Coverage and cost of iodized oil capsule distribution in Tanzania

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Distribution of oral iodized oil capsules (IOC) is an important intervention in areas with iodine deficiency disorders (IDD) and low coverage of iodized salt. The mean reported coverage of 57 IOC distribution campaigns from 1986–1994 of people aged 1–45 years in 27 districts of Tanzania was 64% (range 20–96%). This declined over subsequent distribution rounds. However, due to delayed repeat distribution, only 43% of person-time was covered, based on the programme objective of giving two IOC (total 400 mg iodine) at 2-year intervals.

Three different capsule distribution strategies used in 20 distribution rounds in 1992–1993 were analyzed in depth. Withdrawal of financial support for district distribution expenses under the ‘district team’ strategy, and the subsequent change to integrated ‘primary health care’ distribution, increased delays and capsule wastage. The third, more vertical strategy, ‘national and district teams’, accomplished rapid distribution of IOC about to expire and subsequently a return to the initial ‘district team’ allowance strategy was made. Annual cost of ‘district team’ distribution was 26 cents per person (400 mg iodine/2 years). Cost analysis revealed that the IOC itself accounts for more than 90% of total costs at the levels of coverage achieved.

IOC will be important in the elimination of IDD in target areas of severe iodine deficiency and insufficient use of iodized salt, provided that high coverage can be achieved. Campaign distribution of medication with high item cost and long distribution intervals may be more cost-effectively performed if separated from regular PHC services at their present resource level. However, motivating health workers and community leaders to do adequate social mobilization remains crucial even if logistics are vertically organized. Insufficient support of distribution expenses and health education may lead to overall wastage of resources.

Introduction

Iodine deficiency causes a range of consequences collectively referred to as iodine deficiency disorders (IDD). It is estimated that globally 1.6 billion people are at risk of IDD, and that 760 million have goitre, 43 million suffer brain damage and 11 million overt cretinism due to iodine deficiency.1,2 Furthermore, recent findings suggest that correction of iodine deficiency may halve the infant mortality rate.3,4 The World Health Assembly and the World Summit for Children have endorsed the goal of eliminating IDD by the year 2000 through universal iodine supplementation,5,6 regarded as one of the most cost-effective health interventions available.7 Effective salt iodation requires special equipment, compliance of the salt manufacturers, relevant monitoring and possibilities of legal enforcement. Progress has been made8 but community effectiveness of salt iodation may be low in communities where salt is produced on an artisan basis in scattered small-scale units. In such areas, intermittent distribution of oral iodized oil capsules (IOC) is an alternative control method, with one dose providing protection for 1 to 2 years.9–11 Furthermore, a new and cheaper iodized oil compound12 promises greater use of IOC as a complement to iodized salt for the elimination of IDD.

In Tanzania, goitre surveys suggested that 40% of the population live in iodine deficient areas and that 25% suffered from an iodine deficiency disorder, including 5 million with goitre, 450 000 with cretinoidism and 160 000 with cretinism.13 Tanzania’s IDD control programme aims at universal salt-iodation as the long-term control measure, using IOC as a start-up and as a complement. Since 1986, IOC have been distributed in districts where more than 10% of the examined schoolchildren had grade 1B or larger goitres, using the 1960 WHO goitre grading system.14 The Tanzania Food and Nutrition Centre (TFNC) coordinated the IOC distribution in these 27 districts with an estimated 1994 population of 7.3 million. The aim was to distribute two IOC (400 mg iodine) every 2 years to males and females aged 2–45 years and one IOC (200 mg iodine) to children aged 12–23 months. Campaign days were used to reach all eligible persons in a village in one day throughout the period 1986–94 but in 1992–93
three different district distribution strategies were used to reach the villages.

The efficacy of IOC is well documented\textsuperscript{9–11} and numerous countries distribute IOC to large populations. An extension also to newborns through the introduction of IOC into the Expanded Program on Immunization\textsuperscript{3} and even the use of IOC as a replacement for iodized salt in areas of severe IDD\textsuperscript{12} have been advocated. However, to our knowledge, no studies of the coverages achieved or the costs and community effectiveness of a large-scale IOC distribution programme have been published. We therefore used available records in Tanzania to assess the overall coverage of the distribution of 6 million IOC doses to a target population of 7 million during 1986–94. Furthermore, we assessed the costs and coverages of three different mass distribution strategies used in 1992–93. The general policy implications of the findings for mass distribution campaigns of IOC and similar medications are discussed.

