

Poverty, access and immunization in Malawi – a descriptive study

Cameron Bowie, Don Mathanga, Humphreys Misiri

Department of Community Health, College of Medicine University of Malawi, Blantyre
Corresponding author: cam.bowie@malawi.net

Abstract

Background: Although a very poor country, Malawi has a good immunisation programme record. But is this programme equitable? If it is, are there lessons to learn for other services that also need to reach the poor?

Methods: The performance of the EPI coverage was assessed using DHS and other survey data in relation to socio-economic features and geographical access. Data provided by UNICEF and the Ministry of Health EPI Unit were used to assess coverage. Demographic and Health Surveys of 1992 and 2000 were used to compare immunisation uptake by wealth quintile groups derived from asset scores for each household. Other socio-economic features analysed were the education level of the mother, gender of the child, region of residence, ethnicity, religion and urban or rural residence.

Results: The EPI provides an equitable service to rich and poor alike. Coverage is as high in districts with poor access to health facilities as it is in districts with good access. There are no significant differences between ethnic, religious or gender groups. More educated mothers have children with higher immunisation rates. Coverage and inequality have worsened between 1992 and 2000, but not to a significant degree.

Conclusions: The EPI in Malawi is both effective and equitable. However, low child survival alongside high immunisation coverage is a reminder that health technology interventions such as EPI may not succeed on their own without improvement in the basic determinants of disease - nutrition, sanitation and mothers' education. The use of outreach clinics and paid village health workers is an object lesson for other services which need to reach the poor.

Background

In terms of gross national product (GNP), Malawi is the poorest country in the world bar one, Sierra Leone.¹ Despite this, Malawi gives an impressive performance of immunisation coverage through its Expanded Programme of Immunisations (EPI). A recent league table prepared by UNICEF finds Malawi ranks 16th out of 53 African states for its 84% coverage of the third dose of Diphtheria, Tetanus and Pertussis (DTP3) vaccine in children.² But is the EPI equitable? Are poor children being reached? Are there other social groups failing to receive this cost effective preventive programme?

As in most sub-Saharan African countries, Malawi includes EPI in its chosen essential health package (EHP). Immunisation has the potential to benefit the poor more than the rich but there is little scientific literature on immunisations and poverty in Africa. The poor are more susceptible to infection due to overcrowding, deficient water, sanitation and hygiene, and once infected to a higher mortality. Due to inadequate resources limiting access to care, and weak immune responses due to malnutrition, the poor will benefit relatively more than the better-off from the prevention of diseases through immunisation programmes. For instance, a child living in a crowded home with an adult with open TB is more likely to become infected with TB than a child in a home with good ventilation. The child in the crowded home is more likely to be taken later to a health centre for treatment. A malnourished child who catches measles has more chance of dying than a well-nourished child. Even if the child has not been immunised, sufficient coverage in the village will create herd immunity and keep the measles virus out of contact. The poor child is thereby protected from getting measles infection, which would be more dangerous than a similar infection in a well-nourished child. EPI can offer positive discrimination for the poor child.

This may be the reason why the UN Millennium Goal 4 to reduce child mortality with its Target 5 to "Reduce by two-thirds, between 1990 and 2015, the under-five mortality rate" uses three indicators, one of which concerns measles immunisation. The indicators are:-

1. Under-five mortality rate

2. Infant mortality rate
3. Proportion of 1 year-old children immunised against measles.

This study is one of a series commissioned by the Malawian Ministry of Health through its Sector Wide Approach Technical Working Group on Monitoring and Evaluation. The EPI, if found to reach the poor and vulnerable families, may provide lessons for other EHP interventions if they are found to offer less equitable services.

Methods

The EPI programme in Malawi uses standard ways of measuring coverage.³ The approach features service delivery data (number of immunisations of each sort given) and estimates of target populations for each immunisation (based on National Statistics Office population projections and Health Management Information System derived catchments for each health facility) to provide coverage rates. These coverage rates are cross-checked against amounts of vaccine used, and demographic and other sample surveys, such as Demographic and Health Surveys (DHS). Alternative ways of assessing the effect of potentially vulnerable groups have been used with DHS data, in particular analysing information about gender, religion, region, education and ethnicity.

