-treated bednets and curtains for preventing malaria**. *Cochrane Database Syst Rev* 2000(2):CD000363.
19. Nevill CG, Some ES, Mung'ala VO, Mutemi W, New L, Marsh K, Lengeler C, Snow RW: **Insecticide-treated bednets reduce mortality and severe morbidity from malaria among children on the Kenyan coast**. *Trop Med Int Health* 1996, **1**(2):139-146.
20. WHO: **The African Malaria Report. [http://www.rbm.who.int/amd2003/amr2003/ch5.htm]**. 2003.
21. National Bureau of Statistics (NBS) [Tanzania] and Macro International Inc.: **Tanzania Reproductive and Child Health Survey 1999. Calverton, Maryland: NBS and Macro International Inc.**; 2000.
22. National Bureau of Statistics (NBS) [Tanzania] and Macro International Inc.: **Tanzania Demographic and Health Survey 2004-2005. [http://www.nbs.go.tz/DHS/index.html]**. 2005.
23. Armstrong Schellenberg JR, Mrisho M, Manzi F, Shirima K, Mbuya C, Mushi AK, Ketende SC, Alonso PL, Mshinda H, Tanner M *et al*: **Health and survival of young children in southern Tanzania**. *BMC public health* 2008, **8**:194.

24. Mushi AK, Schellenberg J, Mrisho M, Manzi F, Mbuya C, Mponda H, Mshinda H, Tanner M, Alonso P, Pool R *et al*: **Development of behaviour change communication strategy for a vaccination-linked malaria control tool in southern Tanzania**. *Malaria journal* 2008, **7**:191.
25. Shirima K, Mukasa O, Schellenberg JA, Manzi F, John D, Mushi A, Mrisho M, Tanner M, Mshinda H, Schellenberg D: **The use of personal digital assistants for data entry at the point of collection in a large household survey in southern Tanzania**. *Emerg Themes Epidemiol* 2007, **4**:5.
26. Manzi F, Hutton G, Schellenberg J, Tanner M, Alonso P, Mshinda H, Schellenberg D: **From strategy development to routine implementation: the cost of Intermittent Preventive Treatment in Infants for malaria control**. *BMC health services research* 2008, **8**(1):165.
27. Walley J, Khan MA, Shah SK, Witter S, Wei X: **How to get research into practice: first get practice into research**. *Bull World Health Organ* 2007, **85**(6):424.
28. Williams HA, Durrheim D, Shretta R: **The process of changing national malaria treatment policy: lessons from country-level studies**. *Health Policy Plan* 2004, **19**(6):356-370.
29. Davis P, Howden-Chapman P: **Translating research findings into health policy**. *Soc Sci Med* 1996, **43**(5):865-872.
30. Adam T, Manzi F, Schellenberg JA, Mgalula L, de Savigny D, Evans DB: **Does the Integrated Management of Childhood Illness cost more than routine care? Results from the United Republic of Tanzania**. *Bull World Health Organ* 2005(b), **83**(5):369-377.
31. Adam T, Amorim DG, Edwards SJ, Amaral J, Evans DB: **Capacity constraints to the adoption of new interventions: consultation time and the Integrated Management of Childhood Illness in Brazil**. *Health Policy Plan* 2005(a), **20 Suppl 1**:i49-i57.
32. Agyepong IA, Adjei S: **Public social policy development and implementation: a case study of the Ghana National Health Insurance scheme**. *Health Policy Plan* 2008, **23**(2):150-160.

CHAPTER 6: DEVELOPMENT OF BEHAVIOUR CHANGE COMMUNICATION STRATEGY FOR A VACCINATION-LINKED MALARIA CONTROL TOOL IN SOUTHERN TANZANIA

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Abstract

Background

Intermittent preventive treatment of malaria in infants (IPTi) using sulphadoxine-pyrimethamine and linked to the expanded programme on immunization (EPI) is a promising strategy for malaria control in young children. As evidence grows on the efficacy of IPTi as public health strategy, information is needed so that this novel control tool can be put into practice promptly, once a policy recommendation is made to implement it. This paper describes the development of a behaviour change communication strategy to support implementation of IPTi by the routine health services in southern Tanzania, in the context of a five-year research programme evaluating the community effectiveness of IPTi.

Methods

Mixed methods including a rapid qualitative assessment and quantitative health facility survey were used to investigate communities' and providers' knowledge and practices relating to malaria, EPI, sulphadoxine-pyrimethamine and existing health posters. Results were applied to develop an appropriate behaviour change communication strategy for IPTi involving personal communication between mothers and health staff, supported by a brand name and two posters.

Results

Malaria in young children was considered to be a nuisance because it causes sleepless nights. Vaccination services were well accepted and their use was considered the mother's responsibility. Babies were generally taken for vaccination despite complaints about fevers and swellings after the injections.

Sulphadoxine-pyrimethamine was widely used for malaria treatment and intermittent preventive treatment of malaria in pregnancy, despite widespread rumours of adverse reactions based on hearsay and newspaper reports. Almost all health providers said that they or their spouse were ready to take SP in pregnancy (96%, 223/242). A brand name, key messages and images were developed and pre-tested as behaviour change communication materials. The posters contained public health messages, which explained the intervention itself, how and when children receive it and safety issues. Implementation of IPTi started in January 2005 and evaluation is ongoing.

Conclusions

Behaviour Change Communication (BCC) strategies for health interventions must be both culturally appropriate and technically sound. A mixed methods approach can facilitate an interactive process among relevant actors to develop a BCC strategy.

Background

Malaria continues to be a leading cause of pain, death and poverty in sub-Saharan Africa. Efforts have been directed at the prevention of malaria in pregnant women and young children who carry the greatest burden of the disease. In addition to the promotion of treated mosquito nets, sulphadoxine-pyrimethamine (SP) is recommended by the WHO for intermittent preventive treatment of malaria in pregnancy (IPTp) in endemic countries. Intermittent preventive treatment of malaria in infants (IPTi) using SP has been shown to be a promising approach for malaria control in young children, with a protective efficacy of 20-59% against malaria in children during their first year of life [1-3]. IPTi consists of a full dose of antimalarial treatment delivered to young children at defined intervals alongside routine health contacts, such as vaccinations at the 2nd, 3rd and 9th month of life. Linking malaria control to Expanded Programme on Immunization (EPI) contacts in this way builds on the success of this well-established program which was launched in 1974 [4,5]. Further studies are underway across Africa under the umbrella of the IPTi consortium to generate evidence to inform a policy decision for public health use of IPTi [6]. A recent review by an expert committee of the US Institute of Medicine concluded that IPTi using SP decreases the incidence of clinical episodes of malaria by 20–30% [7,8],

SP was introduced as Tanzania's first-line treatment for malaria in 2001. However, adverse publicity caused widespread alarm about the safety of this

drug, with publication in the national press of dramatic photographs showing people with rare, but very severe adverse events. There was concern that acceptance of IPTi using SP might be compromised. The work described here is part of a community effectiveness study of IPTi using SP in southern Tanzania. The work investigated providers' and communities' understanding of, attitudes and practices related to SP for malaria treatment and IPTp, as well as the acceptability of adding IPTi into existing immunization services. This paper reports a mixed methods approach to inform the development of a behaviour change communication strategy for malaria control with IPTi in southern Tanzania.

Methods

The study involved work at community and health facility levels between August and November 2004, in five districts (Tandahimba, Newala, Lindi Rural, Ruangwa and Nachingwea) of Lindi and Mtwara regions, southern Tanzania. Qualitative data was collected at both levels through focus group discussions and in-depth interviews while quantitative data was collected from health providers through a modular questionnaire during a health facility survey. The districts, with a total population of 890,000 and 134 health facilities, are inhabited by a variety of ethnic groups, predominantly Makonde and Mwera, but including other groups such as Yao, Malaba and Makua. Lindi and Mtwara regions have the highest under-five mortality rates in Tanzania [9]. Geographically, the five districts include the coastal belt along the Indian Ocean to the Makonde plateau in the hinterland,

extended woodlands with wild animals and an international border with Mozambique. Swahili, the national language of Tanzania, is widely spoken in the area and was used throughout data collection and in the development of the BCC materials for IPTi.

Rapid qualitative study

Fifty-two focus group discussions (FGDs) and eight unstructured open ended interviews were held with community members and health workers between September 2004 and January 2005. Data was collected by a team of seven experienced field assistants led by a social scientist. The assistants were trained for five days on interview skills, data recording with MP3 recorders and preparation of daily summaries. Training included group work, role-play and practical fieldwork. Data was collected in ten villages, purposefully selected to represent areas with both low and high EPI coverage rates according to a household survey conducted during 2004. Selection also considered varied geographic locations including coastal areas, the Makonde plateau, semi urban and rural communities, those close to and far from referral hospitals and the international border to Mozambique.

Village leaders were briefed one day before the FGDs and asked to help prepare respondents and venues. On days of data collection, four FGDs were held, one each with “community own resource persons” (widely referred to in Tanzania by the acronym CORPs, they are people who do voluntary work in their community relating to health, agricultural extension work, water, etc.), mothers of babies and

pregnant women at Reproductive and Child Health clinics, mothers of babies and pregnant women at village centres and mothers of babies and pregnant women in outlying hamlets. Three pairs of interviewers each held one FGD in the morning and took turns to conduct the fourth session in the afternoon. The FGDs and interviews were facilitated using a guide with questions on perceptions of and experiences relating to vaccination services, malaria, and use of SP, willingness to accept and views on how to implement IPTi. Community understanding of the existing health posters was assessed to determine their clarity to target audiences, in terms of text, images and take home messages. All discussions were recorded using an MP3 voice-recorder and transcribed verbatim. Debriefing notes from each FGD were prepared daily and these together with a review of transcribed text enriched the content analysis process, which involved coding of related text under corresponding themes.

Health facility survey

A modular questionnaire was administered to health workers at all 134 government, NGO and private health facilities (including hospitals, health centres, and dispensaries) in the five districts. As well as information on the structure and function of the health system, one module of the questionnaire included questions to evaluate the health worker's perceptions of SP for treatment and prevention of malaria. This module was designed with input from an initial in-depth interview with a Public Health Nurse at a health centre in Mtwara municipality. A team of 18 research assistants plus a field co-ordinator administered the health facility questionnaire, following four days of training and

pilot testing. The supervisor accompanied at least one interview each day and any discrepancies were discussed with the interviewer and later among all team members, and appropriate action taken. Questionnaires were processed using a double data entry system in DMSys software (SigmaSoft International, Chicago, IL, USA http://www.sigmasoftintl.com). Data were checked for logical consistencies, completeness and quality and then summarized according to a pre-defined analytical plan using Stata 8.2 (Stata Corp LP, College Station, Texas, USA).

Development of the BCC strategy

The BCC strategy was developed in such a way as to be feasible and low cost on a national scale. The core of the strategy was interpersonal communication between health workers and mothers at the time of giving babies EPI vaccines. This core was supported by a brand name and posters. To ensure that the content of BCC materials was in harmony with national policies and standards, an extensive series of consultations was done with national stakeholders including senior managers and staff of the Ministry of Health, the EPI programme, the Reproductive and Child Health department, the Health Education Unit, the National Malaria Control Programme and the National Kiswahili Council in Tanzania.

Development of BCC materials

During the rapid qualitative study, results of earlier IPTi efficacy trials in other parts of Tanzania were presented to respondents before discussions about

willingness to accept IPTi. The respondents who included health workers, mothers and community-own resource persons were then asked to suggest a brand name for IPTi, images, captions and appropriate channels for BCC messages.

Results

Perceptions of malaria in young children

Malaria was mentioned as a common childhood illness in all FGDs, with fever and crying at night as the main symptoms, occurring particularly during the heavy rains between October and April/May. This season was associated with high mosquito numbers, thought to be directly linked to malaria. Malaria was described as a nuisance to children and a trouble to their parents, particularly mothers because it leads to sleepless nights. Signs of severe malaria and anaemia were attributed to bad spirits, witchcraft, lack of medicines at health facilities and apathy *(uzembe)* among the parents. Severely ill infants were often reported to be treated at home or by traditional healers, despite the knowledge that this could risk their lives due to delays in seeking prompt care at health facilities.

> *"You go for the first and second time [to the health facility] without getting medicines, and then you can't see the importance of going again when the same child falls sick. I would rather go to traditional healers because you can't get drugs at the health facility"* (FGD with mothers in an outlying hamlet).

Child deaths that occurred at home due to delayed treatment or during treatment by traditional healers were accepted because children also die at health facilities.

Perceptions and use of vaccination services

Most respondents felt that it was compulsory for children to attend EPI clinic for vaccinations and weight measurement. Although vaccine-preventable diseases such as pertussis, diphtheria, tetanus and polio were occasionally mentioned, female respondents generally distinguished the vaccines according to how they are administered e.g. as oral drops, into the thigh or into the shoulder. Generally very few, especially among the male respondents, knew the age at which these vaccines were given. Most respondents were not aware what the vaccines protected against, except for measles vaccine, which they said was given at the 9^{th} month of age. In all areas, mothers were responsible for decision making and action pertaining to vaccination clinics. Nevertheless if the mother is sick, fathers, aunts, sisters, and grandmothers could make decisions or take a baby to clinic. The mother's role of taking a baby to clinic was justified because she can soothe the baby after vaccination by breastfeeding as well as the normal mother-child bond, expressed as the mother knowing the pain of bearing a child *(uchungu wa mwana ajuae ni mama)*. It was also generally agreed that mothers would take their babies to clinic regardless of the father's attitude, due to perceived benefits of vaccines in averting disease and mothers being responsible for caring for sick children.

"When a child falls sick, I will be the one to suffer with the child, while my partner will be with other women" (FGD with mothers in outlying hamlet)

"What if I don't take this baby and then she falls sick? I will take her [to vaccination clinic] and tell him [my husband] that it is up to you, if you want to divorce me because of taking a child to clinic, we will see what happens" (FGD with mothers, village centre)

Mothers also felt obliged to take their babies to clinic because if they did not, they might suffer certain consequences such as denial of treatment in case of illness. Health facility workers often demand the child's health card before treatment partly as a way of confirming the age and weight of a baby, and these records are marked during attendance at clinic for vaccinations and or growth monitoring.

"We take [health cards] to [vaccination] clinic so that a child can get drugs when he or she is sick" (FGD with mothers, village centre)

Mothers who did not use EPI were reported to exist in most areas. Reasons for non-attendance were apathy, distance to the clinic, unfriendly staff, rains, and farming, traveling away from home and fear of wild animals on the way. Some mothers were said not to take their babies to vaccination clinic because they were afraid of abscesses or fevers following injectable vaccinations and the occasional unavailability of vaccines:

"Some mothers fear that when their babies receive an injection they will get fevers and abscesses" (FGD, community own resource persons)

"For example, you may be asked to take your baby to clinic to get the vaccine, but whenever you go, you might miss that vaccination even for a whole year because it is unavailable, contrary to the plans" (FGD, mothers, village centre)

Fear of treatment denial due to lack of up-to-date vaccination records was so strong that a few areas it was reported that some mothers might write vaccination dates on their baby's health cards without actually taking them to clinic. Nearly all Community Own Resource Persons at one coastal village without a functioning health facility said they had heard of mothers in their village who wrote false dates of clinic attendance on their children's health cards so as to pretend that they had brought their children to clinic.

Acceptance of SP in the community and among health workers

Antimalarials mentioned in FGDs included quinine, generic SP and two SP brands of Fansidar and Metakelfin. At community level, SP was particularly familiar to pregnant women who had used it for IPTp. There were mixed opinions about the benefits and side effects of SP. Many respondents had used SP safely either for themselves or for their children. However, some participants at a semi-urban village preferred Fansidar because they thought it contained less sulphur,

which they associated with adverse reactions. Some women did not know whether they had received IPTp, despite saying they had received three white tablets which other participants thought were SP. These white tablets were said to be for making the mother and unborn child healthy, particularly to protect from malaria. Several respondents had heard rumours about adverse effects of SP and some had experienced dizziness (mentioned in many places), and less commonly mouth sores, fatigue, fever, rash, and miscarriage.

> *"After taking SP (for IPTp) when I was pregnant, my period started".* (FGD, Women, Semi-urban)

There was a concern that IPTp might lead to large babies, which would lead to a difficult delivery:

> *"Some mothers are also scared that they may be harmed during delivery due to the large size of the unborn baby. Others decide to throw these drugs away, because an enlarged baby may cause a rupture."* (FGD, mothers, outlying area)

Occasionally, the fears were said to have led mothers to discard the SP. Although most female respondents said they had used SP for IPTp, they were aware of others who threw away SP given to them at clinic for consumption at home. One male participant during FGD with Community Own Resource Persons

(semi urban) said that his wife had thrown away SP tablets which she received at clinic for IPTp, because they both suspected that the drugs might be harmful.

Hearsay was the main source of information about the adverse effects of SP while a few knowledgeable participants also recalled statements made by "experts" in the newspapers (Community Own Resource Person).

In the health facility survey, almost all health providers said that they or their spouse were ready to take SP in pregnancy (96%, 233/242) and to treat a relative with SP (95%, 231/242). About three-quarters said they had used SP to treat their own child during his/her most recent illness (72%, 132/183). Only one-fifth of health workers said they had experienced pregnant women who were not willing to take SP (21%, 51/238).

Suggestions for administration of SP for IPTi

Respondents at community and health facilities proposed that like IPT in pregnancy, IPTi should be delivered with direct observation by health workers. Otherwise, it was suspected that some mothers might throw SP away if they were asked to administer at home.

> *Babies should be given that tablet [IPTi] right there [at clinic]; if we [mothers] take it out of the clinic, they [some people] may mislead us that the drugs are harmful so that we can throw them away* (FGD, mothers, village centre).

Understanding existing posters at health facilities

Posters promoting vaccinations, malaria treatment and IPTp were displayed at all health facilities and some village offices. Some of these posters were misinterpreted and participants could often not recall their contents. For example, a poster with instructions about malaria treatment with SP was said to be too wordy. Another poster showing a child protected from six immunizable diseases (*TB, tetanus*, *polio, pertussis, diphtheria and measles*), represented by arrows and a shield, was understood by only a few respondents to show the importance of immunizing children against the six diseases. It was explained by some Community Own Resource Persons that a shield was not known to a young generation in the study districts especially women. Hence, the intended meaning of protection might not always be understood. Much more frequently, respondents thought the poster showed that the child had all six vaccine-preventable diseases.

> *"Those arrows suggest that the baby is being attacked by all those diseases".* (FGD, mothers, village centre)

A second poster showing two pregnant women holding SP tablets for IPTp in the palms of their hands was well understood by some respondents to mean two doses of SP at different stages of pregnancy. Nevertheless, others were not able to tell what was shown on those posters, or had different interpretations.

"I see two pregnant women with their mouths open; I don't know what else they are doing" (FGD, mothers, outlying hamlet)

"I see two girls who are in a bad condition, stretching their arms up as if to seek help" (FGD mothers, outlying hamlet)

Willingness to accept IPTi

Having heard about the results of the IPTi study in Ifakara [1], many respondents at health facility and community levels expressed their willingness to accept IPTi with the hope that it would reduce the nuisance of malaria, particularly sleepless nights (FGD, Distant Hamlet). Others thought that IPTi complements vaccines in children.

*"Vaccines are already available for many diseases such as measles but there is no prevention for malaria and it is a very big problem" (*Community Own Resource Person)

Some participants simply expressed their trust in IPTi if it was going to be delivered through routine health services, in close collaboration with researchers. There were a few reservations that it might be compromised by a shortage of health staff. Many respondents wanted information about the aim of the new intervention, to know what it consisted of, and to be reassured that it was safe.