**Material and methods**

Since the start in 1986 a total of 27 districts have gradually been added to the programme. In these districts, altogether 57 initial and repeat distribution rounds had been initiated by 1 June 1994. From 1986 to 1992, the entire programme districts were targeted for repeat distributions after 2 years. From 1992, national-level teams determined whether less than 75\% of households used iodized salt. If so, another IOC round was planned and target wards (subdistricts) selected based on severity of goitre, target populations calculated and IOC requirement determined. In the districts the national TFNC team instructed the District Medical Officer (DMO) and key district health staff on the principles of campaign distribution.

During an initial visit to the village, the district staff were to brief the village leadership on IDD, IOC and to set a date for distribution. The village leadership was then responsible for spreading the message and mobilizing the population, while peripheral health staff made the actual distribution on instruction from the district staff. On distribution day the target population (1–45 years of age) lined up and swallowed the IOC in front of the distributor who marked the number of complying individuals on a tally-sheet. Tally-sheets were to be submitted to the DMO for compilation of a district distribution report, which was to be sent to TFNC. This report was to specify the number of capsules received, the number of individuals tallied as having swallowed IOC and coverage in the target population. Any unused IOC was to be returned via the district-level to the national control authority (TFNC).

### Calculating programme coverage 1986–94

Information from each of the 27 districts on initial visible goitre rates (VGR), distribution dates and coverages achieved were obtained from district distribution reports. Distribution intervals and mean of coverages per distribution round were calculated from these data. Coverages obtained were tested against distribution round and initial VGR severity using a non-parametric median test. Multiple linear regression was performed, relating coverage to distribution round and initial VGR.

Time elapsed since the first distribution in each district up to 1 June 1994 was determined. For each district the period mean target-population was calculated as the mean of annual population estimates, obtained by adjusting the 1988 census population for an annual 2.8\% population growth\textsuperscript{15} and an estimated 82\% of the total population belonging to the target 1–45 year age group. The total targeted person-years was then determined by multiplying the mean target population by the number of years elapsed from the first distribution in the respective district up to 1 June 1994 (Figure 1).

Based on distribution dates, IOC coverages achieved and the objective of supplementing at two-year intervals, we calculated the person-years supplemented according to programme

![Figure 1](https://via.placeholder.com/150)

**Figure 1.** Schematic representation of coverage in a district population. [The total target population person-time is represented by the area under the curve. Person-time supplemented according to programme objectives is represented by the area in the hatched boxes. The people and time-periods in the shaded area were not covered due to either low coverage or repeat distribution later than the planned 2-year interval. The percentage of person-time supplemented according to programme objectives is calculated as the hatched area divided by the total area under the curve]
Strategies for campaign distribution of IOC 1992–93

At the village level the principles for campaign distribution remained the same. However, different strategies were used to organize the work at district level during 1992–93. These strategies were documented through interviews with past and current programme managers as well as with district health staff in seven districts. Distribution performance was assessed from three sources: (1) administrative records at TFNC, for the date and number of IOC delivered to the 20 districts from January 1992 to June 1993, as well as for the number of unused IOC returned; (2) a total of 15 distribution reports submitted by these 20 districts as per December 1994; and (3) travel reports from supervision visits to seven districts that had not submitted distribution reports, and a supervision visit to the only district that had used the ‘PHC distribution’ strategy and submitted a partial distribution report. This review revealed three distinctly different strategies.

The first strategy, ‘district team distribution’, involved health staff from district headquarters who received allowances from the national IDD programme for travelling to villages to prepare or carry out the distribution. From the district level typically the district health officer, one or two nurses, a medical assistant, and sometimes the pharmaceutical assistant would tour the district to inform community leaders and set days for distribution. Local rural medical aids or dispensary staff were recruited to assist in the distribution at village level. Participating peripheral health staff also received allowances. The district health services received funds to cover the cost of fuel, but used their existing vehicles for the distribution.

The second strategy, ‘Primary Health Care distribution’ (PHC), was meant as an integration of IOC distribution with other services without provision of additional funds for allowances or fuel, in order to save on distribution expenses. The district health services were instructed by TFNC to distribute IOC in campaign form without allowances to involved staff at district or village level.