A local survey used a geographic information system (GIS) method to draw 5km buffer zones around each health facility which provides under 5 services.¹¹ The population living more than 5 km from a health facility was counted. Each district was categorised into those with high, average or low access. Immunisation coverage for the three categories of district was compared.

Results

Coverage

Despite reduced health budgets in recent years, coverage has been largely maintained for all the immunisations offered as seen in Figures 1-4 representing annual coverage data prepared by UNICEF. The immunisation requiring the highest coverage to reap the benefits of herd immunity is measles which has the

lowest uptake. Recent micro-epidemics confirm the need for mass immunisation campaigns from time to time as the proportion of susceptible children increases - in turn increasing the risk of measles outbreaks. A national mass measles campaign for under-5 year olds was completed in September 2005 and coincided with a similar one in neighbouring Mozambique. Other than measles, there are very few EPI preventable infections occurring in Malawi. The key effect of the prolonged high coverage in Malawi since 1980 is the protection of children of poor families and communities.

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Figure 1 - BCG Immunisation coverage 1980 – 2003 Malawi

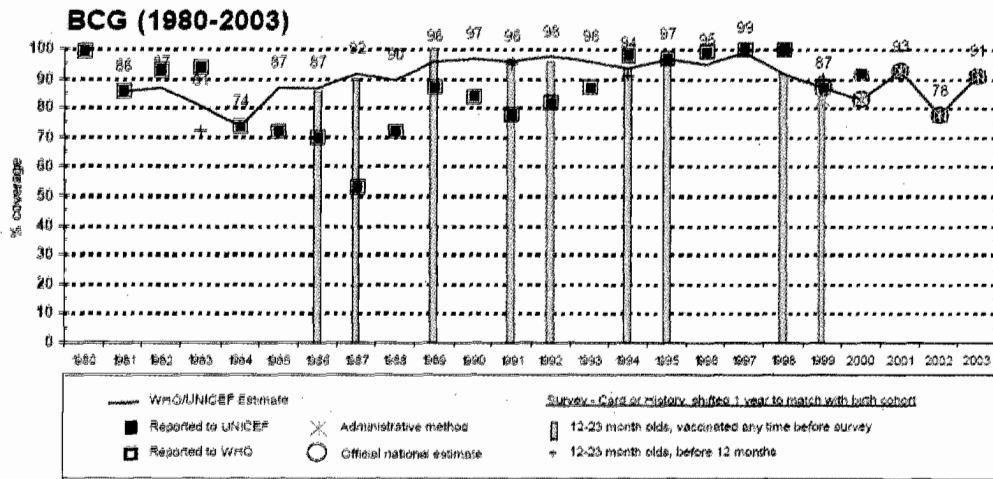


Figure 2 - DTP3 Immunisation coverage 1980 – 2003 Malawi

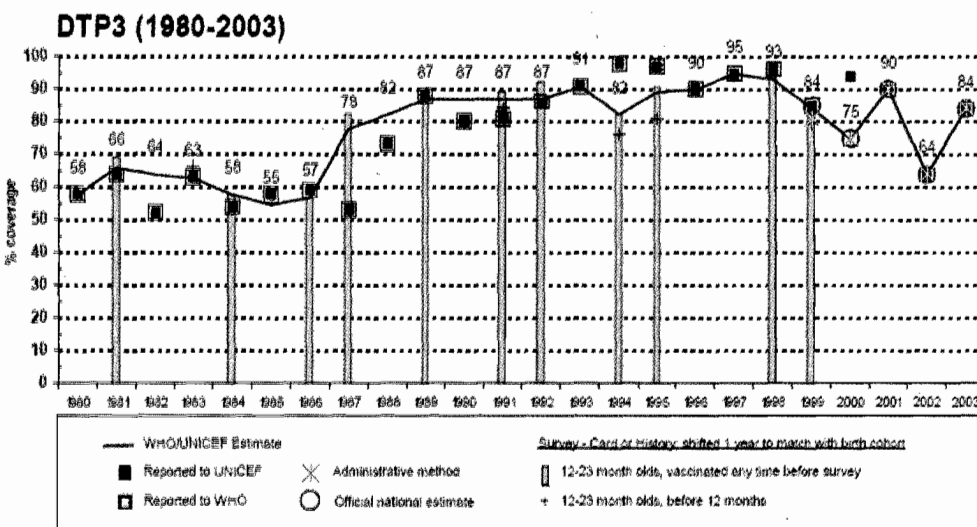


Figure 3 - Measles Immunisation coverage 1980 – 2003 Malawi

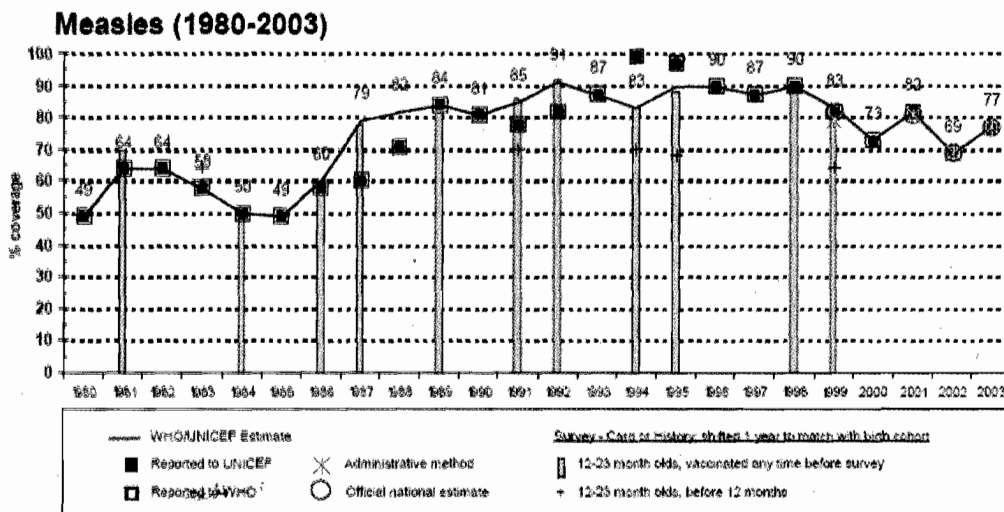
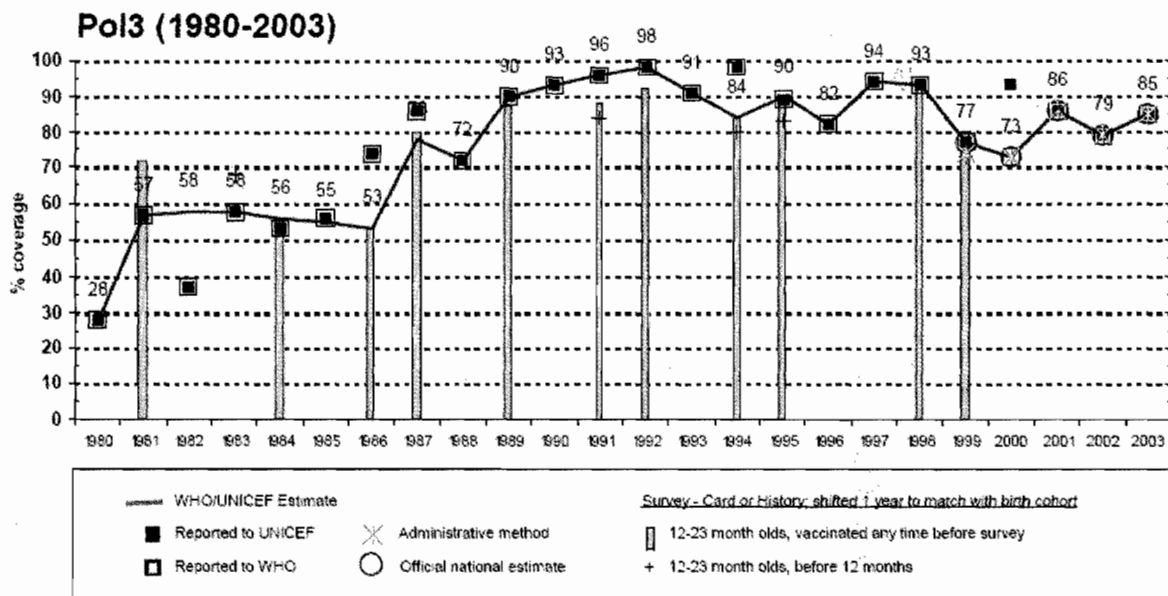