Communication channels for vaccination services

Health workers were mentioned in most sessions as the main source of information about vaccination and other child care services. Radio, community meetings at village and ward levels, announcements in churches and mosques, using a village crier and posters placed at health facilities, markets and big trees by the roadside were also mentioned, especially during mass immunization campaigns. However, there were widespread complaints among mothers about infrequent health education sessions and inadequate explanations of the purpose of EPI vaccinations. On the other hand, some nurses alluded to mothers being uncooperative which barred their efforts to give health education.

> *"When [we] educate them at clinic, they boycott. If you ask [a mother] which diseases are prevented by this injection, she tells you she doesn't know. A mother can say I don't know even if she is attending with her third baby''* (Public health nurse, district hospital).

Development of BCC strategy for IPTi

Many respondents suggested that messages about IPTi should be delivered using the same channels as for routine vaccinations and during campaigns. Guided by the need for large-scale feasibility and low cost, the strategy focused on interpersonal communication between health workers and mothers, supported by a brand name and posters.

Brand name

FGD participants, health staff, and stakeholders at all levels were asked to suggest suitable brand names for IPTi. The aim was to find a culturally compelling and simple Swahili word or phrase containing concepts about prevention of malaria in infants linked to vaccinations. Many brands were suggested (Table 1) but were not adopted either because of possible negative connotations, no direct association with malaria prevention, or no link to vaccination. For example, the brand SHOKA (axe) was suggested as IPTi would 'chop down malaria as an axe chops down trees', but an axe is a potentially harmful tool and, therefore, not appealing as part of a brand name. OKOA (save) was suggested as this might convince mothers that the intervention would save lives, but there was no easy way to link OKOA with either malaria or EPI. The brand name MKINGE (protect him or her) was chosen because as this draws from a word that mothers often use for vaccines (*kinga*, meaning protect). When used as part of the phrase *"MKINGE mtoto wako dhidi ya malaria"* (protect your child from malaria) the connection between IPTi, malaria prevention and routine vaccinations is clear. Both training materials for health workers and the posters developed made extensive use of the "MKINGE" brand name for IPTi.

Posters

Building on the strengths and gaps on how existing posters were understood and suggestions from respondents, two posters for display at health facilities were developed and pre-tested. It was argued in various FGD sessions that mothers would get the messages from posters if they contained attractive images and

clear messages. Illiterate mothers were said to ask others if they wanted to understand the written messages on health posters displayed at health facilities.

The posters were pre-tested in parts of Dar es Salaam, Lindi and Mtwara regions, to ascertain the clarity and of captions, images and design. Community representatives, health workers and influential people at district and national levels were also consulted to ensure the posters were technically sound and culturally appropriate.

Poster I: What is IPTi?

The aim of this poster was to help health facility staff explain to mothers what IPTi is and when it is given. When pre-tested (Figure 1), the poster was perceived to show a single mother, whose dress make her look unhealthy, holding a baby, and an anxious nurse preparing medication ready for administering to the child. The caption "*Mkinge mtoto wako dhidi ya malaria" i.e*. "protect your child against malaria*"* was perceived to be too scattered. The background and font colours were not appealing to most respondents.

The final version (Figure 2) was perceived in pre-testing to be attractive, showing a friendly nurse giving IPTi to a baby, as other happy women with their babies queue for IPTi at a vaccination clinic. The captions read (1) "Protect your child against malaria" (2) "MKINGE is the delivery of SP to babies when they are given vaccines, at the age of 2, 3 and 9 months".

Poster 2: What does IPTi do?

The aim of this poster was to explain the benefits of IPTi to mothers and to reassure them about the safety of the intervention. During pre-testing of the first draft (Figure 3), participants thought the sleeping baby was either dead or very sick. Another baby lying on the mat at the bottom left of this poster was also thought to be unhealthy.

The final version (Figure 4) shows a healthy mother and her child in a rural setting. There are three captions (1) “Protect your child from malaria” (2) “MKINGE reduces malaria and anaemia” (*3)* “Many children have already used MKINGE”.

The posters also show the logo for the IPTi Consortium, the Tanzanian Ministry of Health and Ifakara Health Research and Development Centre (renamed Ifakara Health Institute in July 2008). The posters were produced and distributed to health facilities in the first quarter of 2005 to support implementation of IPTi.

Discussion

The success of interventions and control programmes is moderated by local priorities and conditions, and the development of effective information, education and communication to support behavioural interventions requires good community based data [10]. Mixed research methods helped the study team to understand the local socio-cultural context about malaria, anaemia, SP and

vaccinations before introduction of IPTi. The resulting local knowledge, experiences and expectations from community and health providers were used to inform the development of a BCC strategy for implementation of a new vaccination-linked malaria control tool in southern Tanzania.

Several women were interviewed who had probably used IPT in pregnancy but were unaware of it. There was no local term for IPT in pregnancy, and this could partly be due to lack of a brand name. A brand name helps to strengthen community knowledge and understanding of a new intervention, makes it easier to train health staff, and to manage, monitor and evaluate.

The success of health interventions depends upon an approach that is gender-sensitive [11]. Our findings suggested mothers were culturally accepted and expected to be key decision-makers for matters related to vaccination services. Mothers in our study took their babies for vaccination despite complaints of fevers and swellings after injections. In other settings, fear of side effects has been reported to deter attendance to EPI clinic [12]. Our findings suggest that concerns about side effects were outweighed by perceived benefits of weight measurement and vaccination together with avoiding the denial of treatment if the child's health card is incomplete.

There was an interest to explore rumours about SP because negative perceptions have been reported to affected behaviour and uptake of other

reproductive health services [13]. Rumours about adverse effects of SP in our study featured in a few peri-urban settings, originating from hearsay and newspapers. Debates among researchers and decision makers prior to change of first line antimalarial treatment from chloroquine to SP also contributed to these widespread rumours [14]. Yet, many respondents had personally or knew others who safely used SP for malaria treatment or IPT in pregnancy. None of the respondents in our study had first-hand experience of adverse effects of SP and there were no vivid local examples about it. Implementation of IPTi with SP was, therefore, widely welcomed, especially after information that it would be through the routine health delivery system which they trusted. The extent to which the source of IPTi is trusted might influence decisions about IPTi.

Study limitation

It should be noted that the data collection process was relatively rapid and might not facilitate in-depth understanding of socio-cultural issues. The findings were urgently required to inform the development of the BCC strategy.

Advantages of approach used

Quantitative data on the coverage of EPI guided purposeful selection of the areas where qualitative data was collected. As an interactive process, the rapid qualitative data collection and quantitative health facility survey enabled involvement of local communities, front line health workers, district and national stakeholders in the development of BCC materials for IPTi.

Through this process, awareness was created and co-ownership of IPTi promoted in line with project's guiding principle of "together we develop IPTi". The methods used did not only help to inform development and pre-testing of BCC strategy but also helped in understanding of preferred communication channels from the viewpoint of the target audiences. FGDs general reveal "normal" behaviour and what is expected in a given society as people of similar characteristics freely interact to discuss pertinent issues in their real life context.

In deciding the BCC strategy, not all of the communication channels proposed were adopted -- such as radio, ward and village meetings and using village criers. The meetings would be prohibitively expensive for large-scale implementation by the Ministry of Health. Radio would have led to information about IPTi reaching listeners living outside the project area. Instead, interpersonal communication between health staff and mothers was used, supported by posters and a brand name, images and messages that were prioritized, valued and resonant with the local culture, to enable a culturally compelling BCC strategy [15]. This was in keeping with approaches used by routine health services in sensitizing communities about EPI and malaria interventions. Health workers were expected to use these posters in educating mothers about IPTi. This approach made implementation feasible and sustainable for use on a larger public health scale if and when needed.

Conclusions

This study describes the development of a behaviour change communication strategy to support implementation of IPTi in southern Tanzania. This paper shows how mixed research methods were applied to inform the development and pre-testing of BCC materials in view of local knowledge, experiences and expectations of community members and health providers as well as the Ministry of Health. The process used was intended to make the BCC materials culturally appropriate and technically sound. The BCC materials developed were made available in line with implementation phases of IPTi and are being evaluated in the context of monitoring the acceptability of this new malaria control tool.

Competing Interests

The authors declare that they have no competing interests.

Authors' Contributions

AKM participated in the study design, drafting and refining data collection tools, data collection and analysis and first draft of this manuscript. JAS, DS and RP provided technical input on the study design, data collection tools and data collection, and contributed to analysis and writing this manuscript. HM participated in designing and collection of the rapid qualitative study and commented on the manuscript, MM participated in designing and collection of rapid qualitative study and in Health facility Survey, CM and FM participated in designing the tools for Health Facility Survey and led data collection, HM, MT and PA provided technical input to the design of the study. All authors read and approved the final manuscript. .

Figures

Figure 6.1 – Draft version of poster to help health facility staff explain to mothers what IPTi is and when it is given

Figure 6.2 – Final version of poster to help health facility staff explain to mothers what IPTi is and when it is given

Figure 6.3 – Draft version of poster to explain the benefits of IPTi to mothers and to reassure them about the safety of the intervention

Figure 6.4 – Final version of poster to explain the benefits of IPTi to mothers and to reassure them about the safety of the intervention

Tables

Table 6.1 - Suggested brand names for IPTi

Suggested brand name	Literal translation	Intended message	Remarks
SHOKA	*An axe*	*IPTi will chop down malaria as an axe does for trees*	*Could be perceived as a harmful tool*
MKIWA	*None*	*Mpango wa Kinga ya Watoto i.e. a strategy for protecting children*	*MKIWA in Swahili language also stands for an orphan or hopeless person*
LENGA	*Target / shoot / aim at*	*IPTi targets malaria, anaemia and other child problems*	*There is no direct malaria-EPI and child link*
OKOA	*Save*	*To convince the mothers that this strategy saves lives*	*No direct malaria-EPI and child link*
SHAMIRI	*Flourish*	*Children will grow well and happily without diseases*	*No direct malaria-EPI link*
MWAMBA	*A rock*	*IPTi sounds like a rock where children can hide from malaria*	*No direct malaria-EPI link*
NGUZO	*A pillar*	*If a child leans on this strategy he/she will not fall down because of malaria and anaemia.*	*No direct malaria-EPI link*
MKINGE	*Protect him/her*	*Brand name MKINGE draws from the word kinga that mothers often use for vaccines.*	*When part of the phrase "MKINGE mtoto wako dhidi ya malaria"* (prevent your child from malaria), *MKINGE gives a positive image for IPTi linked to both malaria prevention and routine vaccinations*

References

1. Schellenberg D, Menendez C, Kahigwa E, Aponte J, Vidal J, Tanner M, Mshinda H, Alonso P: **Intermittent treatment for malaria and anaemia control at time of routine vaccinations in Tanzanian infants: a randomised, placebo-controlled trial.** *Lancet* 2001, **357:**1471-1477.
2. Chandramohan D, Owusu-Agyei S, Carneiro I, Awine T, Amponsa-Achiano K, Mensah N, Jaffar S, Baiden R, Hodgson A, Binka F, Greenwood B: **Cluster randomised trial of Intermittent preventive treatment for malaria in infants in area of high, seasonal transmission in Ghana.** *BMJ* 2005, **331:**727-733.
3. Macete E, Aide P, Aponte JJ, Sanz S, Mandomando I, Espasa M, Sigauque B, Dobaño C, Mabunda S, DgeDge M, Alonso P, Menendez C: **Intermittent preventive treatment for malaria control administered at the time of routine vaccinations in Mozambican infants: a randomized, placebo-controlled trial.** *J Infect Dis* 2006, **194:**276-85.
4. **Expanded Programme on Immunization.** http://www.who.int/immunization/aboutus/en/
5. UNICEF. **Trends in immunization coverage.** http://www.childinfo.org/immunization_trends.html
6. **The IPTi Consortium** http://www.ipti-malaria.org
7. Editorial. **Preventing malaria in infants: a strategy that works.** *The Lancet* 2008 **372**: 264.
8. IOM (Institute of Medicine). 2008. **Assessment of the Role of Intermittent Preventive Treatment for Malaria in Infants: Letter Report**. Washington, DC: The National Academies Press. http://www.nap.edu/catalog.php?record_id=12180.
9. Research and Analysis Working Group, Poverty Monitoring System, Government of Tanzania: *Poverty and Human Development Report 2005*. Dar es Salaam; 2005.
10. Manderson L: **Applying medical anthropology in the control of infectious disease.** *Trop Med Int Health* 1998, **3:**1020-7.
11. Tanner M, Vlassoff C: **Treatment-seeking behaviour for malaria: a typology based on endemicity and gender.** *Soc Sci Med* 1998, **46:**523-32.
12. Bosu WK, Ahelegbe D, Edum-Fotwe E, Bainson KA, Turkson PK: **Factors influencing attendance to immunization sessions for children in a rural district of Ghana.** *Acta Trop* 1997, **68:**259-67.
13. Feldman-Savelsberg P, Ndonko FT, Schmidt-Ehry B: **Sterilizing vaccines or the politics of the womb: retrospective study of a rumor in Cameroon.** *Med Anthropol Q* 2000, **14:**159-79.
14. Mubyazi GM: **The role of research in changing antimalarial drug policy in Tanzania. Working Paper.** Alliance for Health Policy and Systems Research (AHPSR), Geneva; 2003.

15. Panter-Brick C, Clarke SE, Lomas H, Pinder M, Lindsay SW: **Culturally compelling strategies for behaviour change: a social ecology model and case study in malaria prevention.** *Soc Sci Med* 2006, **62:**2810-25.

CHAPTER 7: FROM STRATEGY DEVELOPMENT TO ROUTINE IMPLEMENTATION: THE COST OF INTERMITTENT PREVENTIVE TREATMENT IN INFANTS FOR MALARIA CONTROL

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Abstract

Background

Achieving the Millennium Development Goals for health requires a massive scaling-up of interventions in Sub Saharan Africa. Intermittent Preventive Treatment in infants (IPTi) is a promising new tool for malaria control. Although efficacy information is available for many interventions, there is a dearth of data on the resources required for scaling up of health interventions.

Method

We worked in partnership with the Ministry of Health and Social Welfare (MoHSW) to develop an IPTi strategy that could be implemented and managed by routine health services. We tracked health system and other costs of (1) developing the strategy and (2) maintaining routine implementation of the strategy in five districts in southern Tanzania. Financial costs were extracted and summarized from a costing template and semi-structured interviews were conducted with key informants to record time and resources spent on IPTi activities.

Results

The estimated financial cost to start-up and run IPTi in the whole of Tanzania in 2005 was US$1,486,284. Start-up costs of US$36,363 were incurred at the national level, mainly on the development of Behaviour Change Communication

(BCC) materials, stakeholders' meetings and other consultations. The annual running cost at national level for intervention management and monitoring and drug purchase was estimated at US$459,096. Start-up costs at the district level were US$7,885 per district, mainly expenditure on training. Annual running costs were US$170 per district, mainly for printing of BCC materials. There was no incremental financial expenditure needed to deliver the intervention in health facilities as supplies were delivered alongside routine vaccinations and available health workers performed the activities without working overtime. The economic cost was estimated at 23 US cents per IPTi dose delivered.

Conclusion

The costs presented here show the order of magnitude of expenditures needed to initiate and to implement IPTi at national scale in settings with high Expanded Programme on Immunization (EPI) coverage. The IPTi intervention appears to be affordable even within the budget constraints of Ministries of Health of most sub-Saharan African countries.

Background

A massive scaling-up of health interventions is required over the coming years [1] if sub-Saharan Africa is to reach the health-related Millennium Development Goals (MDG). Efficacy information is available for key interventions [2] but there is a dearth of information on the resources required for implementation of interventions known to be cost-effective. In recent years costing information has been an integral part of health intervention evaluation as it is vital for management, prioritization and scaling-up of health interventions [3].

Successful scaling-up of a health intervention is based on two prerequisites: first is the *development* of an effective delivery and management system at various levels and second is the longer-term *implementation* of the intervention based on a good knowledge of costs and sound financing strategies. In this study, we costed the resources required to set up integrated management and implementation systems for an intervention to use an existing platform of routine health service delivery. In recent years economists have published a number of costing studies of malaria control interventions, some concerning new interventions [4], some on the cost of existing interventions [5-8] and others on program administrative cost or policy change [9-11]. Few published studies [4, 10] estimated both the cost of developing a delivery strategy and the incremental costs of incorporating an intervention into the routine health system.

Intermittent Preventive Malaria Treatment in infants (IPTi) is a promising tool to fight malaria [12-16]. Efforts are underway through the IPTi Consortium to generate evidence on the safety, efficacy, acceptability and cost-effectiveness of IPTi in a range of settings so as to inform a policy recommendation (http://www.ipti-malaria.org). If IPTi is recommended as a policy, the next challenge will be to transform this intervention into public health action in a reasonable timeframe. This requires a well developed delivery strategy and information on resources required.

In Southern Tanzania, local IPTi safety and efficacy data were available in 2001 [15] and there was interest to explore the operational issues surrounding large-scale implementation as part of an integrated district-based approach to control malaria. Together with the Ministry of Health and other partners, a strategy for the delivery of IPTi was developed, implemented and evaluated between 2004 and 2008. These activities enabled a parallel costing study to produce realistic estimates of the costs of developing the delivery strategy, and of implementing and maintaining it. In contrast to many costing studies, few assumptions were needed as economic costs were simply tracked during the development and implementation phases. For example, we included administrative costs important for decision making and implementation such as stakeholder consultations, adapting the health information system and developing behavior change communication materials for the strategy. The study was designed to enable us to answer the question “What resources are needed to implement IPTi?”,

something asked by policy implementers at district level, such as Council Health Management Teams (CHMTs) in Tanzania. This study therefore provides insights into the budget implications of scaling-up IPTi and prepares the way for identifying future financing options.

Methods

Background

A Tanzanian district is administered at the 3rd level of the government hierarchy in Tanzania, and is also called a Local Government Authority. The district's main purpose is to empower the people to participate in the planning and implementation of local development programmes. In terms of health objectives, a district is a focal point for the planning, delivery and evaluation of health services. Districts mobilize, manage and account for government health resources and deliver health services in line with their own plans and budget allocations.

Health financing in Tanzania involves central government (Ministry of Health and Social Welfare - MoHSW), households, donors, NGO's and private firms. In 1999/2000, households provided the greatest proportion of health care financing (47%), followed by donors (23%), government (22%), NGOs (5%) and firms (3%) [17]. Government spending on health in Tanzania has increased in recent years standing at US$369 million in 2006 (US$ 9.92 per capita) which represents 11.6% of overall government spending (Table 7.1) [18]. Health sector spending is

financed from block grants which are sourced from the Tanzanian government and the health 'basket' fund which is contributed to by donors.

A Comprehensive Council Health Plan (CCHP) brings together annual plans and details the provision of accessible, quality health care services for local communities. These include cost effective interventions developed according to the Essential Health Package (EHP) and in line with the National Health Policy. The CCHP is supported by Local Health Block Grants and the Health Basket Grants based on criteria of population size (70% of the grant value), vehicle mileage (10%), poverty status (10%) and under five mortality rates (10%) [19]. These criteria are important in the sense that the individual is recognized as the main client of the health service, with children aged under five years and pregnant women recognized as the most vulnerable for many health issues. The mileage criterion takes into account the higher operational cost of delivering health services to a rural population and to scarcely populated areas, including the higher costs faced in drug distribution, immunization services and supervision. The under-five mortality criterion directs increased resources to places with higher burden of diseases. The CCHP is drafted by the planning team at the district level and then passed to the Regional Secretariat before approval is sought from the district council, the President's Office for Regional Administration and Local Government and the MoHSW. At the national level, checks are made for adherence to national guidelines, to make sure the plan meets both financial and technical performance requirements for funding.