The third strategy, ‘National plus district team distribution’, was initiated by TFNC during supervisory visits to four districts using PHC where serious distribution delays had made capsule expiry imminent. National level staff trained and supervised staff at district and peripheral level who received allowances to undertake the distribution campaigns. The TFNC team would typically comprise two programme officers and a driver. From the district level they would be joined by a medical assistant as they first mobilized communities and then took part in the actual distribution where necessary.

Cost and coverage distribution strategies 1992–93

The analysis was done from a health care provider perspective. All costs incurred by TFNC and the districts’ health care systems, including opportunity cost of labour and vehicles, were included. Direct and indirect costs for the patients and overhead costs for the foreign donor were disregarded, since inclusion of the latter would make the findings less relevant for Ministries of Health considering IOC distribution. The actual cost of IOC for the 1992 purchase of Lipiodol® from Laboratoire Guerbet, France, was used. TFNC contributions to district expenses for distribution (fuel and allowances) were determined from statements of expenditures in TFNC files. The opportunity cost for the use of district staff was valued at 1992 salary levels obtained from TFNC. Based on a detailed review of one district distribution round and interviews with programme managers, the district staff need for IOC distribution was estimated to be nine person-months per 100 villages, each with a population of 500–2000. Use of district vehicles was determined from five distribution reports and found to be 30 car-days per 100 villages for ‘district team’ distribution and 15 car-days per 100 villages for ‘PHC’ and ‘national plus district team’ distribution, reflecting increased integration and use of national vehicle respectively. Daily opportunity cost for use of district vehicles was derived from a depreciation over four years at a 5% discount rate assuming 250 travel-days per year.

The cost of salaries for the six person IOC programme management at national level was determined from a review of the TFNC 1992/93 budget. The capital cost of office space for administration was determined by annualizing replacement cost over 20 years at a 5% discount rate, as now suggested for health programmes. Administrative overheads were calculated through step-down of total administrative salaries, office space and other non-programme costs on the programme departments, proportionately to their share of total programme expenses. The total management cost thus obtained was shared equally between all programme districts. The mean daily costs for keeping a national supervision team in the field for IOC delivery and/or supervision were calculated from actual expenses for three supervision trips in 1993. These included the cost of staff and allowances for the time spent in the field as well as the daily cost of vehicles as above. This daily supervision cost was added to district distribution expenses as follows:

1. Under the ‘PHC distribution strategy’, the TFNC team spent a total of 8 days during three visits in the one complying district for delivery of IOC and collection of report.
2. Under ‘district team’ distribution, based on distribution supervision reports, an assumption was made that the TFNC team spent 5 days per district to deliver IOC and collect distribution reports.
3. Under ‘national plus district team’ distribution, the actual length of time spent in each district (6–18 days) was used.

Costs were determined in Tanzanian Shillings. No GDP deflation of costs was done for the 18-month study period. Costs were converted to US$ using the 1992 exchange rate of 297 Shillings per US$.19
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Total cost per ingested dose was calculated for each district by summing up the cost of the ingested IOC and the cost of unaccounted-for IOC with national and district distribution costs for salaries, allowances and transport. All costs were divided by the number of persons reported as having ingested IOC, in order to arrive at the total cost per ingested dose. Mean cost per distribution strategy was determined as the mean of complying districts’ costs. For complying districts, a sensitivity analysis was performed for the influence on cost per dose of different assumptions regarding the proportion of unaccounted-for IOC that had actually been correctly utilized, since not all of them may have expired in the pharmacy but have actually been put to their intended use, although unreported in the distribution report.

District reports gave the number of IOC received and the number of persons tallied as having swallowed IOC during distribution. Coverage was calculated by dividing the number of tallied swallowers by the target population size for that year. The number of IOC effectively used by each district was calculated as the number of IOC delivered minus those returned. Since children 12–23 months old received one IOC and people of 2–45 years of age received two IOC, the average dose of 1.97 IOC per tallied person was used to determine the number of IOC accounted for as ingested. Subtraction of this amount from the number effectively used yielded a residual of ‘unaccounted-for IOC’ that was regarded as potentially wasted. Failure to submit a distribution report was investigated by making supervision visits to eight districts and was otherwise taken to mean that no distribution had taken place. Three districts only reported the number of IOC distributed and not the number of persons tallied. For these districts the assumption was made that the correct dose (1.97 IOC) had been given and the corresponding number of persons covered was calculated.