Figure 4 - Polio3 Immunisation coverage 1980 – 2003 Malawi



Socio-economic analysis

The 2000 DHS survey found a rise in immunisation uptake from lowest to highest wealth quintile for all interventions (Table 1). The same picture is found in 1992 (Table 2) but with a bigger uptake differential between the wealth groups. Equality seems to have improved in the eight years between the surveys for BCG and measles and worsened for the third polio immunisation (polio3), DPT3 and a full immunisation course including BCG, polio3, DPT3 and measles (labelled “all above” in Tables 1 and 2). For the full course of immunisations, the coverage falls from 82% to 72%. None of the changes are statistically significant.

Sub-group analysis of urban/rural differences reveals lower uptake but less difference between wealth groups in rural areas (Tables 3-4). Inequality is more in rural areas for polio given at

birth (polio0), polio3, DPT3 and Vitamin A, but is more in urban areas for BCG and measles. Again, none of the differences are statistically significant.

Sub-group analysis of method of immunisation ascertainment in the DHS surveys shows that passport evidence alone produces more similar coverage rates in urban and rural, rich and poor groups. The differences in coverage rates overall may be largely due to the recall by rich urban mothers of immunisations given to their child in the past without documentary evidence. It may be that the urban rich reply positively to questions about immunisations because of better knowledge of the government policy about immunisations in general. Using the more reliable information on health passports, there is less difference between groups, particularly for polio3 and DPT3.

Table 1 – Immunisation coverage and poverty – Malawi 2000

	Quintiles of wealth index (number)					Total
	Lowest quintile	Second quintile	Middle quintile	Fourth quintile	Highest quintile	
Number	451	436	382	400	378	2047
BCG	91.6%	89.8%	90.5%	93.9%	96.1%	92.3%
DPT3	77.8%	82.6%	84.5%	87.6%	91.0%	84.4%
Polio3	72.7%	75.8%	83.3%	86.3%	85.0%	80.3%
Measles	78.6%	81.7%	82.3%	85.8%	89.3%	83.4%
All above	63.9%	68.2%	72.8%	77.1%	79.5%	72.0%
Polio0	43.5%	46.8%	43.1%	48.8%	52.8%	46.9%
Vit A in last 6						
mths	76.1%	77.3%	78.0%	84.3%	79.5%	79.0%

Table 2 - Immunisation coverage and poverty – Malawi 1992

	Quintiles of wealth index (number)					Total
	Lowest quintile	Second quintile	Middle quintile	Fourth quintile	Highest quintile	
Number	132	136	154	144	132	698
BCG	92.2%	96.6%	97.7%	98.7%	98.7%	96.9%
DTP3	78.7%	87.8%	90.8%	91.1%	94.7%	88.9%
Polio3	77.5%	87.8%	90.8%	91.1%	93.4%	88.4%
Measles	77.3%	83.9%	83.9%	91.0%	93.4%	86.0%
All above	73.0%	79.1%	81.0%	87.3%	90.2%	82.3%