Study area

The Southern Tanzania IPTi effectiveness study is being conducted in five districts across two regions: Lindi Rural, Nachingwea and Ruangwa districts in Lindi region, and Tandahimba and Newala districts in Mtwara region. A detailed explanation is given elsewhere [20]. Briefly, the population of this poor, rural area is around 900,000 and subject to the highest infant mortality rate in the country at around 121 per 1,000 live births compared to national average of 68 per 1,000 live births [21, 22]. Like the rest of Tanzania, the health system in the project area comprises a network of tiered public and private facilities where IPTi is delivered alongside Expanded Programme on Immunization (EPI) services. The EPI vaccine coverage is high, with 80-90% of all children aged 12-23 months receiving BCG, DPT and OPV before one year of age [20]. In 2006 the health facilities in the project area comprised seven hospitals, 13 health centres and 114 dispensaries. The project districts are further divided into 24 divisions and IPTi implementation was initiated in half of these divisions. National policy dictates that children and pregnant women should not pay for health services.

The intervention and the delivery strategy

This study was a large scale community-randomised trial, which compared sets of process and outcome indicators between 12 IPTi-implementing divisions and 12 comparison divisions. The IPTi *intervention* is the delivery of a treatment dose of sulphadoxine-pyrimethamine (SP) to infants attending Reproductive and Child Health clinics for vaccination at three points in time: doses two and three of DTP/hep B/OPV, and the measles vaccine, corresponding to approximately 2, 3

and 9 months of age. An infant is given a quarter tablet of SP if they weigh under 5 Kg or a half tablet if they weigh 5 kg or over.

In order to achieve high and sustainable coverage of IPTi as part of routine preventive health services for infants, a number of elements are required that together constitute the IPTi *strategy*. The IPTi strategy was developed in close collaboration with the Ministry of Health and Social Welfare (MoHSW) to ensure that it would be feasible to roll out across the whole country should a policy decision be taken to implement IPTi nationally. The Expanded Programme on Immunization (EPI) which is well established in Tanzania was used as the vehicle for IPTi delivery. IPTi has been implemented by routine health workers. Routine health workers were trained to explain the IPTi intervention to mothers attending the EPI clinic with their infants, to raise community awareness on intervention more generally, and to deliver and document doses of IPTi using modified EPI monitoring tools alongside vaccinations in health facilities. The CHMT through the District Cold Chain Officer and Reproductive and Child Health Coordinator were equipped with adequate and specific tools to manage the requisition and supply of IPTi-related materials.

Costing: methods

One important distinction made in this study is between two types of health system cost: the cost of developing a delivery system for IPTi, which is mainly

incurred at national level, and the cost of implementing IPTi, which is mainly incurred at the district level and below.

Costs were classified into different components, namely strategy development and sensitization; BCC material development; SP purchase and distribution; training; administration of the intervention in health facilities, and strategy management. A description of each is provided in Panel 7.1.

District level total costs and IPTi delivery unit costs were estimated from the health system perspective. Four different health system levels were considered – national, regional, district and health facility. However, regions have only a minor role in health system financing and that role is closer to the district than national role, and thus we summarized regional cost estimates to district level. District implementation costs thus reflect activities undertaken at regional, district and health facility levels. National level costs include all activities organized by the MoHSW and are mainly related to policy matters. Given that a scaled up strategy would be country-wide, the estimated costs of strategy change were allocated across the total number of districts in Tanzania. IPTi dose forecasts were based on current EPI coverage levels.

A costing template enabled detailed costs to be captured relating to each IPTi development and implementation activity. Expenditure on formal meetings and training was tracked by use of specific cost centres in the accounting software

which were later reviewed to extract financial costs. Semi-structured interviews were conducted with nine key informants involved in early IPTi activities including formal meetings, informal meetings and independent desk work. These were IPTi investigators and support staff who were interviewed by one of us (FM) at their convenience according to a discussion guide. The reported time spent was used to derive estimates of financial and opportunity costs related to human resources for IPTi strategy development and implementation. Informal activities included consultations with key stakeholders which did not involve hiring meeting rooms. Desk work included the value of time spent by individuals in preparation, designing, brainstorming or organizing project activities. A summary sheet (panel 7.1) was used to guide summarizing of data according to the activity components and health system level, with a distinction made between financial and non-financial 'opportunity' costs.

Opportunity costs were those that were diverted from other uses or were not fully employed and therefore using up slack (inefficiencies) in the system. Financial costs were those that involved direct budgetary impacts – in other words, financial payments. This cost classification was important with regard to using our estimates in other settings, as health systems financing and configuration differ widely across sub-Saharan Africa. Whereas in one setting the health system might have in-house expertise at the Ministry of Health, others might need external expertise – with a need for additional financial resources. The total cost, which is the estimated economic cost, is the sum of financial costs and non-

financial (opportunity) costs. Cost classification was based on how related activities are usually done, and how they are valued, under a MoHSW-led program. There were no fixed assets purchased specifically for IPTi, but we accounted for hired fixed assets under transport and buildings. The costing estimates reflect a one year time frame.

Ethical clearance

This study received ethical approval from the institutional review boards of the Ifakara Health Research and Development Centre, the National Tanzania Medical Research Co-coordinating Committee, the Tanzania Commission for Science and Technology, and the London School of Hygiene and Tropical Medicine. During field work, information sheets about the study in Swahili were distributed, explaining why it was being carried out, by whom, and what it would involve. Verbal informed consent was obtained from all study participants and confidentiality was assured.

Sensitivity analysis

This costing study started at the beginning of the main IPTi project in 2004 and was completed in 2007. Excel spreadsheets were used to conduct sensitivity analyses on key variables that were susceptible to change over time or in different settings. These include EPI coverage, SP brand, inclusion of community sensitization (differentiating the intervention delivery by researchers and that by

MoHSW), and changes in human resource cost due to recent increases in per diem rates and salaries for health staff in Tanzania.

Results

The costs per district of developing the IPTi strategy and of implementation for the first year, are summarized in Table 7.2. This total cost is broken down into the apportioned cost per district of national level activities and the cost per district of activities at district level or below. Costs were split into personnel, transport and materials and buildings.

The single largest expenditure was for training which cost US$7,392 per district, 51% of the total start-up and year one costs. There was no incremental financial expenditure needed to deliver the intervention in health facilities as available health workers performed the activities without working overtime. The other major intervention related cost was for drug purchase and distribution, some US$3,538 per district (24%). National development related costs were relatively modest when shared amongst the districts; Behaviour Change Communication (BCC) cost US$175 per district (1.2 %). Simulated policy change and sensitization was US$59 per district (0.4%) and management and monitoring cost US$309 (2%) per district.

In terms of cost category, personnel costs amounted to US$6,693 (46% of the total cost), mainly for training (US$4,285) and sensitization (US$1,549). Of the

total personnel cost, US$3,746 (56%) was incremental financial expenditure. The cost of transport was US$3,949 (27% of the total cost), again mainly for training (US$2,746) and sensitization (US$984). Materials and building costs accounted for US$3,944 (27% of the total costs).

Overall, approximately 28% of the costs per district were for national level activities and the rest were costs per district of activities at district level or below.

The unit costs are presented in Table 7.3. The total cost per IPTi dose delivered was estimated at 23 US cents, of which 18 US cents (78%) was financial expenditure and 5 US cents (22%) was opportunity cost.

Table 7.4 summarizes the estimated financial start-up and annual running costs of IPTi, first at national level, second for a single decentralized district, and third to scale up to the123 districts in the whole country. At national level, the start-up cost was estimated at US$36,363 involving development of the strategy including BCC materials, stakeholders meetings and consultations. The annual running cost at national level for intervention management and monitoring and SP drug purchase was estimated at US$459,096. The start-up cost was US$7,885 per district, mainly for training of front-line health staff, with an annual running cost of US$170 per district largely for the printing of BCC materials. Overall US$1,006,278 would be required to develop the IPTi strategy and implement it in the whole country with an additional US$480,006 required to run the intervention across the country for a year.

Sensitivity analysis

Table 7.5 shows the results of sensitivity analyses testing the impact of varying key inputs on the economic costs in the program. Normally under large scale MoHSW-run programs, community sensitization is not included, especially for introducing a new intervention into the EPI program. But since the intervention was implemented through a research programme, it was necessary to introduce researchers through meetings with district health management teams, district heads of departments and community representatives (councilors). These sensitization activities had some impact on the economic cost, with an increase of 8%.

The change in human resource remuneration following a salary increase of 50% for health ministry staff between 2004 and 2006 led to a 17% increase in economic costs per dose delivered. Reducing the intervention coverage from 94% (as reported in the 2006 EPI report [23]) to 71%(as reported by the Demographic and Health Survey 2005 [24]) led to a 32% increase in costs per dose delivered due to the spreading fixed national and district costs among fewer IPTi recipients. The use of locally manufactured SP had a major impact on unit costs, with unit cost per dose delivered reduced by 42% from 23 to 13 US cents, most of which was a saving in financial expenditure. Finally, the most likely scenario of using generic drug, increasing salaries, excluding sensitization and lower EPI coverage increased economic cost by 21%.

Discussion

This paper has presented the total costs of developing and implementing a strategy for the delivery of IPTi. The information is based on the actual costs incurred in the development of an IPTi strategy in conjunction with national authorities and implementation by district health teams. This approach has the advantage of making very few assumptions as costs were tracked in the course of actual implementation. The results should nevertheless be interpreted with caution. The study activities were undertaken by researchers, and although an attempt was made to exclude irrelevant research costs, it is possible that the researchers influenced programme costs in comparison to government-led implementation. However, we are confident that the cost tracking system was detailed enough to ensure that those costs that were likely to be incurred under normal programme conditions were identified and quantified and the sensitivity analysis modeled the effect of the research team on IPTi costs.

The cost findings of the key components were consistent with costing studies of other interventions, although different methodologies were used and different types of costs presented. For example, as shown by Mulligan and colleagues (2006) [10], we found that policy related costs are mainly incurred at national level and that training accounts for a significant proportion of the total cost at district level. Other studies have reported that national level costs for administration and material purchase can constitute a considerable proportion of scale-up costs in the short term [9] and their inclusion increases overall

intervention costs. It is therefore important to consider costs of administration when estimating resource requirements for health intervention scale-up.

The unit cost per dose delivered is very low compared with other interventions such as Insecticides Treated Nets (ITNs) or Indoor Residual Spraying(IRS) [25, 26]. In this study the cost per IPTi-year of protection (3 doses) was US 69 Cents while the cost per net-year of protection ranged from US$1.43 to US$6.05 and the cost per IRS-year of protection ranges from US$3.27 to 3.90 [27]. However, caution is needed in making a direct comparison as the efficacy of various interventions differs and the costing studies used different methodologies. The present study, however, was inclusive in the costs identified and measured, and hence conclusions on the low unit cost of IPTi relative to unit costs of other malaria control interventions are likely to be robust.

Delivery of the intervention at facilities involved no financial resources because excess system capacity was utilized. In effect the intervention boosted efficiency of resource use, while it did not appear to add undue strain to the health system, according to a time and motion study conducted on vaccinating staff in the IPTi study area [28]. Interestingly, IPTi required very few marginal resources even when administration costs were included. To establish and implement the IPTi strategy would require 0.4% of the total health sector budget for 2004/5. Furthermore, only 1% of a typical district budget would be required to develop and run the IPTi intervention in its first year. This might be affordable given the

increased global resources to fight HIV, TB and malaria (http://www.theglobalfund.org).

The cost of IPTi implementation is likely to vary between countries but the estimates in this paper provide an order of magnitude of the resources required to initiate and maintain implementation of IPTi in most sub-Saharan African settings, especially those with high EPI coverage of 80 per cent or more (http://www.unicef.org/immunization/index_coverage.html). Costs vary between settings and change over time, such as the level of staff remuneration, travel expenses and drug costs. What has been presented provides a starting point that could be considered in the light of available system resources and feed into rational decision making.

Scaling-up health interventions is essential if the millennium development goal for child mortality (target 4) is to be met. Strengthening of health system components - human resources, planning capacity, financing and service delivery - is one response to alleviate challenges to move forward to scale-up interventions. Cost data have been presented in a synthesized manner to facilitate utilization by users [29]. The distinction between financial and economic perspectives has implications for health system resource allocation to achieve greater efficiency. The financial cost has a direct influence on budgetary actions and the economic perspective is useful when considering efficient allocation and re-allocation of resources, especially those already available and paid for by the

health system. These different cost categories were presented to support interpretation of total costs and eventual use of the information by decision makers. The measurement of full costs and the distinction between cost categories is important because, although some costs might not require budget expenditure in one setting, they might do in another setting due to variation between health systems.

Conclusion

Actual country-specific data is useful to indicate orders of magnitude of resource requirements and should facilitate rational decision making. The incremental financial and opportunity costs needed to initiate and implement IPTi at national scale show that the intervention is generally affordable within the budget constraints of Ministries of Health of sub-Saharan African countries with high EPI coverage.

Abbreviations

CHMT	Council Health Management Teams
MoHSW	Ministry of Health and Social Welfare
DPT	Diphtheria Pertussis, Tetanus
EPI	Expanded Programme on Immunization
IPTi	Intermittent Preventive Treatment in infants
MCH	Maternal and Child Health

Competing interests

The authors declare no conflict of interest concerning the work reported in this paper.

Authors' contributions

FM conceived the idea and participated in the design of the study, conducted the analysis and writing the manuscript. GH participated in the design of the study, provided technical support and contributed to the manuscript preparation. JS participated in conceiving the idea, study design and writing and interpretation. PA, HM, MT provided technical support. DS participated in the design of the study, coordinated the study, data analysis and interpretation. All authors read, commented on and approved the manuscript.

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TABLES

Table 7.1: Health resources in Tanzania for year 2003 – 2006

Item	Year			
	2003	**2004**	**2005**	**2006[a]**
Health as percentage of overall government spending[b]	12.9%	10.0%	10.9%	11.6%
Level of spending on health (millions)	US$172	US$200	US$261	US$369
Population estimates	34,155,840	35,146,359	36,165,604	37,214,406
Per capita health spending	US$5.04	US$5.70	US$7.21	US$9.92

[a]Budget [b]Excluding consolidated fund services (CFS)

Source: United Republic of Tanzania. Ministry of health. Health sector PER update FY06. Final Report. September 2006

Table 7.2: Estimated resources cost for IPTi strategy development and first year implementation **per district** as part of a national program. Figures are United States dollars, year 2005 (Tsh1205=US$1)

Activities	Level	Human Resource			Transport			Material and building			Total		
		Opport.[a] cost	***Financ.[b] cost***	***Sub-total***	***Opport.[a] cost***	***Financ.[b] cost***	***Sub-total***	***Opport.[a] cost***	***Financ.[b] cost***	***Sub-total***	***Opport.[a]***	***Financ.[b]***	***Grand***
Development costs (start-up)													
Policy change	National[c]	39	6	45	2	3	5	0	6	6	41	15	56
Sensitization	National[c]	3	0	3	0	0	0	0	0	0	3	0	3
	District[d]	899	650	1,549	635	349	984	12	54	65	1,546	1,052	2,598
BCC	National[c]	104	55	158	3	4	7	0	10	10	106	69	175
Training	District[d]	1,442	2,843	4,285	1,729	1,018	2,746	2	359	360	3,172	4,220	7,392
Implementation costs (annual recurrent)													
Drug purchase & distribution	National[c]	72	0	72	0	139	139	0	3,328	3,328	72	3,466	3,538
Administration of intervention	District[d]	345	0	345	0	0	0	0	0	0	345	0	345
Management & monitoring	National[c]	43	193	236	0	68	68	0	5	5	43	266	309
	District[d]	0	0	0	0	0	0	0	170	170	0	170	170
Total	***National[c]***	***260***	***253***	***514***	***5***	***214***	***219***	***0***	***3,349***	***3,349***	***265***	***3,816***	***4,081***
Total	***District[d]***	***2,686***	***3,493***	***6,179***	***2,364***	***1,367***	***3,730***	***14***	***583***	***595***	***5,063***	***5,442***	***10,505***
Grand Total	**All**	**2,946**	**3,746**	**6,693**	**2,369**	**1,581**	**3,949**	**14**	**3,932**	**3,944**	**5,328**	**9,258**	**14,586**

[a]Opport. – Opportunity [b]Financ. – Financial

National[c] – Apportioned cost **per district** for national level activities District[d] – Cost per district for activities at district level or below

Table 7.3: Estimated unit cost of IPTi per dose delivered

Figures are United States cents, year 2005 (Tsh1205=US$1)

Activity component	Health system level	Financial costs	Opportunity costs	Total costs
Policy change	National	0.01	0.02	0.03
Sensitization	District	0.76	1.12	1.88
BCC	National	0.03	0.05	0.08
SP purchase and distribution	National	12.56	0.26	12.82
Training	District	3.06	2.30	5.36
Administration of intervention in health facilities	District	0.00	1.25	1.25
Strategy management	National	0.65	0.10	0.75
	District	0.62	0.00	0.62
Sub-Total	***National***	***13.25***	***0.43***	***13.68***
	District	***4.44***	***4.67***	***9.11***
Overall total		**17.68**	**5.11**	**22.79**

Table 7.4: Summary of estimated financial costs for a national IPTi program in Tanzania: start-up and annual implementation. Figures are United States dollars, year 2005 (Tsh.1205=US$1)

Level	***Start-up costs (US$ in 2005)***	***Running cost (US$ in 2005)***	***Cost of IPTi strategy development & first year implementation (US$ in 2005)***
Cost at National level	36,363	459,096	69,092
Cost per district	*7,885*	*170*	*11,522*
Sub-total for 123 districts	969,915	20,910	1,417,192
Total for national implementation	**1,006,278**	**480,006**	**1,486,284**

Table 7.5: Results of sensitivity analysis on the economic cost per IPTi dose delivered.

Figures are United States cents, year 2005 (Tsh1205=US$1)

Variables	Financial	Opportunity	Economic cost (Total)
Base case results	17.68	5.11	22.79
Low EPI coverage (71% nationwide)	23.41	6.76	30.18
Exclude sensitization at community level	16.92	4.00	20.9
Use of local brand SP Drug	8.44	4.85	13.29
Increase in salaries and per diem	20.97	5.74	26.71
Using generic drug, increasing salaries, excluding sensitization and lower EPI coverage	22.40	5.28	27.68

Panel 7.1: Components of implementation

1. Policy change and Sensitization

Policy change activities include planning, policy related consultations.

Sensitization activities include meetings with stakeholders.

Both policy change and sensitization involves working with a broad group of stakeholders at national and international organizations, a more focused IPTi core group of key stakeholders and district level health managers. These costs were incurred at the start of implementation.

2. Development of Behaviour Change Communication (BCC) materials – This was incurred before the start of implementation, but also includes minor recurrent costs related to occasional replacement of materials. Activities include development of materials (eg training leaflet, job aid, and posters), pilot testing, production and distribution.

3. SP purchase and distribution – This is mainly a recurrent cost. Purchase activities include importation and overhead costs of arranging importation. Distribution activities involve the distribution from port to Medical Stores Department (MSD), then to regional level, district level and finally to health facilities.

4. Training – This is mainly incurred at the start of implementation but also includes refresher and new staff training. The training involves training trainers at regional and district levels in strategy change, BCC and IPTi administration. In turn, these trainers train the front-line health facility staff.

5. Administration of the intervention in health facilities – This is a recurrent cost. It involves SP provision: preparation, administration to children, recording dosage and dates in immunization cards and books of the Health Management Information System (HMIS) by health workers at facilities. It also includes education of mothers about IPTi. This was calculated as the proportion of an RCH nurse's gross salary spent on IPTi per year at implementing facilities in the 5 study districts.