Results

Programme coverage 1986–94

From the 57 district distribution rounds initiated from 1986 up to 1 June 1994, distribution reports were available for 46 rounds. Reported district coverages in these 46 rounds varied from 20% to 96% of the targeted population, with an overall mean coverage of 64%. Coverages declined over subsequent distribution rounds (Table 1). In the 29 districts with an initial visible goitre rate (VGR) of ≥10%, the mean of coverages was 68% and in the 17 districts with initial VGR of <10%, it was 59% (non-parametric p = 0.19). By multiple linear regression, coverage was significantly inversely related to distribution round (p < 0.05) and positively but not significantly to initial VGR severity (p = 0.2) with an r² of 0.10.

Repeat distribution was not timely at two years in the districts. Mean (median) delay from target distribution date was 1.25 years (1.3 years), ranging between –0.5 (6 months earlier than planned) and 3.4 years late. The proportion of target population years supplemented according to the criterion one dose per two years was 45%. Of the person-years not covered, 42% was due to less than total coverage and 58% due to repeat distribution later than the planned 2-year interval.

Performance of the distribution strategies in 1992–93

In the 20 districts due for distribution in 1992–93, TFNC intended to use ‘district team distribution’ strategy in eleven. Ten (91%) of these reported that distribution had been executed; no information is available from the eleventh, non-reporting district (Figure 2).

TFNC planned to use the ‘PHC distribution’ strategy in nine districts but only one (11%) reported distribution. Since this report was only partial, a supervisory visit was made to this district. It revealed that distribution was still proceeding 2 years after capsule delivery! Supervisory visits by TFNC to three other ‘PHC distribution’ districts revealed that no distribution had taken place 1 year after capsule delivery. As the IOC were about to expire in 1–2 months, these three districts were then allocated funds for immediate ‘district team’ distribution, yielding a mean coverage of 56% in those parts of the districts they managed to cover before the capsules expired. These three districts are not included in subsequent analyses of the ‘district team’ method, due to the short distribution period available before capsule expiry.

Table 1. Coverages achieved in distribution of 57 rounds of IOC in 27 districts in the Tanzanian iodized oil capsule distribution programme, 1986–1994

<table>
<thead>
<tr>
<th></th>
<th>Round 1</th>
<th>Round 2</th>
<th>Rounds 3–4</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coverage</td>
<td>mean</td>
<td>68%</td>
<td>64%</td>
<td>53%</td>
</tr>
<tr>
<td></td>
<td>median</td>
<td>73%</td>
<td>67%*</td>
<td>53%**</td>
</tr>
<tr>
<td></td>
<td>min</td>
<td>20%</td>
<td>27%</td>
<td>21%</td>
</tr>
<tr>
<td></td>
<td>max</td>
<td>96%</td>
<td>92%</td>
<td>72%</td>
</tr>
<tr>
<td>Rounds initiated</td>
<td>27</td>
<td>20</td>
<td>10</td>
<td>57</td>
</tr>
<tr>
<td>Rounds reported</td>
<td>25</td>
<td>14</td>
<td>7</td>
<td>46</td>
</tr>
</tbody>
</table>

* p = 0.23 and **p = 0.04 compared with round 1 using non-parametric median test.
team stayed on to take part in the distribution. All four districts reported distribution within the short period that remained before capsule expiry. The last ‘PHC distribution’ district did not submit a distribution report, could not be visited and was therefore excluded from the analysis. When comparing the non-compliance rate for ‘PHC distribution’ (8/9) versus ‘district team distribution’ (1/11) the relative risk (95% CI) for distribution failure is 9.8 (1.5 – 64) for the ‘PHC distribution’ approach.

In the 15 districts analyzed, the three different distribution strategies yielded coverages with similar means but with wide ranges. Districts achieving lower coverages remained with excess capsules. Unless accounted for as swallowed in the distribution report or returned to TFNC, such unaccounted-for IOC may be regarded as potentially wasted (Table 2).