Table 3 - Urban immunisation coverage and wealth – Malawi 2000

	Quintiles of wealth index (number)					Total
	Lowest quintile	Second quintile	Middle quintile	Fourth quintile	Highest quintile	
	3	11	38	35	220	307
BCG	100.0%	90.9%	92.1%	91.4%	98.6%	96.7%
DPT3	100.0%	81.8%	87.2%	94.1%	94.1%	92.8%
polio3	100.0%	63.6%	79.5%	85.3%	87.7%	85.7%
measles	100.0%	55.6%	84.2%	100.0%	93.2%	91.7%
polio0	33.3%	45.5%	46.2%	64.7%	52.7%	52.8%
Vitamin A in last 6 mths	66.7%	63.6%	78.9%	76.5%	74.2%	74.6%

Table 4 - Rural immunisation coverage and wealth – Malawi 2000

	Quintiles of wealth index (number)					Total
	Lowest quintile	Second quintile	Middle quintile	Fourth quintile	Highest quintile	
number	488	462	374	410	194	1928
received BCG	91.6%	89.8%	90.4%	94.1%	93.8%	91.7%
received DPT3	77.7%	82.6%	84.2%	87.1%	87.2%	83.1%
received polio3	72.5%	76.1%	83.4%	86.3%	82.0%	79.4%
received measles	78.4%	82.2%	82.1%	84.7%	85.1%	82.0%
received polio0	43.5%	47.1%	42.8%	47.4%	52.6%	46.0%
received Vitamin A in last 6 months	76.1%	77.7%	78.0%	84.9%	85.5%	79.7%

The effect of gender, religion, region, ethnicity and education on EPI uptake

As expected, DHS2000 finds that immunisation uptake is higher in the children with more educated mothers. Table 5 summarises the absence of key immunisations in 12-23 month old children by level of education of the mother. For instance, 21% of children of mothers with no education had not had a measles immunisation as compared to 6% of children of mothers with a secondary education.

The Central Region fares worse than the North or South for all immunisations bar vitamin A supplementation and the mass

polio immunisation campaign in 2000 (Table 6). There was no gender inequality with respect to immunisation uptake. There were statistically significant different immunisation uptake rates between different religions with atheism associated with low uptake. Of those professing to a religion, SDA/Baptist group seem the most compliant and Anglicans the least. The Muslim concern about polio vaccine in Nigeria has not migrated to Malawi. In terms of ethnicity, Chewa and Nkhonde or Ngonde tribes were found to less compliant than the other ethnic groups. The differences found for religion and ethnicity although statistically significant are probably not important.

Table 5 - Children not receiving immunisations by highest educational level of mother – Malawi 2000

Children who did not receive		Highest educational level			Total	Chi sq test
		No education	Primary	Secondary		
BCG	Count	78	88	5	171	p<0.005
	% within Highest educational level	12%	6%	3%	8%	
DPT 3	Count	138	204	6	348	p<0.005
	% within Highest educational level	20.5%	14.7%	3.4%	15.5%	
POLIO 3	Count	174	250	15	439	p<0.005
	% within Highest educational level	25.9%	18.1%	8.4%	19.6%	
MEASLES	Count	138	223	11	372	p=0.001
	% within Highest educational level	20.6%	16.1%	6.2%	16.7%	
POLIO 0	Count	397	702	89	1188	p=0.001
	% within Highest educational level	59.1%	50.6%	49.7%	53.1%	
Vitamin A in last 6 months	Count	175	273	21	469	p<0.005
	% within Highest educational level	26.1%	19.7%	11.7%	21.0%	
Vaccinated during Polio 2000	Count	111	266	38	415	p=0.17
	% within Highest educational level	89.5%	87.5%	97.4%	88.9%	