6. Strategy management – This is incurred partly at the start of implementation, and partly as an ongoing activity. The start-up costs are converted to annual costs assuming a 10 year intervention period. In the case of the Southern Tanzania project, it involved the recruitment of a public health professional to support the implementation activities. It also included consultations with regard to adaptation of HMIS and immunization cards, as well as printing costs.

Note that components 1 and 2 are sometimes referred to as administrative or higher level costs.

They involve activities to get the intervention developed and implemented by the routine health system. The costs were spread over 10 years which is the expected lifetime of a national program

References

1. United Nations Statistics Division: **The Millenium Development Goals Report. New York**. 2006.
2. Jones G, Steketee RW, Black RE, Bhutta ZA, Morris SS: **How many child deaths can we prevent this year?** *Lancet* 2003, **362**(9377):65-71.
3. Hutubessy RC, Baltussen RM, Torres-Edejer TT, Evans DB: **Generalised cost-effectiveness analysis: an aid to decision making in health**. *Applied health economics and health policy.* 2002, **1**(2):89-95.
4. Hutton G, Tediosi F: **The costs of introducing a malaria vaccine through the expanded program on immunization in Tanzania**. *The American journal of tropical medicine and hygiene,* 2006, **75**(2 Suppl):119-130.
5. Goodman CA, Coleman PG, Mills AJ: **Cost-effectiveness of malaria control in sub-Saharan Africa**. *Lancet* 1999, **354**(9176):378-385.
6. Goodman CA, Coleman PG, Mills AJ: **The cost-effectiveness of antenatal malaria prevention in sub-Saharan Africa**. *The American journal of tropical medicine and hygiene* 2001, **64**(1-2 Suppl):45-56.
7. Goodman CA, Mutemi WM, Baya EK, Willetts A, Marsh V: **The cost-effectiveness of improving malaria home management: shopkeeper training in rural Kenya**. *Health policy and planning* 2006, **21**(4):275-288.
8. Morel CM, Lauer JA, Evans DB: **Cost effectiveness analysis of strategies to combat malaria in developing countries**. *BMJ Clinical research ed,* 2005, **331**(7528):1299.
9. Johns B, Baltussen R, Hutubessy R: **Programme costs in the economic evaluation of health interventions**. *Cost Eff Resour Alloc* 2003, **1**(1):1.
10. Mulligan JA, Mandike R, Palmer N, Williams H, Abdulla S, Bloland P, Mills A: **The costs of changing national policy: lessons from malaria treatment policy guidelines in Tanzania**. *Trop Med Int Health* 2006, **11**(4):452-461.
11. Abdulla S, Goodman C, Coleman P, Mubyazi G, Kikumbih N, Okorosobo T: **The Costs, Effects and Cost-Effectiveness of Changing the First-Line Drug for the Treatment of Malaria in Tanzania**. In *London: Malaria Consortium* [http://wwwmalariaconsortiumor]. 2000.
12. Chandramohan D, Owusu-Agyei S, Carneiro I, Awine T, Amponsa-Achiano K, Mensah N, Jaffar S, Baiden R, Hodgson A, Binka F, Greenwood B: **Cluster randomised trial of intermittent preventive treatment for malaria in infants in area of high, seasonal transmission in Ghana**. *BMJ (Clinical research ed* 2005, **331**(7519):727-733.
13. Macete E, Aide P, Aponte JJ, Sanz S, Mandomando I, Espasa M, Sigauque B, Dobano C, Mabunda S, Dgedge M Alonso P, Menendez, C: **Intermittent preventive treatment for malaria control administered at the time of routine vaccinations in Mozambican infants: a randomized, placebo-controlled trial**. *The Journal of infectious diseases* 2006, **194**(3):276-285.
14. Massaga JJ, Kitua AY, Lemnge MM, Akida JA, Malle LN, Ronn AM, Theander TG, Bygbjerg IC: **Effect of intermittent treatment with amodiaquine on**

anaemia and malarial fevers in infants in Tanzania: a randomised placebo-controlled trial. *Lancet* 2003, **361**(9372):1853-1860.
15. Schellenberg D, Menendez C, Kahigwa E, Aponte J, Vidal J, Tanner M, Mshinda H, Alonso P: **Intermittent treatment for malaria and anaemia control at time of routine vaccinations in Tanzanian infants: a randomised, placebo-controlled trial**. *Lancet* 2001, **357**(9267):1471-1477.
16. IOM (Institute of Medicine): **Assessment of the role of intermittent preventive treatment for malaria in infants: Letter report. Washington , DC : The National Academies Press**. 2008.
17. Ministry of Health. Tanzania: **National Health Accounts. [http://www.afro.who.int/dsd/nha/country-nha/tanzania-nha.pdf]**. 2001.
18. United Republic of Tanzania. Ministry of health: **Health sector PER update FY06. Final Report. [http://www.who.int/nha/docs/en/Tanzania_NHA_report_english.pdf].** 2006.
19. United Republic of Tanzania. Joint Ministry of Health and Presidents office Regional Administration and Local Government. Health Basket and Health Block Grant: **Guideline for the Disbursement of Funds, Preparation of Comprehensive Council Health Plans. March, 2004.** . [hhtp:wwwdistricthealthservicecom/cms/upload/policies_17_9095pdf]. 2004.
20. Schellenberg J, Mrisho M, Manzi F, Shirima K, Mbuya K, Mushi A, Ketende S, Alonso A, Mshinda H, Tanner M Schellenberg D: **Health and survival of young children in southern Tanzania**. *BMC Public Health* 2008. At [http://www.biomedcentral.com/1471-2458/8/194]
21. Mturi AJ, Hinde PR: **Recent demographic change in Tanzania: causes, consequences and future prospects**. *Journal of international development* 1995, **7**(1):117-134.
22. National Bureau of Statistics (NBS) [Tanzania] and ORC Macro.: **Tanzania Demographic and Health Survey 2004-05. Dar es Salaam, Tanzania. [http://www.measuredhs.com/pubs/pdf].** 2005.
23. United Republic of Tanzania. Ministry of Health and Social Welfare. Tanzania: **Expanded Programme on Immunization (EPI). Annual Evaluation Meeting Report.** . 2006.
24. National Bureau of statistics (NBS): **Tanzania Demographic and Health Survey 2004-2005. [http://www.nbs.go.tz/DHS/index.html].** 2005.
25. Conteh L, Sharp BL, Streat E, Barreto A, Konar S: **The cost and cost-effectiveness of malaria vector control by residual insecticide house-spraying in southern Mozambique: a rural and urban analysis**. *Trop Med Int Health* 2004, **9**(1):125-132.
26. Hanson K, Kikumbih N, Armstrong Schellenberg J, Mponda H, Nathan R, Lake S, Mills A, Tanner M, Lengeler C: **Cost-effectiveness of social marketing of insecticide-treated nets for malaria control in the United Republic of Tanzania**. *Bulletin of the World Health Organization* 2003, **81**(4):269-276.
27. Yukich J, Tediosi F, Lengeler C: **Operations, Costs and Cost-Effectiveness of Five Insecticide-Treated Net Programs (Eritrea, Malawi, Tanzania, Togo, Senegal) and Two Indoor Residual Spraying Programs (Kwa-Zulu-Natal,**

Mozambique). [http://rbmwhoint/partnership/wg/wg_itn/docs/Yukich2007pdf]. 2007.
28. Schellenberg D, Manzi F, Mushi A, Hamis Y, Shirima K, Maokola W, Majura A, Wa-Shija R, Mshinda H, Pool R Menendez C, Alonso P, Hutton G, Tanner M, Roper C, Schellenberg JA: **Community Effectiveness of Intermittent Preventive Treatment delivered through the Expanded Programme of Immunisation for Malaria and Anaemia Control in Tanzanian Infants. Interim Report.** *Unpublished*. 2006.
29. Adam T: **Sources of variability in costing methods. Implications for the transferability of cost-effectiveness results. PhD thesis. Erasmus University. Rotterdam**. 2006.

CHAPTER 8: HUMAN RESOURCES FOR HEALTH CARE DELIVERY IN TANZANIA: A MULTIFACETED PROBLEM

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ABSTRACT

Background

Recent years have seen an unprecedented increase in funds for procurement of health commodities in developing countries. A major challenge now is the efficient delivery of commodities and services to improve population health. With this in mind, we documented staffing levels and productivity in peripheral health facilities in southern Tanzania.

Method

A health facility survey was conducted to collected data on staff employed, their main tasks, their availability on the day of the survey, reasons for absenteeism, and supervisory visits from District Health Teams. A time and motion study of nurses in the Reproductive and Child Health (RCH) clinics documented their time use by task.

Results

We found that of the recommended staff, only 14% (122/854) of the recommended number of nurses and 20% (90/441) of the clinical staff had been employed at the facilities. Furthermore, 44% of clinical staff were not available on the day of the survey because the clinical staff attendance to seminar sessions (38%), long-training (8%), official travel (25%) or on leave (20%). RCH clinic nurses worked productively for 57% of time present at facility or 51% of their paid time. Only 14% of facilities had received 5 visits from district health teams during the 6 months preceding the survey.

Conclusion

This study documented inadequate staffing of health facilities, a high degree of absenteeism, low productivity of the staff who were present and inadequate supervision in peripheral Tanzanian health facilities. The implications of these findings are discussed in the context of decentralized health care in Tanzania.

Background

In the last decade developing countries have witnessed an unprecedented increase in funds for the procurement of commodities such as drugs, vaccines and other medical supplies through the Global Fund for HIV/AIDS, tuberculosis and malaria (GFATM), GAVI and other Global Health Initiatives (GHIs). At the same time there is growing recognition of local health system constraints which impair the efficient delivery of health care and threaten to reduce the effectiveness of the GHIs [1-5]. Scale-up of basic health services depends on the availability of key health systems inputs such as human resources, infrastructure, equipment and drugs. Where the available infrastructure and human resources are used in an efficient way and are fully utilized, then the introduction or scale-up of additional interventions will require additional health workers, drugs, equipment and buildings. However, if there is inefficient use of available resources, productivity gains may be possible through enhanced efficiency of the available resources.

The ratio of health workers to population has a direct relationship with survival of women during childbirth and children in early infancy: as the number of health workers declines, survival declines proportionately [6]. Most sub-Saharan countries face human resource shortages for health service delivery [3, 7]. While the world average for health worker density per 1000 population is 9.3, there is marked inequality with 18.9 health workers per 1000 population in Europe and only 2.3 in Africa [7]. There is also marked variation within Africa: in Chad there are 0.16 nurses per 1,000 population, and Tanzania has 0.39 nurses and 0.25 clinical staff (medical doctors, assistant medical officers and clinical officers) per 1000 population in Tanzania [8]. The health worker shortage in Africa has been attributed to low output of new health workers by medical schools, out migration to other sectors and to more lucrative countries because of poor remuneration and adverse working conditions at home [9, 10]. HIV/AIDS has both increased demand for skilled health workers and directly reduced their availability [11]. There is also an urban-rural imbalance of health workers with more staff in urban centres [9].

The efficient functioning of any health system is contingent on the productivity of the workforce. How best to measure productivity is context specific but generally requires bench marks based on duties defined in a job description. Performance indicators are then compared against targets [12]. However job descriptions are not widely available and performance indicators not generally agreed in Tanzania. A fair and accurate employee performance review may begin with tracking employee behaviors and patterns [13]. There is evidence that productivity of health staff in developing countries is sub-optimal and that personnel are under-utilized [14, 15] . For example, in one study from Cameroon only 27% of health workers' time was being spent on productive activities (curative and clinical work) [15] and in Tanzania the estimated time health workers spent on productive activities was 57% [8]. Potential productivity gains of existing staff were estimated at approximately 26% in Tanzania and 35% in Chad [8]. Various solutions to increase staff and productivity have been proposed that include improved management measures, specific training tailored to the local area, strengthening of enabling factors such as equipment and skills, and the introduction of financial incentives to increase workers' efforts [2, 16-18].

We conducted a number of health system assessments in southern Tanzania as part of an evaluation of Intermittent Preventive Treatment in infants (IPTi) [19, 20]. A structural and functional assessment of the health system [5] preceded IPTi implementation by routine health services [21] and monitoring of costs [22]. Here we document staffing levels in comparison with the Ministry of Health's guidelines, and the productivity of nursing staff in vaccination clinics of peripheral health facilities.

Methods

Study area

The study was conducted in the five districts of Nachingwea, Lindi Rural, Ruangwa, Tandahimba and Newala Districts in Southern Tanzania, a total population of about 900,000 in 2002. A detailed description of the area is given elsewhere [5]. Briefly, the public health system comprises a pyramidal network of dispensaries, health centres

and hospitals. Some villages have volunteer village health workers. The national policy requires that children under the age of five and pregnant women are exempted from fees at government health facilities. However, in practice they pay for drugs and supplies when they are out of stock at the facility. The area is characterized by the highest child mortality in Tanzania; under-five mortality was 153/1000 in the ten year period preceding a 2004/5 Demographic and Health Survey [23].

The health system in Tanzania is largely decentralized. The district is empowered to set priorities, and is responsible for health service implementation and for supervision of individual health facilities on a monthly basis. The dispensary is the lowest level of service delivery, catering for between 6,000 to 10,000 people. Health centres are expected to serve about 50,000 people, approximately the population of one administrative division, providing in-patient services for patients referred from lower levels. Higher up the service pyramid, each district is supposed to have a district hospital. Where there is no government hospital, an available faith-based or NGO hospital is often designated as the district hospital. The regional hospital offers services similar to those at district level but has specialists in various fields and offers additional services not available at district hospitals. The national referral hospital is the highest level of inpatient service.

The Ministry of Health established recommendations for staffing levels in the different types of health facility. Two clinicians and two nurses are recommended for each dispensary and four clinicians and nine nurses for each rural health centre [24]. Health workers delivering the majority of care in rural primary health facilities (dispensaries and health centres) are generally “clinical staff” (Assistant Medical Officers or Clinical Officers or Assistant Clinical Officers) or nurses; there are no medical doctors. Clinical staffs attend four or six years of secondary education before three years of professional training. Nurses include Nursing Officers, Nurse Midwives, Public Health Nurse ‘A’ and ‘B’ and Maternal and Child Health Aides (though this latter cadre is being phased out); their training involves four years of secondary education followed by three years of professional training. However, because of health worker shortages,

it is not uncommon to find auxiliary nursing staff with only basic primary education of 7 years and a single year's introduction to nursing courses performing the tasks of a trained nurse.

Data Collection

Health facility survey

A baseline health facility survey was conducted in September 2004 to facilitate the planning for implementation of IPTi and familiarization with the local health system. All 134 health facilities in the five districts were visited including hospitals, health centres and dispensaries of the public health care system, non-governmental not-for-profit organizations and the private sector. Using a modular tool, data were collected on (i) the number and cadre of health workers employed at the facility and (ii) the number actually present on the specific day of the survey. Other modules assessed the availability of equipment and supplies. Staffs were asked about their main activities, reasons for their colleagues' absence, and supervision by district health staff, the functioning of vaccination activities and their views on how to improve services.

Training of experienced field workers was carried out over a period of five days and included interview technique, group work, role-play and practical fieldwork as well as a pilot test of the survey instruments. The survey was conducted by 16 interviewers working in groups of two, forming eight teams, with two supervisors who assisted the survey co-ordinator. A letter of introduction from each Council Health Management Team, signed by the District Medical Officer and the District Executive Director, was given out at each facility and verbal consent sought before proceeding with interviews.

To help assure the quality of data, at least one interview was accompanied by a supervisor each day. All forms completed each day were reviewed in the evening and feedback given to the interview teams before the next day's work. Data was collected using conventional paper forms which were double entered into DMSys software (Microsoft® Visual FoxPro® platform, Cincinnati, USA), followed by checks of range

and resolution of any inconsistencies. Analysis was done using Stata © (version 8, College Station, Texas, USA).

Time and motion study

A time and motion study was done in 24 dispensaries and health centres in the project area during November-December 2005 [21] . Briefly, the objective was to document health workers time use at a Reproductive and Child Health (RCH) clinic. Pairs of interviewers spent a week at each participating health facility and data were collected towards the end of their stay, when the staff had grown used to the presence of the interviewers. Nurses delivering EPI vaccines and other interventions integrated at the RCH clinic were followed on a typical vaccine clinic day as vaccination is not done every day. Two major categories of time use were distinguished, namely productive and non-productive time. Productive time activities included room cleaning, other work room preparations, mothers` education sessions, delivery of interventions like family planning, provision of *sulphadoxine–pyrimethamine* (SP) to pregnant women (IPTp) and infants (IPTi), recording doses and dates in immunization cards and in Health Management Information System (HMIS). Non-productive activities included unexplained breaks, social contacts and waiting for patients. This non-productive time – through improved staff management and accountability – can be potentially translated into productivity gains leading to improved health service provision. Data were entered at the point of collection using a personal digital assistant (PDA) [25]. The PDA had a menu of nurses' activities; when an activity was selected the time was automatically recorded as the start time for that activity and the end time for the previous activity. The device allowed immediate checking of ranges and data consistency. Analysis was done using Stata © (version 8, College Station, Texas, USA).

Results

Health workers at peripheral health facilities

A total of 134 health facilities were surveyed in the five districts; one facility was closed. Of those surveyed, 127 were primary facilities (health centres and dispensaries) and seven were hospitals. During analysis one regional hospital was dropped as it serves several districts. As shown in Table 1, the study documented clear lines of responsibility for clinical staff and nurses in primary facilities. The vast majority (94%) of clinical staff reported their primary task as case management of patients, though a minority (5%) said their main activity was administration. Nurses reported a broader range of primary activities, dominated by vaccination (33%) and antenatal care (23%). Nursing procedures were reported as the primary task in 14%, and 16% spent most of their time on case management.

The Ministry of Health and Social Welfare's (MOHSW) staff guideline recommends 441 clinical staff and 854 nurses for the facilities visited [24]. However, only 20% (90/441) of the recommended number of clinical staff and 14% (122/854) of the recommended number of nurses had been employed (Table 2). This equates to an overall staffing level of 0.10 clinical staff per 1000 population and 0.14 nurses per 1000 population. There was marked variation in staffing levels between districts, ranging from 0.05 – 0.16 per 1000 population for clinical staff and 0.07-0.23 per 1000 population for nurses.

There was a high level of absenteeism amongst employed staff, with 44% of clinical staff and 49% of nurses absent from their work station on the day of the survey. This reduced the effective coverage of staff to 0.06 and 0.07/1000 population for clinical staff and nurses respectively. Table 3 shows that 38% of the absent clinical staff and 29% of absent nurses were attending meetings or short-term training seminars, 25% of both cadres were on official travel (collecting vaccines, drugs or wages from the district offices) or were on leave (20%).

Activities and Time Use

Vaccination activities in primary facilities were concentrated in the morning hours of the working day (Figure 1). The peak starting time was around 9:00am and completion time was around 12:00 noon. Congestion at clinics was common during these times as nurses encourage people to come early for most health services leading to a concentration of activities in the morning hours (personal observation). Only a few activities, such as family planning, continue into the afternoon. On average there is one prescriber in each primary facility with the workload averaging 29 outpatients per clinician per day in health centres and 20 in dispensaries [26]. Table 4 shows the results of the time and motion study. Out of the 24 facilities visited, 19 had vaccination activities during the researchers' visits. RCH nurses spent an average of 7 hours 9 mins per day at their health facility, of which 4 hours 3 mins were considered productive. An average of 1 hour 30 mins was spent administering EPI vaccines or other child health interventions linked to vaccination (such as vitamin A, IPTi), and filling the health Management Information System's forms. A further 59 minutes were spent on antenatal care and family planning. Nurses in eight facilities were occupied with case management for a mean of 29 minutes. Other activities (non contact productive activities including work place cleaning and preparation of work day supplies) took 1 hour and 10 mins of nurse's time. Over half (56% (10/18)) of the nurses were unproductive for three or more hours, waiting for patients, chatting or just wandering around. Unexplained absenteeism accounted for 51 minutes on average.