Cost of the distribution strategies

Table 3 shows that the total cost per dose ingested is dominated by the cost of IOC ingested, but that the cost of unaccounted-for IOC also makes up a significant part. For ‘district team distribution’ the mean cost of distributing two IOC (400 mg iodine) with a mean coverage of 61% was US$0.51 (1992) per recipient, corresponding to an annual cost of 26 cents given the 2-year distribution interval. Distributing one IOC (200 mg iodine) each year using the same distribution strategy would correspond to an annual cost of 28 cents per recipient, on the assumption that distribution costs remain constant.

Table 4 presents the cost-profile of IOC distribution in a well-performing district with low capsule wastage where a more detailed breakdown of district expenditures was available. It is compared with the cost-profile of the Expanded Program on Immunization. For the iodized oil capsule distribution programme the cost of IOC constitutes 92% of the total cost per dose swallowed, while the cost of allowances and opportunity costs for labour are small (Table 4). Peripheral health workers earned less than US$20 per month and their daily allowance was less than US$2, equivalent to the cost of 13 IOC. A district health-staff’s allowance was about US$5, equivalent to 36 IOC. The total daily cost of keeping a national supervision team in the field was US$140, equivalent to 1000 IOC. The potential saving from withdrawing district

### Table 2. Reported district IOC coverages and proportions of IOC unaccounted for in 15 distribution rounds initiated between January 1992 and June 1993

<table>
<thead>
<tr>
<th>Distribution strategy</th>
<th>District team</th>
<th>PHC</th>
<th>National &amp; District team</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of distribution rounds</td>
<td>10</td>
<td>1</td>
<td>4</td>
<td>15</td>
</tr>
<tr>
<td>Coverage</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean*</td>
<td>61%</td>
<td>56%</td>
<td>68%</td>
<td>62%</td>
</tr>
<tr>
<td>Median</td>
<td>61%</td>
<td>56%</td>
<td>66%</td>
<td>60%</td>
</tr>
<tr>
<td>(range)</td>
<td>(38–92)</td>
<td>(38–92)</td>
<td>(53–89)</td>
<td>(38–92)</td>
</tr>
<tr>
<td>% of capsules unaccounted for</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>26%</td>
<td>43%</td>
<td>36%**</td>
<td>30%</td>
</tr>
<tr>
<td>Median</td>
<td>27%</td>
<td>43%</td>
<td>41%</td>
<td>35%</td>
</tr>
<tr>
<td>(range)</td>
<td>(0–68)</td>
<td>(0–68)</td>
<td>(8–54)</td>
<td>(0–68)</td>
</tr>
</tbody>
</table>

* Mean of individual districts’ coverages in targeted parts of district only.
** Some extra IOC were left for demand from non-targeted parts of districts.
staff and fuel allowances and ‘integrating’ the distribution into Primary Health Care would constitute less than 3% of the total expenses and be very small in equivalent number of IOC gained or lost.

A one-way sensitivity analysis was performed for the effect on total cost per dose ingested of different assumptions on the fate of capsules unaccounted for. The proportion of unaccounted-for IOC assumed ingested by the target group in a correct dose varied between 0 and 100%. The resulting total costs are presented in Figure 3. Total cost per dose ingested remains similar for all three distribution strategies, as the proportion of unaccounted-for IOC assumed to have been ingested rises until no capsule waste is assumed. Only if more than 75% of unaccounted-for IOC are assumed to have been correctly ingested does ‘PHC distribution’ in the one complying district become marginally more cost-effective than ‘District team distribution’.

**Discussion**

Recent calls for wider use of iodized oil capsules by virtue of their effect on mortality and their lowered price demonstrate the need to analyze past experience of mass distribution of IOC. The IOC distribution studied in this paper was performed mainly in very remote districts in Tanzania with well-documented IDD. This was the first large-scale action against iodine deficiency in this country, which has a gross national product among the lowest in the world. The review of distribution reports indicates that at least 12 million person-years were protected against iodine deficiency. As the efficacy of IOC is well documented, it can be concluded that

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**Table 3.** Average component and total cost per ingested dose (two IOC) under each distribution strategy in the 15 distribution rounds analyzed (1992 US$)