Table 6 - Children not receiving immunisations by region in Malawi 2000

Children who did NOT receive		Region			Total
		North	Central	South	
BCG	Count	14	93	64	171
	% within Region	5.4%	9.5%	6.4%	7.6%
DPT 3	Count	28	204	115	347
	% within Region	10.9%	21.0%	11.4%	15.5%
POLIO 3	Count	34	250	156	440
	% within Region	13.1%	25.7%	15.5%	19.7%
MEASLES	Count	37	221	114	372
	% within Region	14.3%	22.8%	11.3%	16.7%
POLIO 0	Count	92	602	495	1189
	% within Region	35.7%	61.8%	49.3%	53.2%
Vitamin A in last 6 months	Count	43	213	213	469
	% within Region	16.6%	21.9%	21.2%	21.0%
Vaccinated during Polio 2000	Count	69	143	203	415
	% within Region	90.8%	89.4%	87.9%	88.9%

Table 7 - Children not receiving immunisations by gender – Malawi 2000

Children NOT receiving		Sex of child		Total	Chi sq test
		Male	Female		
BCG	Count	81	89	170	p=0.07
	% within Sex of child	7.3%	7.9%	7.6%	
DPT 3	Count	177	170	347	p=0.17
	% within Sex of child	16.0%	15.1%	15.5%	
POLIO 3	Count	225	215	440	p=0.07
	% within Sex of child	20.3%	19.1%	19.7%	
MEASLES	Count	185	187	372	p=0.5
	% within Sex of child	16.7%	16.6%	16.7%	
POLIO 0	Count	578	610	1188	p=0.1
	% within Sex of child	52.1%	54.1%	53.1%	
Vitamin A in last 6 months	Count	244	225	469	p=0.19
	% within Sex of child	22.0%	19.9%	20.9%	
Vaccinated during Polio 2000	Count	210	204	414	p=0.46
	% within Sex of child	90.1%	87.6%	88.8%	

Accessibility

The proportion of the population within reasonable access of an EHP health facility varies considerably from district to district. The districts have been grouped into low, medium and high access (Table 8) and the national EPI Unit coverage data were

analysed. In general there is little difference between the districts although the differences are statistically significant (Figure 5). Counter-intuitively for BCG, the more people that have good access, the lower the immunisation coverage.

Figure 5 - Immunisation coverage in districts with difficult access to health services Malawi 2000