When asked how services could be improved, health workers suggested increasing the number of employees, better maintenance of buildings, providing more working equipment and improving the availability of drugs (Table 5).

Supervision

Although 84% of facilities had been visited by supervisors in the six months preceding the survey, only 13% (17/110) had received five or more visits and 49% had only received one or two visits (Table 6). Case management was observed in 20% of the visits, but the Health Management Information System forms completed to document

the visit 82% of the time. The health workers were asked about their positive and negative experiences of supervision visits. The positive points included perceived support in terms of bringing supplies, identifying expired drugs, following up on policy implementation, helping to identify problems and provide solutions, and provision of on the job training in 62% (69/111) of clinics. Supervisors were said to have shown kindness and respect to health workers, encouraged self evaluation, reminded workers of their responsibilities and helped during patient consultations in 36% (40/111) of clinics. There were also negative experiences, including dissatisfaction with the supervision quality in 24% (26/105) of clinics because of a tendency of some supervisors to spend a minimal amount of time at facilities, and infrequent visits. Some supervisors were thought to be incompetent or uninterested with the problems of the facilities. On occasions, supplies were not brought on time or drugs which had already expired were delivered. Some (15% (15/105)) of the health workers complained that the supervision was not supportive as it only engaged with the person in charge and did not provide direct feedback to other health workers. In about a third (32% (33/105)) of clinics, the respondents mentioned that some supervisors were unfriendly, made false accusations, lacked respect for clinic staff and failed to provide moral support. Nevertheless, the overall feeling was that supervisory visits were helpful.

Discussion

The documented low number of health workers assigned to rural health facilities and absenteeism in this study are comparable to other findings from Tanzania and elsewhere [27-29]. However, in this current study all have been brought together – the features of the multifaceted human resources problem. These findings have serious implications for health service provision in southern Tanzania given the no more than one-fifth of the number recommended by the Ministry of Health's own guidelines were actually employed; of those employed, about half were absent from their duty station on the day of our survey; over half of the nursing staff followed during routine vaccination days were non-productive for at least three hours of the working day; and that supervision visits by district health staff to peripheral health facilities were infrequent and of variable quality.

The Ministry of Health established recommendations for staffing levels by interviewing key informants, observational studies and consultative meetings with staff in all levels of service provision [24]. The final criteria for staffing levels were based on the type of services provided, the type of health facility and the number of patients anticipated.
The norms might be appropriate for some places (e.g. urban dispensaries with a high utilization rate) but for others not (e.g. rural remote facilities covering a relatively small population). This may explain why the study identifies both time shortages and an inefficient use of available staff time. Accounting for service demand is crucial as utilization is likely to differ between remote facilities with lower population densities and few users compared to urban facilities with high population densities.
We found that only 14% of nurses' and 20% of clinical staff positions had been filled, lower than the national average of 35% [30]. We noted marked variation in staffing levels between the districts in our project area. The particularly marked lack of staff in rural settings has been documented previously[8]; as a result, service delivery is predominantly provided by untrained health workers
Mæstad suggested possible incentive schemes to attract trained people to work in rural areas [2]. "Pull incentive packages" could involve provision of hardship allowances or housing, "push incentives" could involve implementation of coercive measures such as bonding, in which health workers are obliged to serve in rural areas for a number of years upon completion of internship. Testing how well such incentive schemes work in developing countries needs to be given priority.

Inadequate staffing levels were compounded by a high level of absenteeism. Approaching a third of all employed staff were absent from their work place, resulting in only about 12% of the recommended staff actually being available at the health facility. Health workers in rural facilities are pulled in different ways - to attend seminars and to collect their salaries and sometimes vaccines or other supplies from the district capitals. Such distractions further undermine their ability to provide services. However, despite understaffing, the nurses in primary facilities did not appear to be overworked, suggesting that for preventive care there is a lack of

balance between service supply and demand. Where nursing staff had been employed and were available on site in primary facilities, a surprising amount of time was non-productive, with over half the nurses being unproductive for at least three hours on a vaccination clinic day, considered the busiest time of the week. As observed and documented by researcher during the week long follow-up of staffs in the primary facilities in this study, the variation in productivity was largely a function of patient flow: when patients were not present, nurses tended to sit idly. The possible explanation could be presence of untrained staff in primary facilities that has impact on quality of some services that require trained health workers for example maternal health and major issues related to HIV or non-communicable disease problems [31]. Patients in most instances value and search for services that they perceive to provide better quality care. They could by-pass primary level facilities to facilities perceived to have high quality, leading to loss in functionality of referral systems [32, 33]. The consequence could be underutilization of lower level facilities, overload of hospitals and high out-of-pocket payments for private facilities [34, 35]. This is likely to be particularly detrimental for the poorest, increasing poverty through spending more than the limited resources available for basic needs. To increase access and client confidence for health service requires better availability of skilled health workers at a rate that exceed attrition and reduces inequalities in distribution.

In the decentralized Tanzanian health system, the district Council Health Management Team (CHMT) is responsible for the health services provided in its district. The in-charges of primary facilities apart from providing medical services, have a role in overseeing the day to day activities in their facilities and communicate with CHMTs on various requirements related to drugs, supplies and equipments. The CHMT members are supposed to visit each facility on a monthly basis to supply commodities, review HMIS data and support front-line staff. We found that such supervisory visits were infrequent and not always supportive. Adequate supervision could reduce absenteeism and mitigate some of the factors that reduce health workers' productivity. However, CHMTs face genuine challenges in providing supportive supervision to peripheral health facilities. Many CHMTs plan a monthly supervision schedule, often

found posted on their notice boards, but find it difficult to keep to it (personal observations and communications with District Medical Officers in 2 rural districts). Competing interests lead CHMT members to training seminars, after which they are obliged to train front-line health workers, taking the latter away from their duty stations. Molyneux and others recommended more training in health facilities and fewer seminars in the district head quarters to increase health workers' time for patient care and increase the relevance of the training [36]. Another reason for failure to perform supervision and execute other duties on a timely basis is delays in disbursement of basket funds to the districts from the Ministry of Health and Social Welfare [*Source: personal communications with DMOs of Lindi Rural and Nachingwea in November, 2008*]. Additional local factors, such as the breakdown of vehicles and unavailability of fuel, compound the situation. In addition these same people are required to manage the HMIS, look after visiting officials and health stakeholders, who often arrive at very short notice, and to contribute directly to service provision in their districts. The distribution of paperwork such as guidelines and checklists is not enough to effect change: these needs to be complemented with follow-up, audit and feedback to lead to changes and influence performance [37]. Integrated supervision has been proposed to improve the efficiency of supervision visits as part of Tanzania Essential Health Intervention Programme (TEHIP) activities, and this is worth taking forward [38]. Improved supervision is likely to require timely disbursement of funds, sufficient staff, prior notification of visits, appropriate training for supervision and improved supervision of CHMTs by regional and national level staff.

This study is unique in its presentation of the multifaceted human resource problem compared to studies in other developing countries. Most studies presented individual problems related to human resources productivity, capacity issues or incentives packages [39-46]. This current study has shown that a lack of trained health workers associated with a high degree of absenteeism, and that the low productivity of the few health workers actually present in peripheral health facilities in southern Tanzania is further exacerbated by inadequate supervision. This has implication in the formulation of polices to alleviate the human resource problems. While increasing the numbers of

health workers is important, working on incentives to retain them in underserved areas to reduce inequalities in their distribution is also necessary. One approach to tackle the health worker crisis, promoted by WHO, is to recruit and train not only the local people but residents of respective cultural zones as alternative and mid level providers [47]. This will orientate health worker training and development of career incentives to encourage service in rural and disadvantaged areas to counteract the tendency of health workers to cluster around cities.

There were methodological limitations associated with this study. The facilities and health workers included in the time and motion study were purposively sampled such that IPTi-implementing and comparison facilities were similar in terms of vaccine coverage and the number of vaccinating staff. Nevertheless we believe they were representative of health facilities in the area. The time and motion study did not include private providers where productivity patterns may differ from government providers. Although the time and motion approach is considered a gold standard in measuring health workers time use [48] , it is subject to the so-called Hawthorne effect where what is being observed changes as a result of being observed. However this would likely result in positive bias [49], meaning that the documented productivity is higher in health workers under observation. We suspect the extent of this bias was reduced by the fact that interviewers carried out the time and motion study after they had spent several days at the facility, so that health workers had got used to their presence, and they used PDA technology which is less conspicuous than clipboards and pens. Another way in which the time and motion study may have over-estimated the productivity of health workers is that the study was done on the busiest day of the week, when vaccination activities were taking place.

Conclusion

We have documented a shortage of front-line health workers, a high level of absenteeism and low productivity of existing health workers. Long-term investment in the Tanzanian health work force will be required to achieve adequate staffing levels. CHMTs require strengthening so that they are more able to conduct supportive

supervision and there is a need to make health workers accountable to their supervisors and to the community. Nevertheless, improved management, service integration and staff incentives should enable health workers to perform better.

Abbreviations

CHMT: Council Health Management Teams; HMIS: Health Management Information System; PDA: Personal Digital Assistant; MoHSW: Ministry of Health and Social Welfare; DPT: Diphtheria Pertussis Tetanus; EPI: Expanded Programme on Immunization; IPTi: Intermittent Preventive Treatment in infants; RCH: Reproductive and Child Health.

Competing interests

The authors declare that they have no competing Interests.

Authors' contributions

FM conceived the idea and participated in the design of the study, coordinated data collection, conducted the analysis and writing the manuscript. JS helped develop the idea, study design, analysis, writing and interpretation. GH participated in the design of the study, provided technical support and contributed to the manuscript preparation. KW contributed to the manuscript preparation and interpretation. CM, KS contributed technical support and writing the manuscript. HM, MT provided technical support. DS participated in the design of the study, coordinated the study, data analysis and interpretation. All authors read, commented on and approved the manuscript.

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TABLES

Table 8.1: Health workers primary task in primary health facilities in southern Tanzania

Primary Task	Clinical staff N=82		Nurses N=81	
	%		%	
Case management of patients	94	(n=77)	16	(n= 13)
Administration	5	(n= 4)	3	(n= 2)
Vaccination and all child preventive services	1	(n= 1)	33	(n= 27)
Nursing procedures	0		14	(n= 11)
Childbirth care	0		11	(n= 9)
Antenatal	0		23	(n= 19)

Table 8.2: Health workers Density per District in health facilities in southern Tanzania compared to Ministry of Health guideline

District	Popn[b]	Clinical Staff								Nurses							
		Rec[a]		Employed			Available on the day of survey			Rec[a]		Employed			Available on the day of survey		
		No	*Per 1000 Popn[b] Equiv*	*No*	*% Rec*	*Per 1000 Popn[b] Equiv*	*No*	*% Emp[c]*	*Per 1000 Popn[b] Equiv*	*No*	*Per 1000 Popn[b] Equiv*	*No*	*% Rec*	*Per 1000 Popn[b] Equiv*	*No*	*% Emp*	*Per 1000 Popn[b] Equiv*
Lindi Rural	214,882	115	0.54	24	21%	0.11	19	79%	0.09	194	0.90	32	16%	0.15	16	50%	0.07
Nachingwea	161,473	119	0.74	22	18%	0.14	11	50%	0.07	271	1.68	24	09%	0.15	11	46%	0.07
Ruangwa	124,009	57	0.46	20	35%	0.16	3	15%	0.02	116	0.94	29	25%	0.23	15	52%	0.12
Newala	183,344	77	0.42	13	17%	0.07	8	62%	0.04	136	0.74	22	16%	0.12	12	55%	0.07
Tandahimba	203,837	73	0.36	11	15%	0.05	9	82%	0.04	137	0.67	15	11%	0.07	8	53%	0.04
All districts	887,545	441	0.50	90	20%	0.10	50	56%	0.06	854	0.96	122	14%	0.14	62	51%	0.07

[a]Rec: Recommended health worker as per Ministry of Health Guideline 1999
[b]Popn: population
[c]Emp: employed

Table 8.3: Reasons for health workers absence in primary facilities

Reason for absence	Clinical staff N=40	Nurses N=45
	%	%
Meetings/Seminars	38 (n=15)	29 (n=13)
Other official travel	25 (n=10)	25 (n=11)
On leave	20 (n= 8)	20 (n= 9)
Long term training	8 (n= 3)	4 (n= 2)
On a different shift	5 (n= 2)	4 (n= 2)
Outreach	0 (n= 0)	2 (n= 1)
Sick	3 (n= 1)	9 (n= 4)
Other	2 (n= 1)	7 (n= 3)

Table 8.4: Time spent by a sample of 19 RCH nurses on specific activities

Activities	N	Mean Hour:min	Median Hour:min	95% confidence interval Hour:min	
				Lower	Upper
Case Management	8/19	00:29	00:19	00:04	00:54
Activities linked to vaccination (administration of EPI vaccines, IPTi, vitamin A, recording in Health Management Information System)	19/19	01:30	01:34	01:12	01:49
Maternal health (IPTp, Antenatal care, family planning)	18/19	00:59	00:45	00:31	01:26
Other (non contact productive-cleaning, day supplies preparation)	19/19	01:10	01:06	00:50	01:39
RCH nurse total time at facility	19/19	07:09	07:19	06:41	07:38
Overall non-productive time	18/19	03:06	01:06	02:14	03:58

Note: Time and Motion study of sub-sample of 24 facilities, 5 of which had no vaccination activities during researchers' visits

Table 8.5: Suggestions to improve services

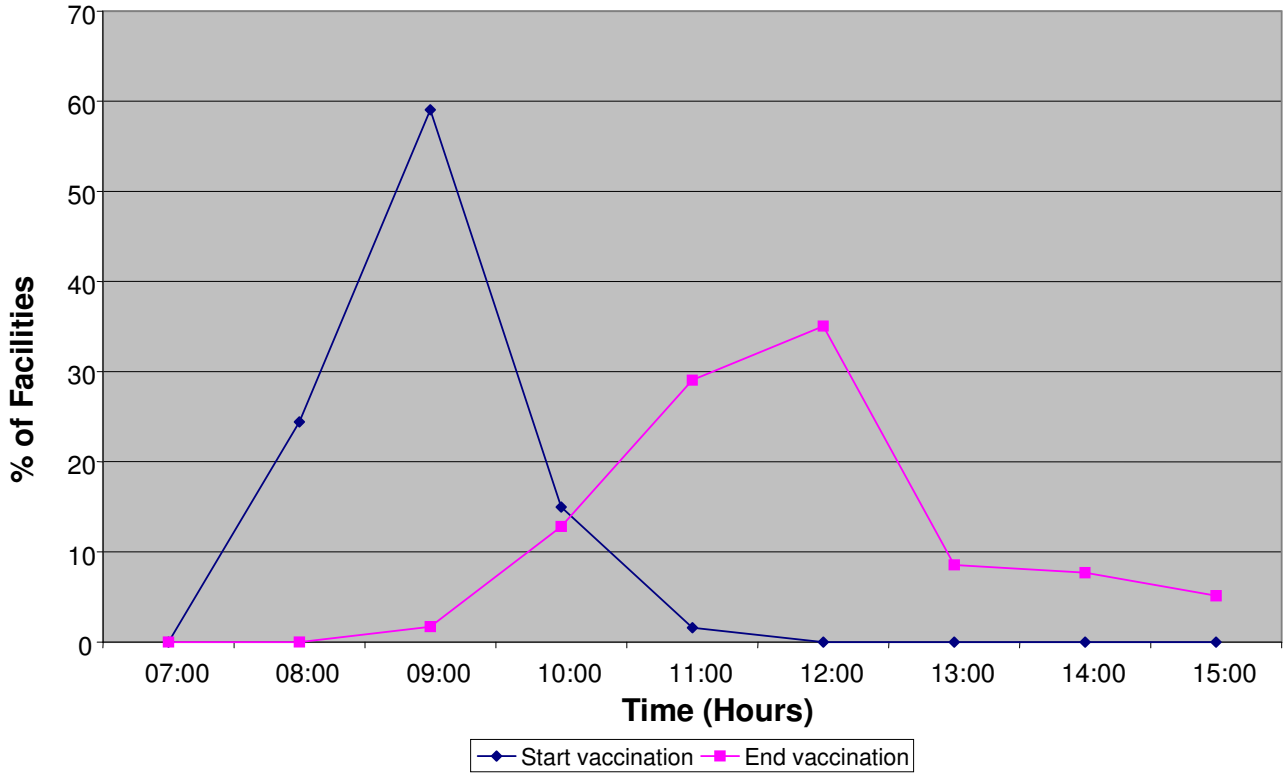
Description	1st response (N=115)		2nd response (N=98)	
	%		%	
Increase number of employees	58	(n=67)	18	(n=18)
Maintenance of buildings	13	(n=15)	2	(n= 2)
Provide more working equipment	11	(n=13)	12	(n=12)
Improve availability of drugs	6	(n= 7)	16	(n=16)
More training for employees	8	(n= 9)	19	(n=18)
Salary Increase	0	(n= 0)	27	(n=26)
Other (for example staff housing, ambulance, improve laboratory)	4	(n= 4)	6	(n= 6)

Table 8.6: Supervision* activities in primary facilities

Number of times a facility is visited by a supervisor in last 6 month	Percent
0	16 (n=21)
1-2	49 (n=64)
3-4	22 (n=29)
5+	13 (n=17)

*Supervision visits: Average 2.2 and median 2

Figure 8.1: Timing of vaccination activities in primary health facilities



References

1. Barden-O'Fallon, J., G. Angeles, and A. Tsui, *Imbalances in the health labour force: an assessment using data from three national health facility surveys.* Health Policy Plan. 2006. **21**(2): p. 80-90.
2. Mæstad, O., *Human Resources for Health in Tanzania: Challenges, Policy Options and Knowledge Gaps. CMI Report. Chr. Michelsen Institute (CMI). [www.cmi.no/publications].* 2006.
3. Kurowski, C., et al., *Scaling up priority health interventions in Tanzania: the human resources challenge.* Health Policy Plan, 2007. **22**(3): p. 113-127.
4. Leonard, K.L. and M.C. Masatu, *Variations in the quality of care accessible to rural communities in Tanzania.* Health Aff (Millwood), 2007. **26**(3): p. w380-92.
5. Armstrong Schellenberg, J.R., et al., *Health and survival of young children in southern Tanzania.* BMC Public Health, 2008. **8**: p. 194.
6. Anand, S. and T. Barnighausen, *Human resources and health outcomes: cross-country econometric study.* Lancet, 2004. **364**(9445): p. 1603-9.
7. WHO (2006) *The World Health Report 2006. Working Together for Health.*
8. Kurowski, C., et al. *Human resources for health: requirements and availability in the context of scaling up priority interventions in low-income countries. (2003) Case studies from Tanzania and Chad. HEFP Working Paper 01/04. Online at: [http://www.hefp.lshtm.ac.uk]. London: Health Economics and Financing Programme, London School of Hygiene & Tropical Medicine.*
9. Serneels, P., et al., *For public service or money: understanding geographical imbalances in the health workforce.* Health Policy Plan, 2007. **22**(3): p. 128-38.
10. McCoy, D., et al., *Salaries and incomes of health workers in sub-Saharan Africa.* Lancet, 2008. **371**(9613): p. 675-81.
11. Dieleman, M., et al., *'We are also dying like any other people, we are also people': perceptions of the impact of HIV/AIDS on health workers in two districts in Zambia.* Health Policy Plan. 2007. **22**(3): p. 139-48.
12. Stewart, F.M., Wasserman, Robert L., Bloomfield, Clara D., Petersdorf, Stephen, Witherspoon, Robert P., Appelbaum, Frederick R., Ziskind, Andrew, McKenna, Brian, Dodson, Jennifer M., Weeks, Jane, Vaughan, William P., Storer, Barry, Perkel, Sara, Waldinger, Marcy, *Benchmarks in Clinical Productivity: A National Comprehensive Cancer Network Survey* J Oncol Pract 2007. **3**: p. 2-8.
13. Heet, L., *Human Resources. Guide to performance appraisal. [http://www.business.com/directory/human_resources/workforce_management/performance_and_productivity/performance_appraisal].*
14. Dominick, A. and C. Kurowski (2005) *Human resources for health - an appraisal of the status quo in Tanzania mainland.* *At http://info.worldbank.org/etools/docs/library/206771.*
15. Bryant, M. and R.O. Essomba, *Measuring time utilization in rural health centres.* Health Policy Plan, 1995. **10**(4): p. 415-22.
16. International Council of Nurses, I.H., I.P.F. Federation, World Confederation for, and W.D.F. Physical Therapy, World Medical Association, *Guidelines: Incentive for Health Professionals. 2008. [http://www.who.int/workforcealliance/documents/Incentives_Guidelines%20EN.pdf].*

