Scaling up zinc treatment for childhood diarrhoea in the developing country setting: a before- and after-intervention study

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Abstract

Introduction

Zinc sulphate is an important intervention for the treatment of diarrhoea in children in developing countries. We undertook a series of interventions to increase the availability and usage of zinc sulphate at primary healthcare facilities in Solomon Islands.

Methodology

A 12 month before-and-after intervention effectiveness trial in 80 randomly selected clinics.

Data was collected on whether children < 5 years old with diarrhoea had received zinc. Data was also collected on other medications received, the availability of zinc and staff comprehension. A series of interventions was implemented by the National Pharmacy Services Division.

Results

The mean usage of zinc sulphate increased by 191.2% over baseline; from 106/771 (13.7%) at baseline to 283/710 (39.9%) ($p<0.05$, χ^2) at follow-up; the use of Oral Rehydration Salts (ORS) did not decrease.

The availability of zinc sulphate increased from 3/77 clinics (3.9%) to 61/69 clinics (88.4%) ($p<0.05$).

Summary

Low cost interventions can improve the usage of zinc sulphate in the pacific island setting.

This paper provides a model for other countries to increase uptake of zinc sulphate and other interventions at the primary healthcare level.

Keywords

Essential Medicines, Zinc Sulphate, Child Health, Access to Medicines, Developing Countries, Pacific Island Countries, Diarrhoea

Introduction

Zinc sulphate is an important intervention for the treatment of diarrhoea in children in developing countries. It has been shown to be effective in:

- Reducing the severity and duration of acute diarrhoea;¹
- Decreasing mortality and improving weight gain among children with severe malnutrition;²
- Preventing diarrhoea in low birth-weight babies;³
- Reducing the severity and duration of dysentery;⁴
- Reducing the risk of subsequent episodes of diarrhoea.⁵

The Solomon Islands is a least-developed pacific island country, with a population of 560,000.⁶ In Solomon Islands, oral zinc sulphate was introduced onto the Essential Medicines List in 2009 by the National Medicines and Therapeutics Committee. This was a positive step but no subsequent training was conducted or specific information packages were introduced in relation to its use. Zinc remained largely unknown and anecdotal evidence suggested that it was not available in clinics and not being used in children with diarrhoea.

This situation is reflected more broadly in Asia-Pacific, where many countries have been slow to convert evidence into practice on the use of zinc sulphate. A global study in 2012 found that less than 15% of surveyed countries included zinc sulphate on their Essential Medicines Lists (EMLs) and that less than 10% of countries in the Western Pacific Region had done so.⁷ Those countries that have included zinc sulphate have had mixed success scaling up its usage, most notably in Bangladesh, which achieved between 10% (rural) and 25% (urban) usage of zinc for diarrhoea in children <5 years old following a promotional campaign.⁸

All medicines, including zinc sulphate, are provided free of charge through public clinics in Solomon Islands. Medicines are provided through the National Pharmacy Services Division which distributes to 320 clinics across 9 provinces, through a network of Second Level Medical Stores. Nurses in the clinics order drugs bimonthly.

A pilot project in Western Province, Solomon Islands in 2011/12, used low-cost interventions to improve the availability of zinc sulphate at the primary healthcare level, in 45 clinics. These interventions included a locally-produced informative poster and patient information cards. Pharmacy officers were instructed to question clinic drug orders that did not request zinc.

The pilot study only evaluated availability and did not assess whether zinc was actually being used in children with diarrhoea.

The results of this pilot study, which was presented at the Asia-Pacific Conference on National Medicines Policies⁹, were used as the model for scale-up across the country. Additional interventions

included a radio program, an article in a health newsletter and the re-distribution of the Standard Treatment Manual for Children. These relatively low cost interventions were implemented across the entire country (approximately 320 clinics), and the effect on availability of zinc in clinics and the usage of zinc for diarrhoea in children less than 5 years of age was measured.

An increasing number of Australian pharmacists have undertaken long term work in developing countries in the Asia Pacific region. This area of pharmacy practice has demonstrated a beneficial impact on health outcomes for vulnerable populations in our region. This paper describes the outcome of a project undertaken by the Solomon Islands Ministry of Health, with the support of Australian pharmacists and researchers.

Research hypothesis

That a series of low cost, clinic-level educational interventions by pharmacy for nurses can improve the availability and usage of zinc sulphate for childhood diarrhoea at the primary healthcare level in Solomon Islands.

Methodology

The study design was a 12 month before-and-after intervention effectiveness trial.

