Review of Early Childhood Development (ECD) Interventions and Charities in Sub-Saharan Africa

Mandate

Two anonymous donors have approached Effective Altruism Québec for donation recommendations. The initial mandate given by the donors was to find one or more donation opportunities to reduce human misery as much as possible, with a focus on interventions that are potentially transformative and empower people to improve their lives durably. In line with what the donors are thinking, we are assuming this goal will involve aid to people living in extreme poverty in the developing world. The donors are particularly interested in helping people in Sub-Saharan Africa, so we are focusing on this region.

The intent is to donate 1 million Canadian dollars starting in 2021, probably donating 200k per year for five years. It's possible that other such donations will follow afterward.

We tried clarifying with the donors exactly how to interpret the "transformative" criterion and what this translates to in terms of outcomes to maximize. This criterion remains fuzzy for the donors themselves, and indeed their preferences are not entirely fixed. However, the criterion is linked to empowerment and durable positive change, as opposed to short-term interventions which may have no durable impact. The donors' initial thought was to focus on education, so we have performed a review of this sector as described in a separate document. The donors are enthusiastic about education as a form of empowerment. They assign intrinsic value to better education as an outcome.

Other donor preferences to keep in mind:

- Donations should be tax deductible in Canada (this means charities should be registered in Canada or the US, since the donors have US income as well which allows them to deduct donations to US registered charities).
- Preference for charities that accept stocks as a donation
- All other things being equal, the donors like the idea of supporting initiatives that originate from a fairly local organization. But this could very well be too restrictive, depending on what is considered "local".

Another key consideration is how direct an impact the donors want to have, since this could determine whether things like policy advocacy and research and development are on the table or not. After discussing this with them briefly, the donors are comfortable with impact within the next 1 to 20 years or so, but not keen on options like R&D and policy advocacy which may or may not have an impact at all. So the donors will probably be more comfortable with proven interventions rather than speculative ones, with a strong probability of having a positive impact.

Overview

Based on 2010 data on poverty and stunting, Black et al. (2017) estimated that 250 million children (43%) younger than 5 years in low-income and middle-income countries are at risk of not reaching their developmental potential. In Sub-Saharan Africa, this figure climbs to 66% of children. Grantham-McGregor et al. (2007) argue that “these disadvantaged children are likely to do poorly in school and subsequently have low incomes, high fertility, and provide poor care for their children, thus contributing to the intergenerational transmission of poverty”. In particular, they estimate that this translates to a deficit of over 20% in adult earnings.

Consider for instance the case of stunting, where children are said to be stunted if their height-for-age is more than two standard deviations below the World Health Organization Child Growth Standards median. Stunting is linked to a 0.7 grade loss in school, 7 months delay in starting school, and 22-45% reduction in lifetime earnings (European Parliament). A 1% loss in height is associated with a 1.4% loss in productivity (European Parliament).

Given that developmental deficits in early childhood can have lifelong repercussions, some claim ECD interventions have higher returns than “investments in human capital taking place later on in life” (Denboba et al.).

Following the World Bank, we define early childhood in this report as the period before a child enters primary school (from pregnancy to when a child reaches 5 or 6 years). There are many different types of early childhood development (ECD) interventions that focus on different developmental outcomes – mental development, physical development, psychosocial development, motor development and so on. Similarly, there is a very broad range of ECD interventions - the World Bank, for instance, identifies 25 key interventions (World Bank, Stepping up ECD).

Given this very broad range, we focused on only a subset of ECD interventions. In particular, we investigated:

- Interventions that have been reviewed by charity evaluator GiveWell that specifically target the ECD period
- Interventions with an educational or stimulation component (parenting, psychosocial stimulation, preschool and educational television shows)

The following sections briefly summarize our findings for these categories of interventions.

Review of Interventions

Early Childhood Interventions reviewed by GiveWell

GiveWell has reviewed a large number of interventions related to Early Childhood Development (ECD). We read the reviews performed by GiveWell and, in some cases, additional literature on a given intervention. Given the donors' mandate, we focused only on interventions where there is the potential of long-term impact on adult outcomes, excluding the outcome of simply being alive, which is associated with averting the death of a 0-5 year old child.