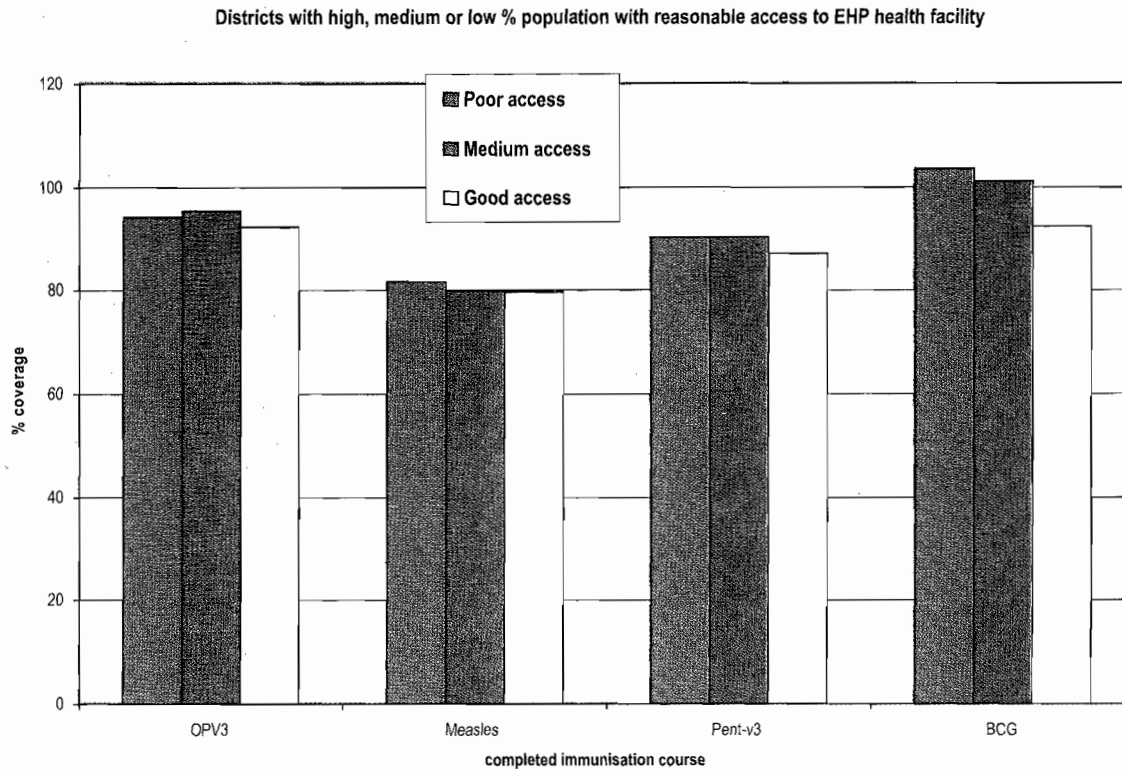


Table 8 - Access to Under 5 health services in Malawi 2003

District	% under 5s living within 5 km of a health facility	district access
Chitipa	22%	low
Kasungu	23%	low
Balaka	29%	low
Chikwawa	33%	low
Machinga	34%	low
Mchinji	35%	low
Dowa	40%	low
Ntchisi	41%	low
Mangochi	43%	medium
Mwanza	44%	medium
Mzimba	44%	medium
Nkhotakota	46%	medium
Nkhata Bay	47%	medium
Phalombe	48%	medium
Rumphi	50%	medium
Karonga	52%	medium
Salima	53%	medium
Lilongwe	53%	high
Ntcheu	54%	high
Dedza	54%	high
Thyolo	62%	high
Chiradzulu	62%	high
Zomba	63%	high
Mulanje	63%	high
Nsanje	66%	high
Blantyre	79%	high

The proportion of under 5 year old children living within 5 km of a health facility providing under 5 health services, Malawi 2003. Source: JICA Health facility survey 2003 Data from Dr Hozumi.

Discussion

The EPI programme demonstrates the success in Malawi of a programme reaching all strata of society and with herd immunity in force, protecting all children, however rich or poor their parents. Such is the logistical accomplishment of the programme that districts with the poorer access of health facilities maintain equal or higher coverage. EPI preventable disease is all but eliminated. Target diseases have either been eliminated e.g. polio and diphtheria, or are now rare e.g. measles and tetanus.

There is a positive gradient of immunisation uptake increasing with higher wealth quintile. This is partly due to higher reported uptake in urban areas where there are more rich families. In rural areas the differences between wealth quintiles is minimal. 100% coverage is never the target in immunisation programmes. The target coverage depends on the infection being prevented (from about 80% for pertussis to 90% for measles). The levels in the poorest rural families are still sufficient to allow herd immunity to provide protection for all but measles. The levels found for measles require boosting immunity with the use of mass campaigns periodically (as has happened this year). Mass campaigns in Malawi seem to work particularly well for the rural poor.

No discernable significant differences are found for ethnic, religious or gender groups. The report of the 1998 Integrated Household Survey¹² noted no difference in immunisation uptake levels between urban and rural, rich and poor families (as shown in their poverty profile report 513 and suggested the reason might be biased recall of mothers of poor families. Our results suggest that no bias is evident and that the similar uptake levels in these groups can be attributed to the programme. Immunisation ascertainment as measured by a recording in the child's passport in the DHS surveys provides very similar results for each wealth quintile group.

A key finding is the better immunisation uptake in children of the more educated mothers. This is one more piece of evidence towards the pre-eminent importance of female education as a way to improve child survival.

Categorisation of poor access populations to health care provides a means of assessing immunisation coverage using a measure of geographical rather than socio-economic barriers to services. The results show that geographical access problems have been successfully circumvented by the EPI programme using outreach clinics.