17. Rowe, A.K., et al., *How can we achieve and maintain high-quality performance of health workers in low-resource settings?* Lancet, 2005. **366**(9490): p. 1026-35.
18. Hongoro, C. and B. McPake, *How to bridge the gap in human resources for health.* Lancet, 2004. **364**(9443): p. 1451-6.
19. Egan, A., J. Crawley, and D. Schellenberg, *Intermittent preventive treatment for malaria control in infants: moving towards evidence-based policy and public health action.* Trop Med Int Health, 2005. **10**(9): p. 815-7.
20. IPTi Consortium, *www.ipti-malaria.org*.
21. Manzi, F., et al., *Intermittent preventive treatment for malaria and anaemia control in Tanzanian infants; the development and implementation of a public health strategy.* Trans R Soc Trop Med Hyg, 2008.
22. Manzi, F., et al., *From strategy development to routine implementation: the cost of Intermittent Preventive Treatment in Infants for malaria control.* BMC Health Serv Res, 2008. **8**: p. 165.
23. National Bureau of Statistics (NBS) [Tanzania] and Macro International Inc. (2005) *Tanzania Demographic and Health Survey 2004-2005. [http://www.nbs.go.tz/DHS/index.html]*.
24. Ministry of Health. Tanzania, *Guidelines. Staffing levels for health facilities/institutions. MOH/CSD: April 1999*. 1999.
25. Shirima, K., et al., *The use of personal digital assistants for data entry at the point of collection in a large household survey in southern Tanzania.* Emerg Themes Epidemiol, 2007. **4**: p. 5.
26. Simba, D., N. Mwangu, and G. Msamanga, *Rationalising human resource deployment in the wake of reforms: the need for measuring health workers workload.* Tanzania Medical Journal, 2004. **19**(2).
27. Munga, M.A. and O. Mæstad, *Measuring inequalities in the distribution of health workers: the case of Tanzania* Human Resources for Health, 2009. **7:4**.
28. Chen, L., et al., *Human resources for health: overcoming the crisis.* Lancet, 2004. **364** (9449): p. 1984-90.
29. Kruse, G., et al., *Burnout and use of HIV services among health care workers in Lusaka District, Zambia: a cross-sectional study.* Human Resources for Health 2009. **7:55**.
30. Ministry of Health and Social Welfare, *Tanzania. Primary Health Services Development Programme (PHSDP) 2007 - 2017. Dar es Salaam.* 2007.
31. Dogba, M. and P. Fournier, *Human resources and the quality of emergency obstetric care in developing countries: a systematic review of the literature.* Hum Resour Health, 2009. **7**: p.7.
32. Mariko, M., *Quality of care and the demand for health services in Bamako, Mali: the specific roles of structural, process, and outcome components.* Soc Sci Med, 2003. **56**(6): p. 1183-96.
33. Bank, W., *Better health in Africa: experience and lessons learned Washington, D.C.* 1994.
34. Mamdani, M. and M. Bangser, *Poor people's experiences of health services in Tanzania: a literature review.* Reprod Health Matters, 2004. **12**(24): p. 138-53.
35. Manzi, F., et al., *Out-of-pocket payments for under-five health cares in rural southern Tanzania.* Health Policy Plan, 2005. **20 Suppl 1**: p. i85-i93.

36. Molyneux, E. and M.W. Weber, *Applying the right standards to improve hospital performance in Africa.* Lancet, 2004. **364**(9445): p. 1560-1.
37. Leong, C.L., et al., *Providing guidelines and education is not enough: an audit of gentamicin use at The Royal Melbourne Hospital.* Intern Med J, 2006. **36**(1): p. 37-42.
38. de Savigny, D., et al., *in focus: FIXING HEALTH SYSTEMS*. 2008, The International Development Research Centre. PO Box 8500, Ottawa, ON, Canada K1G 3H9.
39. Voetagbe, G., et al., *Midwifery tutors' capacity and willingness to teach contraception, post-abortion care, and legal pregnancy termination in Ghana.* Hum Resour Health. **8**: p. 2.
40. Leon, B.K. and J. Riise Kolstad, *Wrong schools or wrong students? The potential role of medical education in regional imbalances of the health workforce in the United Republic of Tanzania.* Hum Resour Health. **8**: p. 3.
41. Rowe, L.A., et al., *Building capacity in health facility management: guiding principles for skills transfer in Liberia.* Hum Resour Health. **8**: p. 5.
42. Dubois, C.A. and D. Singh, *From staff-mix to skill-mix and beyond: towards a systemic approach to health workforce management.* Hum Resour Health, 2009. **7**: p. 87.
43. Corluka, A., et al., *Are vaccination programmes delivered by lay health workers cost-effective? A systematic review.* Hum Resour Health, 2009. **7**: p. 81.
44. Proper, K.I., D.J. Deeg, and A.J. Beek, *Challenges at work and financial rewards to stimulate longer workforce participation.* Hum Resour Health, 2009. **7**: p. 70.
45. Barnighausen, T. and D.E. Bloom, *Designing financial-incentive programmes for return of medical service in underserved areas: seven management functions.* Hum Resour Health, 2009. **7**: p. 52.
46. Barnighausen, T. and D.E. Bloom, *Financial incentives for return of service in underserved areas: a systematic review.* BMC Health Serv Res, 2009. **9**: p. 86.
47. WHO. *Tackling the crisis: what is needed.* http://www.who.int/mediacentre/factsheets/fs302/en/index.html.
48. Bratt, J.H., et al., *A comparison of four approaches for measuring clinician time use.* Health Policy Plan, 1999. **14**(4): p. 374-81.
49. Wickstrom, G. and T. Bendix, *The "Hawthorne effect"--what did the original Hawthorne studies actually show?* Scand J Work Environ Health, 2000. **26**(4): p.363-7.

CHAPTER 9: COVERAGE AND EQUITY OF INTERMITTENT PREVENTIVE TREATMENT IN INFANTS FOR MALARIA CONTROL IN SOUTHERN TANZANIA

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Working paper
This is a working paper that will further be improved for publication on a peer reviewed journal. Additional literature review will be added to compare and contrast experiences of coverage with new interventions and discuss the findings with reference to decentralized routine health delivery.

Summary

Social and economic policies of a country determine the quality of its population's health in terms of interventions fair distribution of health services and outcome. Nearly all interventions are delivered in an inequitable way especially at the start, and tend to reach the least poor in society first. In southern Tanzania a study was undertaken to evaluate community effectiveness of implementing Intermittent Preventive Treatment in infants (IPTi) for malaria and anaemia control. The intervention was delivered by the routine health system. As part of the evaluation, analysis was done to find the IPTi coverage in different socioeconomic groups and by gender, ethnicity and distance from the nearest health facility.

Data was analysed from a representative cluster sample survey of 3024 children aged 12-23 months in 2907 households conducted in 2007. A measure of household wealth was developed based on ownership of assets including a house in which they live in and whether or not it was connected to mains electricity, ownership of a bicycle, a radio, a mobile phone, mosquito nets, the type of cooking energy (wood, charcoal, gas or electricity), ownership of livestock or poultry and the type of roofing material (corrugated iron or thatch). A weighted sum of the assets was calculated using principal components analysis to create an index of household wealth. Households were categorized into five equal sized groups from the poorest to the least poor.

We found no evidence of inequities in IPTi coverage by socio-economic group, gender and ethnic group. There was some evidence of inequity by distance whereby children from households more than 5 kms from the nearest health facility had lower IPTi coverage than those living nearer (41% vs 58%, p=0.006). Vaccine coverage was more equitable across socio-economic groups than had been reported from a similar survey in 2004.

The results suggest that the delivery of IPTi by the routine health system linked to EPI is equitable across socio-economic groups. These findings of apparent equity for IPTi by socio-economic status are very interesting. Careful design of the intervention from the onset to integrate into routine delivery worked well and reached all social groups regardless of their economic, gender or ethnic background. This is a really interesting finding because most new interventions are inequitable. In particular our findings revealed that IPTi delivered together with EPI is relatively pro-poor. The revealed inequality by distance could be addressed by delivering the intervention through the already available outreach network services linked to EPI complemented with fixing its constraints related to timely payment of health workers allowances and provision of transport. Specifically in Tanzania, the inequities by distance could be alleviated by careful implementation of the Primary Health Services Development Programme (PHSDP) launched by the government of Tanzania in recent years. The programme entails construction of a health facility in every village associated with an increase in health workers to further service delivery.

BACKGROUND

Social and economic policies of a country determine the quality of its population's health in terms of fair health distribution across the social spectrum, and the degree of protection provided due to socio-economic disadvantages and ill-health [1]. Nearly all interventions are delivered in an inequitable way especially at the start, and tend to reach the least poor in society first. In many countries even the Expanded Programme on Immunization (EPI) is inequitable by socio-economic status [2]. In fact the concept of equity is complex; it could mean achievement of progress towards adequate coverage in the poorest of the poor. The Commission on Social Determinants of Health defined equity in health as presence of systematic differences in health for different groups of people which are avoidable by reasonable action and that their existence is unfair [3]. An equity consideration is important when estimating coverage, to find out if interventions reach all segments of the community regardless of their social or economic backgrounds. It is well established that most health interventions do not reach the poorest segment of the population [1, 4, 5]. However, this recognition in itself is not enough: deliberate efforts for change need to be undertaken to identify what works in reaching the poor, and why it works, so as to achieve progress towards ' equity effectiveness' [6] . Investment on pro-poor health care has added value in raising the health of the population, affecting their productivity and, then leads to economic growth.

In southern Tanzania a study was undertaken to evaluate community effectiveness of Intermittent Preventive Treatment in infants for malaria and anaemia control (IPTi) [7]. IPTi is the delivery of a treatment dose of sulphadoxine-pyrimethamine (SP), integrated with Expanded Programme on Immunization (EPI) routine vaccinations against DPT/OPV (at 2 and 3 months of age) and measles (at 9 months of age), regardless of the presence of symptoms of malaria or parasitaemia. The selection of the delivery strategy was done in such a way as to build on the well-established Expanded Programme on Immunization (EPI) which has a history of attaining high coverage [8, 9]. The EPI is housed at the Reproductive and Child Health (RCH) clinic of the routine health care delivery, thus, the new intervention made use of the existing system infrastructures.

The intervention was developed and implemented in a consultative approach where by all parties concerned were involved [7]. The main parties include researchers from Ifakara Health Institute, the district health management teams of five districts with inputs from other stakeholders: regional supervisors, National Malaria Control Programme, Department of Reproductive and Child Health – IMCI of the Ministry of Health and Social Welfare, National Expanded Programme on Immunization and WHO country office. The 24 divisions in the study area was divided into half (12) intervention divisions and the rest (12) comparison division. The activities were done in such a way that implementation of the IPTi strategy could continue after the research team had left.

Here we report an assessment of IPTi coverage with regards to socio-economic status, child gender, ethnic background and distance from the nearest health facility. The study contributes to understanding whether integrating IPTi to an already established routine delivery system has the potential to reach all segments of the population. This is necessary to inform evidence based policy making with regards to reaching the poorest and most vulnerable as interventions scale-up.

METHODS

Study area

The study was done in southern Tanzania in five districts of Lindi rural, Nachingwea, Ruangwa, Newala and Tandahimba. Details of the social setting and health system are given elsewhere [8]. Briefly, the common occupations of the people are subsistence farming, fishing and small scale trading. Most people live in mud-walled and thatched-roof houses, only a few houses have roofs made of corrugated iron sheets. Water supply is a big problem: common water sources are hand-dug wells which rely on seasonal rain, communal boreholes, natural springs and rivers. The rural roads are unpaved with some not passable during rainy seasons. The area is characterized by the highest child mortality in Tanzania. Under-five mortality was 153/1000 in the ten year period preceding the Demographic and Health Survey in 2004/5 [9].

Data collection

A household survey was done June-November 2007 in the study area. The survey concluded the evaluation of the impact of IPTi on morbidity and mortality as well as collecting baseline information on maternal and newborn mortality. All data was collected using hand-held PDAs (personal digital assistants). The training was conducted for 3 weeks in June 2007. There were 243 trainees mostly recruited from study districts. Most training facilitators were research project staff supported by 4 pre-trained experienced field coordinators ('commanders'), 14 pre-trained facilitators and invited experts for example on issues of maternal health and birth history studies. Training included lectures, group discussion, PDA practicals, field practicals, and field experience sharing and feedback sessions. Selection of interviewers was based on merit, including performance during practical training, mastering the PDA and good character. Out of 243 trainees, 237 qualified, of which 227 were selected to start the work and 12 were selected for training to carry out a linked follow-on survey to assess intervention and vaccine coverage and malaria prevalence. Training for this linked survey took a further 10 days and involved lectures, field practice on interviews and blood sampling, group discussions and feedback.

The main survey teams visited all households in the 5 districts and completed a household module. Information collected include identifiers, household assets (socio-economic status markers), education and occupation of the household head, listing of all members of the household, location of the household using a Geographical Positioning System (GPS). Information on deaths in women aged

13-49 in the household in the past three years were collected and women aged 13-49 had a birth history module completed. Mothers of children <2 years and those who lost a child in infancy were identified and asked if they were willing to be visited by the child health and Verbal Autopsy teams, respectively. A random sample of those who were willing were selected and visited by these teams after the initial survey.

During the linked follow-up coverage and malaria survey, cluster sampling was done, using sub-villages (vitongoji) as clusters, with 8 clusters in each division. Clusters were selected with equal probabilities and mothers or guardians of all children aged 2-23 months were interviewed, giving a self-weighting sample of all children in each division. The survey team asked more detailed questions about child health regarding IPTi and vaccine coverage, and indicators of process and context. They also took a blood sample to test for malaria parasites. Thus, the malaria module included assessment of parasitaemia and blood sampling for later measurement of drug resistance markers. Household heads were asked to give their written consent to participate.

All data were entered into PDAs at the point of collection [10]. Standard range, consistency and completeness checks were carried out at the time of data collection in the field. Analysis was done using Stata (version 10, College Station, Texas, USA) whereby adjustments for survey design effect of clustering were done using “svy” commands.

Definition of terms

Socio-economic status

This is a term used to rank people in the population according to their economic status. Inequity in health is based on ethical judgements about differences in programme outcomes based on ones economic status which are unfair and unjust [11] and therefore could potentially be corrected. In this study, an index of household wealth was created based on ownership of assets then a weighted sum of the assets was calculated using principal components analysis [12]. The inclusion was based on whether or not a household rented the house in which they live, whether they owned a bicycle, a radio, a mobile phone, mosquito nets, what was their cooking power (wood, charcoal, gas or electricity), whether they owned livestock or poultry, what was the type of their roofing material (corrugated iron or thatch), and whether or not the house they lived in was connected to mains electricity. Then the households were categorized into one of five equal sized groups from the poorest to the least poor. P-values for testing hypotheses concerning inequalities by socio-economic status, child gender, ethnic group of the household head or distance from the nearest health facilities were taken from a test for trend based on svylogit where adjustment for survey design effect of clustering is done.

Distance from health facility

GPS data were used to calculate the distance in kilometer (km) from the household to the nearest health facility as a straight-line used as a good proxy for

true distance traveled. This was calculated using Pythagoras theorem (http://mathworld.wolfram.com/PythagoreanTheorem.html). Practically, it is the distance as a bird would fly hence the term 'as the crow flies' between the household and the nearest health facility. This means that the distance presented is not exactly the same as the true distance that people actually travel as in reality the true distance travel would be longer due to roads and tracks not being straight, presence of hills, rivers, etc. The proxy distance calculated was categorized into 2: under 5km which is roughly one hour's journey on foot or as over 5km.

Coverage of IPTi

We defined IPTi coverage as a child aged 12-23 months who had received 3 IPTi doses before they were 12 months old. This definition is in keeping with the standard coverage indicators for EPI vaccines (you can refer here to DHS reports I think, also the MCE website too, but do check both first to be sure that they show the definitions).

RESULTS

The survey team visited 243,612 households in the 5 study districts. Over 99% (225,980 of those asked) agreed to take part. In a few households (15,823, 6.5%), nobody could be found on the day of the survey. In the follow-up coverage and malaria survey, the teams interviewed the mothers of 3,024 children who were under 2 years old.

To describe the type of assets that are owned by the people in each of the quintiles of the socio-economic status score from principal components analysis, a summary is provided in Table 9.1. In the summary table, it is shown that households in the least poor quintile own more valuable assets compared to a household from a poorest quintile. The poorest household would have no bicycle, phone or poultry and is living in a thatched roof. The least poor quintile would be living in a tin roofed house, own a mobile phone, a bicycle and radio.

The findings of the coverage of IPTi with regard to socio-economic groups, distance from a health facility, child gender and ethnicity is presented in Table 9.2. There was no evidence that coverage of IPTi varied by socio-economic status of a child. Coverage in the poorest was 39% compared to 51% in the least poor, but this different was not statistically significant (p=0.160).

We found strong evidence that overage of IPTi was related to the distance from the nearest health facility. Children living within 5km from the health facility had higher coverage (58%) compared to those living more than 5km away, in whom the coverage was 41%, (p =0.006).

The study found no evidence of any gender difference in the coverage of IPTi. Although it was higher in females (54%) compared to males (48%), this difference was not statistically significant (p=0.159).

We found no evidence that the ethnic background of the head of the household was related to IPTi coverage. Although there were apparent differences in coverage by ethnic group (48% in the Makonde, 51% in the Mwera, 59% among the Yao and 58% among others), the difference was not statistically significant (p=0.261).

The findings showed that, the overall population coverage of the third dose of IPTi was 51% (n=329/645). We found no evidence of EPI vaccine coverage varying by socio-economic status (DPT3 coverage in the poorest 76% and 85% in the least poor, p= 0.179) as shown in Table 9.3. Furthermore, there was no evidence of the coverage of EPI vaccines to be affected by child gender as presented in Table 9.4, (DPT3 in males 81% and in females 78%, p=0.401).

Discussion

This report has shown that the coverage of IPTi did not vary by socio-economic status of a child, ethnic background or a child gender. This is exciting news, because it implies that the program well reached the poorest and least poor alike [13]. This might be explained by the careful design of the intervention from the onset to integrate it into a well working and far reaching program in Tanzania that is well utilized by all mothers from all social background [2, 14].

The distance from a household to a nearest health facility showed that those living less or within 5km had higher coverage than those from far households.

This might be explained by longer times a caretaker has to travel to reach a facility, the difficulty means of transport, the poor road infrastructure, all of which have a marked impact on utilization and health outcomes [15].To increase accessibility to health facilities, the government of Tanzania has adopted the goal of construction of a health facility in every village through implementing the Primary Health Services Development Programme (PHSDP) of 2007 – 2017 [16]. The outcome of this should be to reduce inequities in health access.