The following GiveWell-reviewed ECD interventions were found to have possible long term benefits other than avoiding mortality: salt iodization, seasonal malaria chemoprevention, insecticide treated bednets, deworming, breastfeeding promotion, iron supplementation for school-age children.

Meanwhile, the following ECD interventions were found to have no clear case for long-term impacts other than reducing child mortality: therapeutic zinc supplementation, vitamin A supplementation, non-therapeutic zinc supplementation, oral rehydration solution, immunization to prevent maternal and neonatal tetanus, supplementary immunization activities to prevent measles, immunizations, interventions to promote handwashing, SMS reminders for vaccination, syphilis screening and treatment during pregnancy, treatment of malaria, prevention of mother-to-child transmission of HIV, immunization to prevent meningitis A, integrated community case management, mass media to promote behavior change, intermittent preventive treatment of malaria during pregnancy, maternal mortality reduction.

Table 1 summarizes key information for the relevant interventions. Table 1 includes information from GiveWell reviews as well as supplementary information from our own research when relevant. Details on GiveWell reviews can be found on their website.

Table 1: Summary of key information for ECD interventions reviewed by GiveWell with long-term benefits

Intervention	**Benefits/ Effectiveness**	**Cost-effectiveness**	**Charities**
Promoting breastfeeding as per WHO and UNICEF guidelines: early initiation, exclusive breastfeeding up to 6 months, partial breastfeeding to 24 months	Decreased diarrhea morbidity Increases in IQ of 1 to 6 points (Lutter and Lutter, 2012. Fetal and early childhood undernutrition, mortality and lifelong health) Improved cognition in childhood and adolescence (Britto et al., 2017) Long-term benefits may include developmental benefits for infants that increase adult earnings potential	Quite uncertain; may be similar to GiveWell priority programs	Alive & Thrive
Iron supplementation for school-age children	Strong evidence for decreased cases of anemia Weak to moderate quality evidence for increase in cognitive ability	Uncertain; may be in the same range as priority programs	Evidence Action, Food Fortification Initiative, Project Healthy Children, Global Alliance for Improved Nutrition, Fortify Health
Salt iodization	Increases the IQ of mild-to-moderate iodine-deficient children by 4 points	Within the range of cost-effectiveness of GiveWell priority programs	Iodine Global Network, GAIN universal salt iodization program

	on average. Not clear whether and to what extent this persists to adulthood.	Cost benefit ratios of up to 30:1 (Denboba et al.)	
Distribution of long-lasting insecticide-treated bednets	Decreased 0-5 year old mortality; decreased anemia; decreased splenomegaly; increased weight-for-age and weight for height (in some cases); May lead to increased income/ economic growth	In range of GiveWell priority programs; estimated 0.00911 increase in ln(income) per 1 USD donation	Against Malaria Foundation (GiveWell top charity)
Seasonal malaria chemoprevention: giving children under 5 a full malaria treatment course during malaria season	Decreased 0-5 year old mortality; decreased anemia; decreased splenomegaly; increased weight-for-age and weight for height (in some cases); May lead to increased income/ economic growth	In range of GiveWell priority programs	Malaria Consortium seasonal malaria chemoprevention (SMC) program (GiveWell top charity)
Treatment of malaria	Decreased 0-5 year old mortality; decreased anemia; decreased splenomegaly; increased weight-for-age and weight for height (in some cases); May lead to increased	Expensive; less cost-effective than GiveWell priority programs	N/A

	income/ economic growth		
Deworming children	May improve adult income; may have small positive impact on haemoglobin levels and weight, and possibly other positive health impacts.	In range of GiveWell priority programs	Evidence Action's Deworm the World Initiative; Schistosomiasis Control Initiative; Sightsavers; END Fund (GiveWell top charities)

Interventions with an education or stimulation component

Psychosocial stimulation

Psychosocial stimulation programs involve educators and/or parents playing and interacting with children to help stimulate their development. These can either involve home visits or be center-based. The most famous such program in developing countries took place in Jamaica and involved weekly home visits over 2 years from community health workers teaching parenting skills and encouraging stimulating interaction with children. Follow up studies were conducted and found a 25% increase in income 20 years later for participants relative to controls (Gertler et al., 2014).