<table>
<thead>
<tr>
<th>Distribution strategy</th>
<th>District team</th>
<th>PHC</th>
<th>National &amp; District team</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of distribution rounds</td>
<td>10</td>
<td>1</td>
<td>4</td>
<td>15</td>
</tr>
<tr>
<td>Cost of two IOC</td>
<td>0.30 (59%)</td>
<td>0.30 (55%)</td>
<td>0.30 (54%)</td>
<td>0.30 (57%)</td>
</tr>
<tr>
<td>Cost for unaccounted-for IOC/dose reported ingested*</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>0.16 (31%)</td>
<td>0.22 (40%)</td>
<td>0.20 (36%)</td>
<td>0.18 (34%)</td>
</tr>
<tr>
<td>Median</td>
<td>0.11</td>
<td>0.22</td>
<td>0.21</td>
<td>0.16</td>
</tr>
<tr>
<td>(range)</td>
<td>(0.03–0.62)</td>
<td>(0.03–0.35)</td>
<td>(0.02–0.14)</td>
<td>(0.0–0.62)</td>
</tr>
<tr>
<td>Management &amp; distribution cost/dose reported ingested</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>0.05 (11%)</td>
<td>0.03 (5%)</td>
<td>0.07 (12%)</td>
<td>0.06 (11%)</td>
</tr>
<tr>
<td>Median</td>
<td>0.05</td>
<td>0.03</td>
<td>0.07</td>
<td>0.04</td>
</tr>
<tr>
<td>(range)</td>
<td>(0.02–0.14)</td>
<td>(0.04–0.11)</td>
<td>(0.02–0.14)</td>
<td></td>
</tr>
<tr>
<td>Total cost/dose reported ingested</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>0.51 (100%)</td>
<td>0.55 (100%)</td>
<td>0.56 (100%)</td>
<td>0.53 (100%)</td>
</tr>
<tr>
<td>Median</td>
<td>0.45</td>
<td>0.55</td>
<td>0.60</td>
<td>0.54</td>
</tr>
<tr>
<td>(range)</td>
<td>(0.32–0.97)</td>
<td>(0.36–0.69)</td>
<td>(0.32–0.97)</td>
<td></td>
</tr>
</tbody>
</table>

* Assuming that all unaccounted-for IOC were wasted. Due to rounding errors, sums of means and percentages may not match exactly.

**Table 4.** Comparison of cost profiles for iodized oil capsule (IOC) distribution in Mbozi district, Tanzania 1993 using ‘district team’ distribution and the Expanded Program on Immunization (1992 US$ and %)

<table>
<thead>
<tr>
<th>Programmes</th>
<th>Iodized oil capsule distribution</th>
<th>Expanded Program on Immunization</th>
</tr>
</thead>
<tbody>
<tr>
<td>IOC/vaccine</td>
<td>49 270 92%</td>
<td>10%</td>
</tr>
<tr>
<td>Transport</td>
<td>1 707 3%</td>
<td>13%</td>
</tr>
<tr>
<td>Social mobilization</td>
<td>*</td>
<td>5%</td>
</tr>
<tr>
<td>Labour</td>
<td>1 134 2%</td>
<td>42%</td>
</tr>
<tr>
<td>Equipment (not costed)</td>
<td></td>
<td>13%</td>
</tr>
<tr>
<td>Building and other costs (not costed)</td>
<td></td>
<td>5%</td>
</tr>
<tr>
<td>Management, training and supervision</td>
<td>1 469 3%</td>
<td>12%</td>
</tr>
<tr>
<td>TOTAL</td>
<td>53 850 100%</td>
<td>100%</td>
</tr>
<tr>
<td>Annual cost per person covered</td>
<td>0.16 **</td>
<td>0.77 ***</td>
</tr>
<tr>
<td>Coverage</td>
<td>63%</td>
<td>80%</td>
</tr>
</tbody>
</table>

The only equipment used in IOC distribution is paper for tally sheets. Distribution is outdoors, cost for storage of IOC disregarded. *Included in labour cost; ** assuming a two-year duration for the 162 773 persons treated; *** annuity of US$15 for a fully immunized child over a life expectancy of 55 years at a discount rate of 5%.