Although the overall coverage of IPTi was reasonable, with 51% of the target group reached in the intervention area, this obviously leaves 49% of 12-23 year olds who had received fewer doses of IPTi, or no doses at all. The problem might be that measles vaccine coverage was very low, and since IPTi depends on measles vaccine, IPTi coverage was also low. During implementation we documented situation whereby delivery of IPTi was not done when the IPTi trained health worker was absent. Other reasons might be living more that 5km from a health facility or vaccine supply issues which interfere the functioning of the EPI clinic and other interventions linked to it [8]. The main ways to reduce missed opportunity include application of incentives to health workers, educating health workers through feedbacks and discussions, as well as outreach services.

The coverage of IPTi was reasonable at 51% of the population and that the distribution was not influenced by ethnicity nor by the child gender or child socio-economic status. Further, given that the intervention was given as directly

observed treatment (DOT) at health facilities that translate into high level of adherence and consequently increasing positive health outcomes[17]. Evaluation of individual malaria intervention that is implemented simultaneously with many other programmes targeting the same disease might be challenging. However, concerted efforts to fight a disease could translate into large survival gains [18].

The applicability to other settings of the IPTi delivery strategy describe here depends on many underlying factors. In some settings, EPI-linked IPT is not necessarily the most appropriate approach and alternative IPT schedules and delivery systems are needed [19]. Countries differ in terms of functioning of the health systems, coverage of the EPI vaccines and in terms of malaria intensity. In west Africa one study has shown that the delivery of IPTi linked to EPI was not the most appropriate approach due to seasonality of malaria transmission [19]. This implies that success of a malaria control intervention depends on the selected approach tailored to a specific setting based on the malaria epidemiology and health system set-up.

Implication of the study for understanding equity in Tanzania

The findings of this study revealed equitable distribution of IPTi by socio-economic status, ethnicity and gender. However, people living more than 5km from health facility were covered less by the IPTi intervention. The following part

discusses the equity situation in the country in terms of coverage of vaccination and other health interventions, the current situation, future trends and how this is related to the functioning of the health systems.

How the performance of the existing health system have an impact on equity trends in Tanzania? This question can well be discussed by relating the available evidence on equity in Tanzania with ongoing health policy implementation. The analysis of the 2004/5 DHS data in relation to equity revealed that Tanzania's poorest quintile suffer a greater burden of ill-health compared to least poor quintile. The study showed that infant and under-five mortality rates for the poorest quintiles are higher compared to least poor, and the situation is worse in southern Tanzania where IPTi study has taken place [20]. The analysis further showed that the children of least poor women were 40% more likely to receive measles vaccination compared to children from poorest women, which contradicts the findings of our study in the small area of southern Tanzania and signify the heterogeneity of people, districts and regions in the country. Gwatkin and others evaluated equity trends for different countries with regards to health nutrition and population status [21]. The coverage of basic health services such as immunization, antenatal care, and treatment of illnesses was good among the better-off compared to the poorest people. For Tanzania the health indicators showed no improving trends in terms of equity over the years1996, 1999 and 2004 [21]. Other evidence also confirm this situation, whereby immunization

coverage does remain almost constant over years and the relative risks between least poor and poorest remained unchanged [2].

The health disparities and the subsequent lack of progress towards reduced health inequities can directly be linked to the weak health systems in Tanzania as in other developing countries [22-24]. In Tanzania drugs in rural facilities are available only in few days of a month; the health cost sharing impairs access by the poorest that are failed by the non-functional health insurance schemes (particularly the community health insurance fund). Most facilities are dilapidated; health workers are not enough and those available lack the necessary skills or are not motivated at all. There is much rural-urban discrepancy in the human resource distribution where there are more health workers in urban centres than rural places. In this thesis Chapter 8, we showed that in southern Tanzania health staff employed is lower than 20% compared to national average of 35%.

The government actions taken to improve economic growth, poverty reduction and better social services provides a foundation for a step up in growth [25]. However further strategic actions to bring about structural changes are needed in order to increase the scale of growth and development there to attain the important initial milestone towards universal coverage. When this is associated with deliberate program to reach the underserved it has the potential to reducing inequities. The Tanzania government intention to strengthen primary health care program and increase the number of health workers is a move towards a positive

direction and promising in terms increasing access of health care and improvement in peoples well-being [26]. However, these are investments that take long to bring changes. Decision makers in Tanzania find it difficult to implement incentive schemes to retain the existing and newly recruited health workers. The failure could be attributed to lack of political will, lack of accountability, limited finances or lack of evidence on how to apply the incentive schemes and questions of sustainability. Consequently access to health care is impaired and the most affected are the poorest members of the society. The development and implementation of strategies for alleviating health inequities are patchy in Tanzania. As a result, the long-term trends appear to be less towards the direction of achieving greater equity through rational organization. Although the national intention is to distribute services according to concepts of equity, but the focus is on efforts to achieve increase coverage to the overall wider population which may not alone reach all including the poorest. What is critical for reducing health disparity is the requirement to overcome the health system constraints which act as barriers for improving the level of health of disadvantaged groups. In additional the government needs to initiate special programme to increase opportunities for health to the poorest that might bring health differentials down to the lowest level possible. Therefore realization of equity can be achieved through not only increasing geographical access but also through strengthening the overall health systems that make available the health services. This could be attained by good governance, enhanced transparency, participation and accountability together with strengthening national support

systems for human resources training and retention, strengthening logistics for supplies and equipments, improve service quality, monitoring and regulation of services, improve health financing, financial management as well as improve the health management information systems.

Conclusion

Incorporation of equity assessment from the onset of effectiveness evaluations is important to monitor how well the intervention reaches the poorest groups. This study has shown that IPTi delivered through the existing health system was equitable by socio-economic status, 39% in poorest and 51% in the least poor, but those living more than 5km from a health facility had lower coverage than those living nearer. Delivery of IPTi linked to EPI led to equitable coverage of IPTi in all socio-economic groups without affecting the delivery and coverage of EPI vaccines.

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TABLES

Table 9.1: Asset ownership for households in each socio-economic status quintile

Socio-economic status quintile	Number of house-Holds	Percentage of households	Means SES score	Rented house	Bicycle	Radio	Phone	Bed nets	Use wood for cooking	Own livestock	Own poultry	Connected to electricity	Tin roof
				%	%	%	%	%	%	%	%	%	%
Poorest	434	15	-1.263	0	0	0	0	74	100	0	12	0	0
Very Poor	560	19	-1.020	0	32	0	0	85	100	12	79	0	0
Poor	653	23	-0.465	0	33	58	0	86	100	10	58	0	14
Less poor	648	22	0.116	8	74	73	1	89	100	18	75	0	25
Least Poor	592	21	2.034	17	80	83	39	95	87	24	66	3	64

Source: household survey, 2007

Table 9.2: IPTi coverage (dose 3) by different factors

Variable	Details	IPTi coverage %	CI %	Observations n/N	Pvalue
Wealth Quintiles	Poorest	39	26 – 53	34/88	
(SES)	Very poor	50	40 - 59	67/135	
	Poor	54	45 – 62	84/157	
	Less poor	58	48 – 67	73/127	
	Least poor	51	39 – 63	54/106	0.160
	All	51	44 - 57	312/613	
Child Gender	Male	48	42 – 55	169/349	
	Female	54	46 - 62	160/296	0.159
	All	51	45 – 57	329/645	
Ethnic group	Makonde	48	37 – 59	96/200	
	Mwera	51	42 – 59	176/347	
	Yao	59	45 – 73	16/27	
	Other	58	47 – 68	41/71	0.261
	All	51	45 – 57	329/645	
Distance from	<=5km	58	51 – 66	114/277	
health facility	>5km	41	32 – 51	215/368	0.006
	All	51	47 – 57	329/645	

Table 9.3: Vaccine coverage by Social Economic Status

Variable		Poorest %	Very Poor %	Poor %	Less Poor %	Least Poor %	All %	Pvalue
Vaccine	DPT3	76	78	77	81	85	79	0.179
coverage	OPV3	70	73	73	76	81	75	0.171
	Measles	48	53	56	52	59	54	0.224

Table 9.4: Vaccine coverage by Child Gender

Variable		Male	Female	All	Pvalue
		%	%	%	%
Vaccine	DPT3	81	78	79	0.401
coverage	OPV3	77	72	75	0.094
	Measles	53	55	54	0.538

References:

1. WHO: **Commission on Social Determinants of Health. FINAL REPORT .Closing the gap in a generation Health equity through action on the social determinants of health. [http://www.who.int/social_determinants/en/]**. 2008.
2. Delamonica E, Minujin A, Gulaid J: **Monitoring equity in immunization coverage**. *Bulletin of the World Health Organization* 2005, **83**(5):384-391.
3. Marmot M, Friel S, Bell R, Houweling TA, Taylor S: **Closing the gap in a generation: health equity through action on the social determinants of health**. *Lancet* 2008, **372**(9650):1661-1669.
4. Victora CG, Hanson K, Bryce J, Vaughan JP: **Achieving universal coverage with health interventions**. *Lancet* 2004, **364**(9444):1541-1548.
5. Wagstaff A, Bustreo F, Bryce J, Claeson M: **Child health: reaching the poor**. *American journal of public health* 2004, **94**(5):726-736.
6. Gwatkin D, Wagstaff A, Yazbeck A: **Reaching the Poor with Health, Nutrition and Population Services: What Works, What Doesn't, and Why.. USA: The World Bank. 2005. Washington DC.** 2005.
7. Manzi F, Schellenberg J, Hamis Y, Mushi AK, Shirima K, Mwita A, Simba A, Rusibamayila N, Kitambi M, Tanner M *et al*: **Intermittent preventive treatment for malaria and anaemia control in Tanzanian infants; the development and implementation of a public health strategy**. *Transactions of the Royal Society of Tropical Medicine and Hygiene* 2008.
8. Armstrong Schellenberg JR, Mrisho M, Manzi F, Shirima K, Mbuya C, Mushi AK, Ketende SC, Alonso PL, Mshinda H, Tanner M *et al*: **Health and survival of young children in southern Tanzania**. *BMC public health* 2008, **8**:194.
9. National Bureau of Statistics (NBS) [Tanzania] and Macro International Inc.: **Tanzania Demographic and Health Survey 2004-2005. [http://www.nbs.go.tz/DHS/index.html]**. 2005.
10. Shirima K, Mukasa O, Schellenberg JA, Manzi F, John D, Mushi A, Mrisho M, Tanner M, Mshinda H, Schellenberg D: **The use of personal digital assistants for data entry at the point of collection in a large household survey in southern Tanzania**. *Emerging themes in epidemiology* 2007, **4**:5.
11. Whitehead M: **The concepts and principles of equity and health**. *Int J Health Serv* 1992, **22**(3):429-445.
12. Filmer D, Pritchett LH: **Estimating wealth effects without expenditure data--or tears: an application to educational enrollments in states of India**. *Demography* 2001, **38**(1):115-132.
13. Victora CG, Vaughan JP, Barros FC, Silva AC, Tomasi E: **Explaining trends in inequities: evidence from Brazilian child health studies**. *Lancet* 2000, **356**(9235):1093-1098.
14. Gwatkin DR, Bhuiya A, Victora CG: **Making health systems more equitable**. *Lancet* 2004, **364**(9441):1273-1280.

15. Buor D: **Analysing the primacy of distance in the utilization of health services in the Ahafo-Ano South district, Ghana**. *The International journal of health planning and management* 2003, **18**(4):293-311.
16. Ministry of Health and Social Welfare: **Tanzania. Primary Health Services Development Programme (PHSDP) 2007 - 2017. Dar es Salaam**. 2007.
17. Tugwell P, de Savigny D, Hawker G, Robinson V: **Applying clinical epidemiological methods to health equity: the equity effectiveness loop**. *BMJ (Clinical research ed* 2006, **332**(7537):358-361.
18. Masanja H, de Savigny D, Smithson P, Schellenberg J, John T, Mbuya C, Upunda G, Boerma T, Victora C, Smith T *et al*: **Child survival gains in Tanzania: analysis of data from demographic and health surveys**. *Lancet* 2008, **371**(9620):1276-1283.
19. Chandramohan D, Webster J, Smith L, Awine T, Owusu-Agyei S, Carneiro I: **Is the Expanded Programme on Immunisation the most appropriate delivery system for intermittent preventive treatment of malaria in West Africa?** *Trop Med Int Health* 2007, **12**(6):743-750.
20. Women's Dignity Project and Ifakara Health Institute: **Health Inequalities and Equity in Tanzania. Policy Brief. Dar es Salaam**. 2006.
21. Gwatkin D, Rutstein S, Johnson K, Suliman E, Wagstaff A, Amouzou A: **Socio-economic Differences in Health Nutrition and Population within Developing Countries. Country Reports on HNP and Poverty. An Overview. The World Bank. September.** 2007.
22. Leonard KL, Mliga GR, Mariam DH: **Bypassing health centers in Tanzania: Revealed preferences for observable and unobservable quality. Economics Department. Columbia University. Discussion Paper #:0102-43. [http://www.econ.columbia.edu/RePEc/pdf/DP0102-43.pdf]**. 2002.
23. Sahn DE, Younger SD, Genicot G: **The Demand for Health Care Services in Rural Tanzania. DOI: 10.1111/1468-0084.t01-2-00046**
Oxford Bulletin of Economics and Statistics 2003, **65**(2):241–260.
24. Kurowski C, Wyss K, Abdulla S, Mills A: **Scaling up priority health interventions in Tanzania: the human resources challenge**. *Health Policy Plan* 2007, **22**(3):113-127.
25. The Government of Tanzania: **NATIONAL STRATEGY FOR GROWTH AND REDUCTION OF POVERTY (NSGRP). VICE PRESIDENT'S OFFICE. Dar es Salaam. June**. 2005.
26. The United Republic of Tanzania. Ministry of Health and Social Welfare: **Human Resource for Health Strategic Plan 2008 - 2013. Dare es Salaam**. 2008.

CHAPTER 10: DISCUSSION AND CONCLUSION

Introduction

This thesis was devoted to the analysis of cost and health system issues which are key consideration for uptake of health interventions, especially when they are being considered for scaling up. The analysis was based on a large-scale effectiveness trial of a delivery system as well as an intervention, rather than a tightly controlled clinical trial of an intervention alone, therefore undertaken in a more real life context in which health services are delivered to the target populations. Specifically, the thesis focuses on the development and implementation of a public health strategy for Intermittent Preventive Treatment in Infants (IPTi) for malaria and anaemia control in a highly malaria-endemic area of rural districts in southern Tanzania. This chapter starts with a review of the methodological approaches, followed by a discussion of the main research findings with reference to the original objectives described in chapter 4. Finally, the policy implications for malaria control interventions and approaches to scaling up interventions are discussed and recommendations for further research on effectiveness evaluations and health system are made.

Methodological issues

In undertaking this study multiple approaches were employed. The collaborative approach employed during IPTi strategy development and implementation provided a chance for documentation, reflection and fine turning of activities as they took place. The health system matters were evaluated using health facility surveys, household surveys, and observation of the way vaccinating nurses used their time, using a time and motion study. Personal Digital Assistants (PDAs) were used to enter data at the point of collection. The qualitative data were collected by observations, informal interviews and in-depth interviews. Each of these methods had their strengths and limitations as explained in the paragraphs below.

The collaborative approach employed in this study enabled the research team to have a good understanding of the functioning of the routine health delivery system. Views of all stakeholders were included in study design and implementation; therefore the strategy developed was very successful as it was supported by the implementers (district, regional and national), the policy makers as well as international stakeholders. A sense of ownership was created, thus providing strong grounds for implementing IPTi if it becomes a national policy. The strength of this approach was the involvement of researchers who were spearheading the activities, and who obtained study funding and evaluated the activities. They provided input into understanding the technical part of the interventions, and acted as middlemen in the interaction of key stakeholders and organizing implementation. The close and constant collaboration the research team had with those working within the health system meant that the intervention was designed and implemented in such a way that it could continue within the routine system after the research team withdrew. Where problems of individual interests arose, this was solved through communication, feedback and discussions. The limitations of the researchers having such a central role include reduced generalizability as high technical support was involved and possibly more effective program than under routine conditions.

The study used Personal Digital Assistants (PDAs) for data collection during the health facility and household surveys and the time and motion studies[1]. This was powerful in creating data compilations soon after the survey completion as it cut out the problems of data entry and also made data validation and cleaning easier and quicker availability of final data sets. The uses of PDAs facilitated robust data collection systems, and also lead to massive savings in terms of time to do data entry, cleaning and data loss along the way. There are challenges using PDA in rural areas of developing countries due to lack of reliable electricity for recharging batteries, and solar rechargeable batteries were used in most cases. Commitment of programmer and survey coordinators was important to solve problems, for example when the devices were not working properly. Good survey planning is core to the success of very big evaluation survey work using PDAs. The PDA approach, when supplemented

with paper checks and controls, provided a good way to validate data quality. In terms of PDA acceptability, attitude surveys showed that the community had no suspicions regarding PDA use in data collection, and also supervisors and interviewers were comfortable using PDAs. For a very small survey it is not worth using PDAs because of the time needed for programming. Also PDAs are not very useful for open questions, because it would take a long time to type the answers into the PDA, so they are much better for closed questions than for open questions.

The time and motion study involved observation of vaccinating nurses to the proportion of time health workers used on different activities at RCH clinic. There were a number of strengths and challenges in our approach. Strengths included determination of exactly how time is being spent to give an average time for a job. Thus, through synthesis of workflow processes, this approach could be used to improve productivity and the efficiency with which health care services operations are performed. Potential weaknesses with the time and motion studies is that of altered staff behavior or performance resulting from awareness of being a part of an experimental study termed as the "Hawthorne effect"[2]. and leading to higher probability of positive results in intervention studies[3]. To rescue the potential for Hawthorne effect in this study, the survey team worked with the health workers for a week with many contacts at work and in social life before the observational study was undertaken. We expect this to have minimized the Hawthorne effect to a great extent and therefore what has been documented is the normal behaviour and performance level of health workers.

In estimating the cost of developing and implementation of IPTi, we tracked the costs of real activities. This provided the scale and scope of resources required for IPTi that was robust as very few assumptions were used in the cost calculations and that the estimates are likely to correspond to local reality [4]. Although in developing countries there is high fluctuation of exchange rates, we presented the results using dollar value to overcome the constraint[5]

To develop an appropriate behaviour change communication (BCC) strategy to support implementation of IPTi by the routine health services, a rapid qualitative assessment was conducted to investigate communities' knowledge and practices relating to malaria, EPI, sulphadoxine-pyrimethamine and existing health posters[6]. The results of this assessment were used to develop an appropriate BCC strategy for IPTi involving personal communication between mothers and health staff, supported by a brand name "MKINGE, that means protect him or her in Swahili" and two posters. The outcome of the qualitative research we believe was robust as the team consisted of experienced researchers who had a good rapport with the community members. The field team was well trained and they conducted all studies under the leadership and direct supervision of a senior sociologist. This helped to ensure validity and reliability of the data collected.

Overall, the application of multi-disciplinary approaches enabled comprehensive exploration of the health system matters with regard to strategy development and implementation, the human resource functioning in terms of capacity and time use, cost estimates of developing and implementing a public health strategy and the issues of intervention coverage among the target population. The end output was a large body of coherent evidence from piloting studies of IPTi that closely mirrored real life intervention application in the Tanzanian health system. Lessons learned include a strategy for delivery of the IPTi intervention, with a management tool for recording and monitoring; an intervention that was deliverable by routine health workers, able to be supervised by district managers and sufficiently accessible by the community.