80 clinics were randomly selected from 7 provinces in Solomon Islands. Two provinces were excluded (Guadalcanal and Renbel), as they are extremely difficult to access and are supplied directly from National Medical Stores and not through a Second Level Medical Store.

Data collection teams comprising a pharmacist, two pharmacy officers and a child health nurse visited all 80 health clinics in a single month, in April 2013. Data was extracted from clinic outpatient treatment registers. An eligible episode of care was defined as a child less than 5 years, presenting in the preceding 6 months with a diagnosis of diarrhoea or dysentery. The age and sex of each child was recorded, along with whether or not zinc sulphate had been given; the data was otherwise de-identified. Teams also recorded other prescribed medications for diarrhoea, including oral rehydration salts (ORS), albendazole and antibiotics. Patients were included even where additional diagnoses had been recorded.

Patients who had been admitted into an inpatient setting were excluded, as these patients' treatments are usually recorded in a separate treatment register. Most clinics had only outpatient facilities and these admitted patients comprised only a small fraction of the overall number.

The visiting teams checked whether zinc was available in the clinic on the day of visitation and if it was in-date.

A 5 question comprehension survey was also conducted with each staff member working in the clinics on the day of visitation, assessing knowledge on the use of zinc sulphate.

The interventions were commenced following baseline data collection. All clinics in the country received;

- Zinc Sulphate & ORS Poster, as used in a pilot study conducted in Western Province in 2011/12
- Tabulated dosing wall-chart for the 31 WHO Priority Medicines for Mothers and Children. Doubled, A3 size flip chart with 2 page spread showing doses of medicines for women and 2 page spread showing doses of medicines for children.
- ‘Patient Information Cards’; double-sided A5, disease focussed information cards (in the local pijin language, using pictures) on childhood diarrhoea to be given to the parents of patients. These cards were produced by local pharmacists and the research team, containing basic disease information, signs and symptoms, warning signs, treatment and prevention. These were targeted at patients and families but it was anticipated that they might also prompt discussions with nurses. The cards on diarrhoea were part of a series of cards made available to all clinics; eight other diseases were covered by similar cards.
- Several articles on childhood diarrhoea and zinc sulphate in the widely distributed health newsletter produced by the National Medicines Information Centre¹⁰
- An episode of the monthly Pharmacy Radio show, played through the VHF radio network available in clinics
- The Solomon Islands Standard Treatment Manual for Children was re-printed and distributed to all clinics

No training workshops were held; these are an expensive intervention and take clinical staff away from primary healthcare facilities for the duration of training and travel. All educational interventions in our study were low cost and designed for clinic level implementation.

Post-intervention data collection was conducted at 12 months post-baseline in the same 80 clinics, again taking data from the 6 months prior to the day of visitation. At follow-up, the month that the episode of care had occurred in was also recorded.

The same comprehension survey was also conducted at follow-up. Nurse names were not recorded; answers to the survey were not distributed at any stage of the study.

The primary study outcome was the mean percentage of episodes of management of children with diarrhoea where zinc sulphate was used.

Ethics approval was granted by the SI National Health Research & Ethics Committee and the University of Melbourne.

Results

80 clinics were randomly selected for baseline data collection; 3 were closed or could not be visited due to weather or staff absence. Data was thus collected from 77 clinics at baseline. 771 episodes of care were recorded.

At follow-up, 8 further clinics were closed and could not be visited; data was thus collected from 69 clinics at follow-up. 710 episodes of care were recorded.

The data is unpaired and all episodes of care from baseline and follow-up have been included.

The clinic selection and loss to follow-up is shown in Figure 1.

[INSERT FIGURE 1 HERE]

The mean usage of zinc sulphate increased by 191.2% over baseline; from 106/771 (13.7%) at baseline to 283/710 (39.9%) ($p<0.05$, χ^2) at follow-up.

The dose, frequency and duration are not being regularly recorded in clinics. At baseline, 31 out of 106 patients receiving zinc sulphate had the dose recorded, 26/106 had the frequency recorded and 13/106 had the duration recorded. Of these, 30/31 (97%) received the correct dose, 25/26 (96%) had the correct frequency and 12/13 (92%) had the correct duration.

At follow-up, 118 out of 283 patients receiving zinc had the dose recorded, 91/283 had the frequency recorded and 93/283 had the duration recorded. Of these, 117/118 (99%) received the correct dose, 87/91 (96%) had the correct frequency and 71/93 (76%) had the correct duration.

[INSERT TABLE 1 HERE]

The availability of zinc sulphate at the primary healthcare level can be considered a pre-requisite for rational usage; the availability of in-date zinc sulphate increased from 3/77 clinics (3.9%) to 61/69 clinics (88.4%) ($p<0.05$).