Sources: study data and Bateson 1992 (ref. 20).
workers face competing demands, and/or due to rumours that this has been related to 'programme fatigue' as health care for vitamin-A capsule distribution campaigns. In the latter half of what could potentially have been achieved demonstrates the difficulty of organizing mass distributions. These difficulties resulted in both low distribution coverage and delay of repeat distribution. Furthermore, coverages declined with subsequent distribution rounds, as previously reported for vitamin-A capsule distribution campaigns. In the latter this has been related to 'programme fatigue' as health workers face competing demands, and/or due to rumours of medication side-effects. Indeed, in some Tanzanian districts free mass-distribution of IOC has raised public suspicion that IOC serves family planning or other non-medical purposes.

Increasing coverage

The cost-effectiveness of maintaining financial support for district distribution expenses is evident, since eight out of nine 'PHC distribution' districts did not perform the distribution while 10 out of 11 using 'District team distribution' did. The proportion of person-years covered can be further increased through improved distribution coverage and/or more timely initiation of each distribution round.

Increasing the low investment in social mobilization at district level may raise coverage beyond the present mean of 64%. In the distribution round presented in Table 4, labour and social mobilization combined constitute only 2% of total costs. In contrast, the Expanded Program of Immunization, spending 5% of total costs on social mobilization alone, typically reaches coverages of around 80%. Informed and motivated leadership is crucial to achieve this mobilization: 'The single factor which seems to determine the difference between a high and a low coverage turnout is the personality and the enthusiasm of someone in the chain of communication...' notes a health worker from a non-governmental organization who conducted IOC distribution campaigns in the south-western highlands of Tanzania from 1987 to 1990.

However, we see no contradiction between maintaining a 'vertical' approach and increasing community participation. The long distribution interval of expensive medication that must attain a high coverage in a limited time, suggests that it would be cost-effective to provide adequate financial and logistic support for distribution, and leave the primary health care system to mobilize the necessary community participation. Supporting the distribution financially should be seen merely as providing adequate resources to let the district health system cope with another burdensome task.

Our analysis of person-time covered assessed the capacity to repeat distribution at two-year intervals and did not deal with the question of the physiological duration of supplementation. Efficacy studies suggest that smaller doses of IOC be distributed 6-monthly or annually. Such recommendations will risk more rapid development of 'programme fatigue' and place an even higher reward on sound management practices. However, no matter what distribution interval is selected, person-time unsupplemented due to delayed distribution beyond the programme-objective may be minimized by improving programme management at all levels. Timely decisions and disbursement by donors will allow national authorities to plan meticulously and place advance orders for IOC to manufacturers. This will enable timely delivery of IOC to the districts so that well-trained district health staff with adequate financial support can reach, mobilize and distribute IOC to a population that has the time to attend the distribution during an appropriate agricultural season.

Limitations of integration

The IOC distribution studied provides an example where an apparent saving in distribution expenses resulted in loss of effectiveness and increased wastage of resources. PHC workers virtually stopped distributing the IOC when incentives were withdrawn. The analysis relies on distribution reports from health staff in villages and districts. The quality of such data may be questionable but all supervision visits confirmed the main finding: with the 'district team' approach, distribution did take place. In contrast, in seven of eight 'PHC distribution' districts visited, in the absence of financial support of distribution expenses, capsules were about to expire on the pharmacy shelves more than 1 year after capsule delivery.

Distribution safety

Apart from cost, there are other reasons for minimizing losses of IOC. The substantial amounts of IOC that are unaccounted for may have been swallowed by someone who benefited or may have been left to expire. In the case of Tanzania, indications are that unaccounted-for IOC mainly remained on the pharmacy shelves. However, they could also have been used in a potentially harmful way if taken in too large a dose or given to persons outside the target group, such as the elderly with nodulous goitre in whom side-effects such as iodine-induced thyrotoxicosis may occur. The number of capsules that disappear unaccounted for could thus be viewed as a 'quality indicator' for a distribution management system.
Cost analysis

The world market for IOC has so far been dominated by a single supplier of iodized poppyseed oil from which individual countries have been buying with limited bulk discounts. Recent reports of cheaper iodized rapeseed oil12 raise hopes of cheaper formulations and competitive purchasing by international organizations may bring down the price of IOC still further, as it has for essential drugs.