As a member of the research team, the author of this thesis participated in most stages of developing, implementing the strategy and fine tuning. The author was also involved in organization and execution of evaluation activities including training of survey teams, field supervision of both survey work and the time and motion studies as well as analysis and interpretation of the results of evaluation activities. This has been useful in developing field expertise of operational studies, public health evaluation and cost analysis.

Contribution to the development and implementation of a public health strategy for malaria control and scale-up

The following section reviews the contributions of this thesis to the understanding of health system considerations for delivery of a malaria control intervention through routine care with reference to IPTi. The factors to consider include selecting and designing the delivery strategy, evaluating the potential capacity to deliver the intervention in terms of human resources and the financing requirements. Also, consideration of intervention coverage and equity in the community is important. Lastly, a discussion follows on how the lessons learned have contributed to knowledge on how to scale-up a preventive malaria intervention such as IPTi and potentially of other child health interventions.

Key messages of strategy development and implementation

Experience has shown that effective interventions to fight most major tropical diseases are available, but there is persistent tendency of a long time lag before interventions reach to those in need due to a knowledge gap on how these same interventions can be applied to be effective in real life[7-10]. Low investments in health systems strengthening to deliver the intervention are mostly to blame. Health managers in developing countries lack the required expertise needed to implement efficacious interventions. To implement tools that were developed under strict conditions and with considerable human and technical resources is not easy for district implementers to incorporate into routine services and deliver in an under-resourced environment. Collaborative approaches to develop, implement and evaluate tools could provide contextualized evidence on how an intervention works in local settings. As part of the IPTi project, we managed to show how a tool can be developed to fit the local situation and designed to benefit those in need.

The development and implementation process of the public delivery strategy for IPTi revealed the importance of institutionalizing the intervention for integrating into the routine delivery as explained in Chapters 5 and 6. Using the collaborative approach,

the IPTi strategy was developed to ensure that IPTi behaviour-change communication materials were available in health facilities, that health workers were trained to administer and to document doses of IPTi that the necessary drugs were available in facilities and that systems were in place for stock management and supervision. The strategy was integrated into existing systems as far as possible and was well accepted by health staff. Thus, the collaborative approach effectively translated research findings into a strategy fit for national implementation.

The collaborative approach encouraged wide participation from policy makers, implementers and other stakeholder to discuss developments prospectively, rather than validate them after the fact. It was an efficient mechanism to develop a robust strategy by accessing the advice of key stakeholders on the development and fine tuning of the delivery system, helping to maintain awareness and involvement in the process of strategy development, which is vital in determining the longer-term effectiveness of a health strategy. This was a key importance for knowledge sharing that enabled a gradual process of understanding the local setting and synthesizing the evidence which are important to scale-up interventions. The positive experience of IPTi helped provide a living example of what works and how it works, and fostering the realisation among health system staff at all levels that the intervention delivery is feasible under routine conditions.

The involvement of local policy makers and policy implementers created a real sense of ownership of the IPTi programme. From the beginning, activities were from the beginning planned in collaboration with government policy makers, implementers as well as bilateral and multilateral organizations, and the various roles of all partners were clearly defined that ensured ownership and understanding. At international level enough evidence is available regarding the strengths of IPTi as a strategy to deliver drugs for protecting infants against malaria. Further discussions are ongoing regarding whether or not to implement IPTi-SP due to worries regarding SP resistance. At national level the real life implementation of the strategy prepared the policy implementers for their new roles as an important element in managing the change

involved in integration of the new intervention within the health system. This resulted in a very positive response among the health workers, partly because they perceived the IPTi strategy to be a part of a Ministry of Health prevention agenda, which should be implemented by the routine health system. Testing IPTi interventions in real health systems was a way to attract sufficient attention and to move people to act if it becomes a policy and increases funding possibilities. As through the process, institutional framework for IPTi was created to integrate the intervention into the existing health delivery system which could be attractive for implementation and that the evidence could be a substantial stimulus for taking future action regarding to implement the intervention.

Among the lessons learned in this process are that considerable time is needed to prepare for public health action, in addition to providing adequate scientific evidence of benefit, use of a collaborative approach and the availability of adequate financial resources. Researchers worked in partnership with Ministry of Health representatives to deliver a new intervention in a way that could be readily scaled up nationally. In so doing, the process has tried to translate research findings into something that could be applied as public health action. The experience has provided a practical example to scale-up effective interventions for the purpose of reducing disease burden and contributing to improved health.

Key message on costing IPTi

Scarcity theories dictate that resources are limited to meet all ends. Estimation of resources required for routine execution of an intervention is very important as it provides a solid basis for budgeting, resource allocations, and decision making on the type of investment to be done.

In addition, the costing exercise led to improved capacity of the local scientists. As costing expertise is limited in developing countries, this study was of great value from a local and national perspective. The knowledge gained could be applied to estimate IPTi costs and the extent of investment for malaria and other child health

interventions, in efforts to stimulate and attract more of international resources for delivery of health interventions in under resourced countries[11-14]. This is paramount to advocate for resources to scale-up cost-effective interventions and therefore to reach the health-related MDGs.

The cost estimates could guide decision making at various levels of the health system. At policy making level, cost estimates provide input for cost-effectiveness assessment that is key to gauge if undertaking an intervention provides a good value for public money. At district level the cost estimates could be used to assess whether the budget needed for an intervention might be low enough to be considered for inclusion in the health delivery system when estimates indicate budget sufficiency, or to decide gradual coverage of target populations and as a way for identifying financing options for interventions with public health benefits. Understanding and disaggregating costs at the various health system levels and functions (for example administration and implementation) is necessary to maximize the ultimate use of the cost estimates.

Key message on human resources

The differences between the integrated and vertical health delivery approaches are very important when it comes to addressing intervention delivery constraints. Under routine care delivery, fixing the health system constraints is done by considering the system as a whole. However, under a disease-specific approach accelerated accreditation is done only to the health units needed to provide a specific service and then permission is granted if they pass the set requirements. This study, based on an integrated approach of health care delivery, was useful to evaluate the overall system capacity to undertake the IPTi intervention as well as other health interventions. Solutions were suggested to fix the human resource constraints based on an institutionalized approach which aims to benefit all interventions together and strengthen the weak health systems. The evidence presented in this thesis has shown that the facilities in the decentralized rural districts have inadequate staffing, high degree of absenteeism and low productivity. These findings have serious implications in terms of scaling-up existing and new health interventions.

The observed low productivity in human resources delivering care implies the presence of reasonable potential time that could be used to uptake uncomplicated intervention without contributing to further shortages of skilled human resources. Less complicated interventions do not require specialized skills to deliver [15] especially those related to preventive services where in-job training often suffices to equip a health worker with the needed skills [16]. Thus, uptake of an intervention into a system with excess capacity implies improving efficiency [17]. However in the long-run, as more interventions are implemented and complexity sets in, improvement of health worker skills is important. Many developing countries, including Tanzania, are now making efforts to develop more skills for health delivery [18] as well as elsewhere. These efforts needs to be encouraged and supported. As developing countries are severely resource-constrained, they need financial and technical support as well as external stimulus to improve health system production, efficiency, outputs and eventually, health outcomes.

Improved human resource management measures and incentive schemes are at the heart of increasing health workers productivity [19, 20]. Testing of incentive schemes to encourage health worker to change behaviour and engage more in productive activities is important for improving service quality and consequently increase access to new and available health interventions. It is therefore recommended to undertake studies to evaluate applicability of incentives for improving health workers productivity. Also human resources management schemes design and application need to develop first in small areas, then fine tuned before they are scaled-up in the whole country.

The observed constraints with regard to supervision of primary facilities call for action to rescue primary care delivery. At national level, timely disbursement of funds to districts is crucial to enable for timely execution of supervisory and other supportive activities for primary health care. The health management teams at the district and higher levels are urged to make rational allocation of their scarce time to accomplish their duties. It is suggested here that since undertaking seminars is among the

attractive duties to supervisors and the frontline health workers, these could be conducted on weekends and public holidays, hence sparing weekday for public service delivery. This is not a new phenomenon as increasingly we see international meetings scheduled on weekends.

On the course of assessment of human resource for health, it was observed that the rural health facilities were staffed with roughly one-third of the recommended health workers by the Ministry of Health. Of those employed, one-third were absent from their working stations. And of those present and working, a large non-productive time was documented. It is felt that there is a need to study how many health workers are actually needed to effectively service a primary health facility and categorization done with regard to work load in terms of the size of the catchments population. This might be useful to inform staffing guidelines and solve the puzzle regarding the number of health workers required to deliver primary services effectively.

Key message on coverage and equity

The implementation of IPTi in a more real life context was an excellent opportunity to explore the intervention coverage and equity. Analysis was done to find out what was the coverage of IPTi with regards to socio-economic status, distance to the health facility, ethnicity and sex. The findings showed that IPTi delivered through the existing health system was equitable by socio-economic status, ethnicity and gender, but those living within 5km from a health facility had higher coverage that those living further away. The results also suggested that EPI vaccine coverage was fairly equitable across the socio-economic groups. The finding that IPTi did not vary by socio-economic status of a child, ethnic background or a child gender is exciting news. It means that the delivery mechanism reaches the poorest and least poor alike. This might be explained by the careful design of the intervention from the onset to bring about distributive justice.

Decisions regarding how to design implementation to attain equitable access to interventions that respect human rights norms and ethical standards are very pressing

on the part of policy makers and implementers in the fight against some of the major diseases: HIV, malaria and tuberculosis [8, 9, 21]. The observed equitable benefit of IPTi is the result of selecting a delivery strategy that is capable of producing higher levels of health outcome across all segments of society [4]. With IPTi intervention the idea to attain equity was thought from the design phase and it led to selecting a delivery strategy that is well utilized by all segments of the population, well established and had documented high coverage. Thus incorporation of equity assessment from the onset of effectiveness evaluations is important to monitor how well the intervention reaches the poorest groups.

The finding of disparity in IPTi coverage by distance from a household to a health facility indicates the difficulties faced by caretakers to get to the health facility. This is recognized by the Government of Tanzania, which has adopted an initiative that aim to construct health facility in every village to attain universal coverage. This programme needs encouragement and financial boost to make it happen to ensure success, not only to build the facilities but also to staff them.

What is the study relevancy to Tanzania and other developing countries?

It is not possible to apply an intervention delivered in one place directly to other settings, but with context adjustment some lessons learnt can be taken to help in public health action development and implementation.

The application of the experiences of southern Tanzania is likely to be relevant in other parts of the country. As the Tanzanian health system is relatively well structured, district councils, although not homogeneous, have many common aspects like Comprehensive Council Health Planning (CCHP), annual District Medical Officers (DMO) meetings and same leadership under Ministry of Health. Southern Tanzania is a one of the deprived areas of the country in terms of human resources. For example, in terms of nurses, the area has only 14% of the recommended number compared to 35% as a national average. In terms of poverty and child survival, southern Tanzania

indicators also fall short of the national average [18]. We believe therefore that if IPTi was feasible to implement there it is likely to be able to be implemented in other parts of the country.

In other African countries, it is possible to apply the process but with some adaptations due to variations in health systems. The coverage of EPI vaccines are different, expertise availability are not alike, policy makers' commitment and sensitization not the same and that there are differences in the epidemiology of malaria. For example in parts of West Africa where there is highly seasonal malaria transmission, the delivery mechanism would need to be different. Other factors that are key for the performance of the strategy include health worker training, management tools, and drug delivery mechanisms.

Most importantly, the findings of this research show that there needs to be a culture of 'buy in' and a sense of 'ownership' from all the stakeholders to push the strategy forward over their annual planning cycles. The collaborative approach between the research community and those in the health system could be adopted in other settings. Other countries can also adopt the culture of independency after the researchers have left as demonstrated in this study. This was realized through involving the council health management teams in developing the strategy and continue themselves with implementation and monitoring but participated in evaluation.

Implication for scaling-up of other malaria control tools in Tanzania and other developing countries

Debates are ongoing in Tanzania regarding scaling up of tools to fight malaria. The challenges of how best to deliver Intermittent Preventive Treatment (IPT) in pregnancy and how to scale-up malaria rapid diagnostic tests (RDTs) are facing the National Malaria Control Programme. Although efficacy information for these tools is available,

there has not been any transparent initiative to show how they work under real life routine implementation. Exploration is needed to show of how the routine system can deliver the interventions, how much might it cost, what is the human resource capacity needed and establish equitable impact.

The findings of this thesis underline the importance of systematic operational research to establish how new interventions work under routine health systems. The lessons described in this work would have relevance for the future, for development of other public health strategies. The generated information on costs and experience with the issues surrounding drug supply, training, supervision and development of implementation guidelines created a strong institutional framework that could speed up implementation at country level whenever there is a policy recommendation. The evidence generated through the process is important to attract the attention of policy makers and policy implementers and increase the potential to respond quickly whenever a tool becomes adopted within a policy. In order to achieve a decline and later elimination of malaria in Africa, all stakeholders need to support the translation of efficacious tools into effective, equitable and sustainable health interventions. It is the hope of the authors that the experience generated and the evidence gathered as part of this thesis can contribute to an improved understanding of the issues that need to be considered and tackled in order to spearhead routine implementation of interventions and achieve high access. This is the foundation of improved population health and equitable impact on malaria and other major health problems.

Areas for further research

We suggest that the donor community should increase resources for funding health system application of proven effective tools. Operational studies such as this provide evidence and practical lessons for intervention scale-up under the conditions of routine health delivery systems. Development of expertise for cost analysis of health interventions need to be a priority in African settings. Universities in developing countries need to consider establishing health economics units to create the

capabilities to evaluate intervention resource requirements and effectiveness. This is important to enable public health actions to be undertaken on timely basis.

In order to succeed in human resources development efforts in terms of numbers, quality and skill mix, special attention need to be directed towards developing teaching capabilities in health related universities and colleges. There is a tendency of depending on too few training specialties running from one university to another within the country and across African universities. This might compromise the quality of skills being generated. A mentorship programme needs to be in place in African universities to prepare a new generation with skills to take responsibilities in teaching and conducting research. The same applies to colleges of health related sciences to have programme of developing and motivating teaching staff. Attention should be directed not only to producing internationally recognized human resources but also in cadres that are essential in care delivery in the country, for example, the frontline clinical officers and nursing staff.

Based on local demand, incentive packages need to be developed and tested for their applicability in local settings. These are necessary to increase productivity, to maintain and to curb migration to developing countries and realize health workers balance between urban and rural health facilities in developing countries. As in other studies, we also recommend that equity analysis should be an integral part of health system research. This should be streamlined from the level of developing the delivery strategy to the assessment of impact. Delivery mechanisms should be thought in such a way that the poorest can get maximal benefits. The choice of delivery mechanism alone is not enough. Monitoring equity outcome and developing mechanisms to alleviate inequities is of paramount importance. With IPTi, the delivery was ideal to reach most members of the population. In cases where inequity persists, outreach programmes need to be strengthened, through providing more of the needed support and incentives to health workers involved to enable them to do their job well.

References:

1. Shirima K, Mukasa O, Schellenberg JA, Manzi F, John D, Mushi A, Mrisho M, Tanner M, Mshinda H, Schellenberg D: **The use of personal digital assistants for data entry at the point of collection in a large household survey in southern Tanzania**. *Emerging themes in epidemiology* 2007, **4**:5.
2. Lied TR, Kazandjian VA: **A Hawthorne strategy: implications for performance measurement and improvement**. *Clinical performance and quality health care* 1998, **6**(4):201-204.
3. Wickstrom G, Bendix T: **The "Hawthorne effect"--what did the original Hawthorne studies actually show?** *Scandinavian journal of work, environment & health* 2000, **26**(4):363-367.
4. de Savigny D, Kasale H, Mbuya C, Reid G: **in_focus: FIXING HEALTH SYSTEMS**. 2nd edition edition.: The International Development Research Centre. PO Box 8500, Ottawa, ON, Canada K1G 3H9; 2008.
5. Hutton G, Baltussen R: **Cost valuation in resource-poor settings**. *Health policy and planning* 2005, **20**(4):252-259.
6. Mushi AK, Schellenberg J, Mrisho M, Manzi F, Mbuya C, Mponda H, Mshinda H, Tanner M, Alonso P, Pool R *et al*: **Development of behaviour change communication strategy for a vaccination-linked malaria control tool in southern Tanzania**. *Malaria journal* 2008, **7**:191.
7. Mubyazi GM, Bygbjerg IC, Magnussen P, Olsen O, Byskov J, Hansen KS, Bloch P: **Prospects, achievements, challenges and opportunities for scaling-up malaria chemoprevention in pregnancy in Tanzania: the perspective of national level officers**. *Malaria journal* 2008, **7**:135.
8. Lengeler C, deSavigny D: **Programme diversity is key to the success of insecticide-treated bednets**. *Lancet* 2007, **370**(9592):1009-1010.
9. Lengeler C, Grabowsky M, McGuire D, deSavigny D: **Quick wins versus sustainability: options for the upscaling of insecticide-treated nets**. *The American journal of tropical medicine and hygiene* 2007, **77**(6 Suppl):222-226.
10. WHO: **Insecticide-Treated Mosquito Nets: a WHO Position Statement. Geneva , WHO; 2007**. 2007.
11. Kiszewski A, Johns B, Schapira A, Delacollette C, Crowell V, Tan-Torres T, Ameneshewa B, Teklehaimanot A, Nafo-Traore F: **Estimated global resources needed to attain international malaria control goals**. *Bulletin of the World Health Organization* 2007, **85**(8):623-630.
12. Jha P, Mills A, Hanson K, Kumaranayake L, Conteh L, Kurowski C, Nguyen SN, Cruz VO, Ranson K, Vaz LM *et al*: **Improving the health of the global poor**. *Science (New York, NY* 2002, **295**(5562):2036-2039.
13. Stenberg K, Johns B, Scherpbier RW, Edejer TT: **A financial road map to scaling up essential child health interventions in 75 countries**. *Bulletin of the World Health Organization* 2007, **85**(4):305-314.
14. Bryce J, Black RE, Walker N, Bhutta ZA, Lawn JE, Steketee RW: **Can the world afford to save the lives of 6 million children each year?** *Lancet* 2005, **365**(9478):2193-2200.

15. Gericke CA, Kurowski C, Ranson MK, Mills A: **Intervention complexity--a conceptual framework to inform priority-setting in health**. *Bulletin of the World Health Organization* 2005, **83**(4):285-293.
16. Ouma PO, Van Eijk AM, Hamel MJ, Sikuku E, Odhiambo F, Munguti K, Ayisi JG, Kager PA, Slutsker L: **The effect of health care worker training on the use of intermittent preventive treatment for malaria in pregnancy in rural western Kenya**. *Trop Med Int Health* 2007, **12**(8):953-961.
17. Adam T, Amorim DG, Edwards SJ, Amaral J, Evans DB: **Capacity constraints to the adoption of new interventions: consultation time and the Integrated Management of Childhood Illness in Brazil**. *Health policy and planning* 2005, **20 Suppl 1**:i49-i57.
18. The United Republic of Tanzania. Ministry of Health and Social Welfare: **Human Resource for Health Strategic Plan 2008 - 2013. Dare es Salaam**. 2008.
19. Hongoro C, McPake B: **How to bridge the gap in human resources for health**. *Lancet* 2004, **364**(9443):1451-1456.
20. International Council of Nurses IH, Federation IPF, World Confederation for, Physical Therapy WDF, World Medical Association: **Guidelines: Incentive for Health Professionals. 2008. [http://www.who.int/workforcealliance/documents/Incentives_Guidelines%20EN.pdf]**. 2008.
21. Wilson DP, Blower SM: **Designing equitable antiretroviral allocation strategies in resource-constrained countries**. *PLoS medicine* 2005, **2**(2):e50.