A further 34/77 (44.2%) of clinics had expired stock of zinc available at baseline. This reduced to 2/69 (2.9%) of clinics with expired stock at follow-up.

The specific month of treatment was recorded at follow-up to determine longitudinal changes over the intervention period. The usage of zinc increased every subsequent month except one, from October 2013 – April 2014, as shown in Figure 2.1.

The province for each episode of care was recorded at baseline and follow-up. As is shown in Figure 2.2, Western Province had zinc usage of 97/253 (38.3%) at baseline, whilst every other province had a mean usage close to zero, suggesting that the original Western Province pilot study had an ongoing

positive effect on the usage of zinc, 18 months after commencement. Zinc usage had not previously been measured in this way.

Mean usage of zinc increased in every province, as is shown in Figure 2.1.

[INSERT FIGURE 2.1-2.2 HERE]

Comprehension on the use of zinc sulphate also increased. The number of nurses answering correctly increased for 4 out of 5 questions.

Roughly half of all children presenting with diarrhoea at baseline (397/771, 51.5%) and follow-up were given antibiotics (350/710, 49.3%). The mean usage of antibiotics did not change significantly at follow-up, nor did the choice of antibiotic. Our methodology did not allow us to determine if the prescribing of antibiotics was clinically appropriate.

112/771 (14.5%) patients received albendazole at baseline. The usage of albendazole decreased by 7.7% ($p<0.05$) at follow-up. Further investigation would be required to determine if this was related to the increased usage of zinc sulphate.

ORS use did not change at follow-up. ORS was used in 302/771 patients (39.2%) at baseline and 277/710 (39.0%) at follow-up (Table 1).

In those patients where the sex was recorded, 411/735 (55.9%) were male at baseline and 376/693 (54.3%) were male at follow-up.

Discussion

Translating strong decision making at the central level into good practice at the primary healthcare level is an acute challenge in the developing country setting.

Developing contextually appropriate interventions to turn evidence into practice is critical for patient outcomes and the use of zinc sulphate in childhood diarrhoea provides an excellent case study for this. Zinc sulphate is a relatively low-cost intervention with the potential to save lives. Diarrhoea remains the number two cause of post-neonatal death in children under 5 both in Solomon Islands and globally.¹¹

Despite its low cost and known benefits, uptake of zinc sulphate in Solomon Islands remained low after several years on the Essential Medicines List. Promotional activities to increase awareness of zinc sulphate for the treatment of childhood diarrhoea have been successful to a degree in several other settings, including Bangladesh;⁸ a pilot project in Solomon Islands had demonstrated increasing availability at the clinic level but actual usage had not been investigated.⁹

Our study showed that a scaled up version of this pilot project, using low cost educational interventions with no training workshops, significantly increased both the availability and usage of zinc sulphate across Solomon Islands. This may provide a model for other countries in Asia-Pacific seeking to similarly increase usage.

This model should be considered for all other new items included on the Essential Medicines List, as part of concerted efforts to translate policy-level decision-making into good practice. These initiatives should be considered at the time of decision-making by National Medicines and Therapeutics Committees.

The availability of each educational intervention was recorded in each facility at follow-up; these should not be considered an absolute measure of availability however and certainly not an indication of usage. Only 20/69 (29.1%) clinics had Patient Information Cards on the day of visitation – these were intended to be distributed to patients however; their lack of availability on the day of visitation may simply indicate that they had all been given out. Conversely, 65/69 (94.2%) clinics had the Standard Treatment Manual for Children but this does not indicate correct usage of these guidelines.

Increasing the availability of zinc sulphate was achieved through a broader series of interventions and systemic improvements, including methods not described here. The availability of zinc sulphate should be considered a pre-requisite for improving usage; educational initiatives should be linked to contextually appropriate supply chain strengthening. It is noted that the use of expired medicines is strongly discouraged in Solomon Islands. The high proportion of expired stock at baseline probably reflects infrequent usage by clinics or training shortfalls.

The variation in mean usage of zinc between different provinces at follow-up suggests that local contextualisation remain critical. The interventions also may not have reached facilities universally.

The usage of ORS did not change at follow-up. This suggests that increased levels of zinc usage did not reduce ORS usage, as has been shown elsewhere⁸. Though ORS usage appeared low, anecdotally many nurses say that ORS is not recorded in treatment registers when given to patients with diarrhoea, as it may not be considered a ‘drug’ for recording purposes. ORS was available in 88.3% of clinics at baseline and 95.7% of clinics at follow-up and has been widely ordered at all levels for many years, suggesting higher usage than we found.