Despite the success of the EPI in Malawi child survival is still poor with recent estimates of under five year mortality of 133 per 1000 (DHS 2004). The lesson here is that however successfully the SWAp delivers the EHP, the underlying objective - to improve child survival and quality of life - will not be achieved without an equally aggressive attack on the underlying determinants of childhood disease. This may require a re-emphasis on nutrition, sanitation and maternal literacy. Without these, the success of the EPI will remain a drop in the ocean of disease burden and, for Malawi, an expensive technological investment.

Are there lessons to be learnt from the way the EPI works which might improve other EHP programmes? The following features of the national EPI programme may be important.

1. A well-established service known to all levels of staff through regular in-service training.

2. District Management Teams are directly responsible for the programme, unlike other vertical programmes. EPI services can be said to be effectively decentralised.
3. Integration at clinic level with other under-5 services.
4. An outreach clinic programme.
5. The use of Health Surveillance Assistants, paid village health workers to deliver the programme. They run the clinics, immunise, record, and follow up. Their 12-week training includes a significant EPI component, such as learning how to give injections.
6. Monthly monitoring of performance at district level and intelligent monitoring of results at national level with feedback. The EPI Unit checks the data monthly, queries unusual changes and chases late returns.
7. Regular visits by regional EPI officers to check technical issues such as the cold chain and supplies.
8. EPI funded equipment such as fridges and vehicles allocated to districts to allow for a continuous outreach service.
9. Sufficient annual revenue funds to provide basic supervision, training and operations research.

Conclusions

The EPI in Malawi is both effective and equitable. The use of outreach clinics and paid village health workers (HSAs) is an object lesson for other services which need to reach the poor. However the success story of the EPI programme alongside the prevailing child mortality and morbidity rates reinforces the need to concentrate on the fundamental determinants of disease – nutrition, sanitation and education – as well as specific medical interventions.

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References

1. UN Development Programme Report 2005. Available from: www.undp.org.
2. UNICEF Statistics Routine Immunisations. Available from: <http://www.childinfo.org/eddb/immuni/2003%20Coverage%20Tables.xls>
3. WHO, UNICEF. Review of National Immunization Coverage 1980-2003. Geneva: World Health Organization; 2004.
4. Shea RO, Johnson K. The DHS Wealth Index. DHS Comparative Reports No. 6. Calverton, Maryland: ORC Macro; 2004.
5. World Bank. Quantitative Techniques for Health Equity Analysis – Technical Note #7. The Concentration Index. Available from: http://siteresources.worldbank.org/INTPAH/Resources/Publications/Quantitative-Techniques/health_eq_tn07.pdf
6. Wagstaff A, Paci P, van Doorslaer E. On the measurement of inequalities in health. *Soc Sci Med*. 1991;33:545–557.
7. Kakwani NC, Wagstaff A, van Doorslaer E. Socioeconomic inequalities in health: measurement, computation and statistical inference. *J Econ*. 1997;77(1):87–104.
8. Gwatkin D, Rutstein S, Johnson K, Pande R, Wagstaff A. Socioeconomic differences in health, nutrition and population. Health, Nutrition and Population Discussion Paper. Washington, DC: The World Bank; 2000. Available from: <http://www.worldbank.org/poverty/health/data/index.htm>.
9. Gwatkin D, Rutstein S, Johnson K, Suliman E, Wagstaff A. Socioeconomic differences in health, nutrition and population (2nd edn). Health, Nutrition and Population Discussion Paper.

- Washington, DC: The World Bank; 2003. Available from: <http://www.worldbank.org/poverty/health/data/index.htm>.
10. Wagstaff A. The bounds of the concentration index when the variable of interest is binary, with an application to immunization inequality. *Health Econ.* 2005;14:429–432.
 11. Hozumi D. Status of health services facilities in Malawi – findings from preliminary analysis of the Malawi Health Facility Survey 2002. Personal communication. JICA. October 2003.
 12. Economics Development Council. Profile of poverty in Malawi, 1998. Lilongwe; 2000 (revised).
 13. National Statistics Office of Malawi. Integrated Household Survey 2004/05 – Poverty Brief 5. Available from: http://www.nso.malawi.net/data_on_line/economics/ihs/poverty_brief_5.pdf.