In this study, iodized oil capsules constituted more than 90% of the cost per swallowed dose under the conditions and coverages prevailing in Tanzania during the study period (Tables 3 and 4). This is similar to mass treatment of schistosomiasis in Tanzania where the cost of praziquantel accounts for 84% of total costs.30 The cost breakdown of the Expanded Program on Immunization (EPI)30 shows an inverse situation: the cost of the vaccine constitutes only 10%, while labour costs, training, supervision and reaching the relatively small target group in each location predominates. Similarly, a review of seven EPI cost-effectiveness studies concludes that vaccine costs account for 15% of total cost, while costs for labour and transport dominate.21 The reasons for this are the more complex way to store, transport and administer vaccines, as well as the much narrower age-range of the target group. In contrast, IOC is intended for most of the population and more than 1000 clients per staff-day receive capsules in mass distribution. However, it may also be the case that the requirements for successful immunization campaigns in least developed countries have been well defined, whereas most other mass campaigns with expensive medications are planned and implemented without similar awareness of the need to invest in logistics and social mobilization.

Potential savings from ‘integrating distribution into Primary Health Care’ are very small for such distributions, whereas the risk of increasing capsule waste is high. It is thus cost-effective to support district staff with fuel and allowances in order to achieve effective campaign distribution. The cost of providing such support is small: the health worker responsible for the distribution of 2000 capsules per day is paid a daily allowance equivalent to the cost of 15 IOC. Support and supervision by a national team will, in the Tanzanian setting, be cost-effective up to the point where 1000 otherwise wasted capsules are saved per day, i.e. the equivalent cost of keeping the team in the field.

Cost-effectiveness and targeting

Herd-immunity may protect part of the population from infectious diseases even though not all those susceptible have been immunized. In contrast, every single iodine-deficient individual needs to be reached by the IDD programme. IOC distribution will thus have a role to play as a long-term control strategy for elimination of IDD where local small-scale salt production prevents iodized salt from reaching the most remote and perhaps most needy communities. In these communities IOC need to be distributed with very high coverage. Considering the geographic and socioeconomic distribution of IDD, it seems likely that the persons most in need of iodine will be the hardest to reach, both with iodized salt and with IOC. The marginal costs per dose ingested of reaching those populations will thus probably be higher than the average cost in this analysis. However, the greatest effect in terms of mortality and neuropsychological consequences averted will probably only come at the higher cost per dose of extending good coverage to these geographic foci and socioeconomic groups.

There is thus a clear limitation of analyzing only on the intermediate outcome variable ‘cost per dose ingested’. An impact-based outcome measure would be preferable, but lack of data on clustering of IDD and the incremental cost of achieving near complete coverage in these most needy groups make such an analysis difficult. In the absence of this critical information we do not attempt to model the impact of the IOC distribution. However, as at least 43% of person-time was covered, we assume that the programme prevented between one quarter and one half of incident iodine deficiency disorders during its running period. Where IOC in the coming years is integrated with iodized salt to achieve elimination of IDD, it may be more effective to develop criteria for restricted geographic targeting and limit the number of IOC purchased in order to be able to invest more in the mobilization and distribution.

Conclusions

This paper analyzes the experience of using iodized oil capsules in Tanzania as a stopgap measure to control iodine deficiency in a target population of 7 million during a 9-year period. It shows that distribution of iodized oil capsules in community-wide campaigns can substantially contribute to the control of IDD in remote and poorly developed regions. However, data from the Tanzania campaign showing incomplete coverage and distribution delays question the reliance on IOC as the primary control method where full coverage with iodized salt can be assured and monitored. In IDD endemic areas that cannot adequately be covered with iodized salt, periodic IOC distribution remains an important contribution to achieve elimination of IDD, provided that high coverage is achieved even in the most remote and needy populations.

The cost of the IOC constitutes more than 90% of programme costs and significant savings can be made from reducing capsule wastage. The results indicate that supplementation would have been more complete and available funds better used if a larger proportion of resources had been allocated to social mobilization, labour management, training and supervision. The main findings are of general relevance also for the distribution in low-income countries of other medications in campaign form with long intervals. Detailed planning of staff requirements in time, number and quality should be done for all levels before starting a programme. A few national coordinators attempting to integrate distribution into routine district services as they are presently funded and equipped in Tanzania proved far from sufficient. Earmarked resources are needed for this form of occasional distribution campaigns.

References


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