The clinic outpatient registers are considered a good record of medicines received by patients in Solomon Islands; prescriptions are not used at the clinic level. Medicines are supplied directly at the time of consultation by the examining nurse; medications that are not available are not recorded. We are confident that the record contained in the treatment registers is the best available record of medications received. The dose, frequency and duration are not being regularly recorded in these

treatment registers however. In episodes of care where they were recorded, the % of patients receiving the 'correct' dose, frequency and duration is high. Further work is required in investigating this.

We have not shown a causative link between any single intervention and an improvement in the usage of zinc using our methodology; it is possible that the interventions are mutually reinforcing. This question might be addressed in a controlled study.

This research has not examined patient compliance, carer comprehension or patient outcomes. This patient outcome data would better reflect the true impact of these interventions but would be difficult to establish on this scale, in such a difficult setting. Future research focussing on this area, perhaps in a smaller sample population, would be beneficial.

Summary

Low cost pharmacy interventions can be effective in improving the usage of zinc sulphate in the developing country setting. These interventions could be implemented in similar settings.

National Medicines and Therapeutics Committees should consider similar campaigns for all new items added to EMLs in the developing country setting.

This paper provides a model for other countries in Asia-Pacific – particularly in small-island settings – to increase uptake of zinc sulphate and other low-cost interventions at the primary healthcare level. This paper demonstrates the beneficial effect of Australian-supported pharmacy practice amongst our regional neighbours.

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The authors declare that there is no conflict of interest.

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Table 1: Overall results					
	Pre-Intervention (n=771)		Post-Intervention (n=710)		
Overall mean usage of zinc sulphate					
	Mean	C.I.	Mean	C.I.	Change
Overall	106/771 (13.7%)	11.3% → 16.2%	283/710 (39.9%)	36.2% → 43.5%	22.5% (p<0.01)
Mean usage of Zinc Sulphate by Province					
Province	Mean	C.I.	Mean	C.I.	Change
Central	1/113 (0.9%)	0 → 2.6%	44/60 (73.3%)	62.0% → 84.6%	72.4% (p<0.01)
Choiseul	0/47 (0%)	N/A	10/46 (21.7%)	9.7% → 33.8%	21.7% (p<0.01)
Isabel	2/66 (3.0%)	0 → 7.2%	20/113 (17.7%)	10.6% → 24.8%	14.7% (p<0.01)
Makira	3/106 (2.8%)	0 → 6.0%	65/123 (52.8%)	44.0% → 61.7%	50% (p<0.01)
Malaita	3/125 (2.4%)	0 → 5.1%	41/119 (34.5%)	25.9% → 43.0%	32.1% (p<0.01)
Temotu	0/61 (0%)	N/A	4/35 (11.4%)	0.7% → 22.1%	11.4% (p<0.01)
Western	97/253 (38.3%)	32.3% → 44.4%	99/214 (46.3%)	39.6% → 53.0%	8% (p=0.08)
Mean usage of other agents for diarrhoea					
Drug	Mean	C.I.	Mean	C.I.	Change

Antibiotics	397/771 (51.5%)	48.0% → 55.0%	350/710 (49.3%)	45.6% → 53.0%	- 2.2% (p=0.55)
Albendazole	112/771 (14.5%)	12.0% → 17.0%	48/710 (6.8%)	4.9% → 8.6%	- 7.7% (p<0.01)
ORS	302/771 (39.2%)	35.7% → 42.6%	277/710 (39.0%)	35.4% → 42.6%	- 0.2% (p=0.95)

Comprehension survey questions on use of zinc sulphate (n=number of nurses)

Question	Baseline (n=101)	Follow-up (n=83)	Change
Main indication for zinc in children?	61/101 (60.4%)	74/83 (89.2%)	+ 28.8% (p<0.01)
Benefit of giving a child zinc for diarrhoea?	23/101 (22.8%)	66/83 (79.5%)	+ 56.7% (p<0.01)
Should the child be given less ORS if they are being given zinc?	37/101 (36.6%)	56/83 (67.5%)	+ 30.9% (p<0.01)
Recommended dose of zinc in diarrhoea?	6/101 (5.9%)	9/83 (10.8%)	+ 4.9% (p=0.23)
Duration of zinc therapy in diarrhoea?	32/101 (31.7%)	61/83 (73.5%)	+ 41.8% (p<0.01)

Clinic recruitment, loss to follow up and episodes of care

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