This is the only study with such a long-term follow-up. Several other studies have found short-term improvements in cognitive development due to psychosocial stimulation programs. Britto et al. (2017) conducted a meta-analysis of 19 studies and found average effects of 0.36 standard deviations on cognitive development, 0.35 standard deviations on psychosocial development and 0.13 standard deviations on motor development. The World Bank cites effect sizes of 0.32 to 0.97 standard deviations from stimulation programs on higher cognitive and language development (Denboba et al.).

However, it remains unclear whether and to what extent these programs can be expected to produce long-term benefits and what are the key success factors in structuring and delivering such programs. For instance, a program implemented in Colombia was meant to apply the same methods as in the Jamaica study (Attanasio et al., 2014). Psychosocial stimulation initially showed improvements of 0.26 standard deviations on cognitive growth. However, effects of stimulation on cognitive growth disappeared two years later. Meanwhile, an early stimulation program in Pakistan showed cognitive benefits at 2 years of age and also in a follow up study two years later when children were four years old (Yousafzai et al., 2016).

As detailed in Appendix 1, we conducted a very tentative cost-effectiveness estimate for these programs assuming benefits persist long-term and lead to income gains (obviously, a speculative and optimistic assumption). This suggests the cost-effectiveness of psychosocial stimulation programs would be comparable or slightly lower than those of Give Directly unconditional cash transfers.

We did not perform a review of charities operating in the psychosocial stimulation sector given the uncertainty surrounding whether and to what extent these interventions have positive long-term impacts and what factors are key to producing such impacts. The most appropriate avenue for funding interventions in this sector may be to fund research or pilot studies trying to help determine which programs are most effective.

Note: GiveWell conducted their own review of Early Childhood Psychosocial Stimulation a few months after our own review was published, including a cost-effectiveness analysis. Regarding cost-effectiveness, they write that ‘’While it is possible that early childhood psychosocial stimulation programs have moderate impacts on adult income, these programs appear to be relatively expensive, compared to other interventions we have reviewed.‘’

Preschool

We did not perform a full review of the impacts of attending preschool. In a systematic review performed in 2018, Dietrichson et al. find “mixed effects on test scores, and on measures related to health, well-being and behaviour” compared to informal modes of care. They find beneficial average effects for school progression, years of schooling, highest degree completed, employment and earnings. They report an effect on earnings in the range of 0.092% to 2.5%, which seems quite modest compared to the effects of primary or secondary school attendance. They also report that attending preschool tends to increase the number of years of schooling by 0.074 to 0.79 years. They also mention that it is not clear what types of programs have the best long-term outcomes (Dietrichson et al., 2018).

Educational television shows

Educational television shows are another intervention that has been studied as a way of reaching a large number of children and helping to prepare them for school. A meta analysis of 24 studies involving about 10000 children from 15 countries found significant benefits from watching Sesame Street in literacy and numeracy, health and safety, and social reasoning and attitudes toward others (Mares and Pan, 2013). Cognitive effects were of the order of 0.28 standard deviations on average. In the U.S., some studies (e.g. Anderson et al., 2001) find benefits that persist into adolescence. However, these studies do not seem to have involved control groups so there are limitations to interpreting their findings.

In Tanzania, the NGO Ubongo Kids produces educational TV shows. They recently conducted a randomized controlled trial lasting four weeks during which children watched either Ubongo Kids productions or regular cartoons for thirty minutes a day, five days a week. They found some

improvements on cognitive measures for the children who viewed the Ubongo Kids programs (Borzekowski, 2018).

The evidence on educational TV shows shows some promise but there is at present no evidence of long-term benefits of this intervention in developing countries. Given the donors' preferences, this intervention is not a good match at this stage.

Charity recommendations

Among the interventions studied by GiveWell with long-term benefits, it seems the degree of uncertainty about these benefits is roughly comparable, with the possible exception of deworming where the long-term benefits are disputed. Since no intervention clearly stands out in terms of long-term benefits or cost-effectiveness, we decided to focus on the interventions where the listed charities are also GiveWell top charities, that have been thoroughly vetted. This leads us to recommend the Against Malaria Foundation and the Malaria Consortium's Seasonal Malaria Chemoprevention (SMC) program.

Among the interventions with an education or stimulation component, we do not have a charity recommendation at this stage. The psychosocial stimulation programs show promise and the donors could consider funding pilot studies that try to determine how best to structure such programs for long-term impact. However, the donors have also expressed a preference for interventions that have been demonstrated to work, so they will probably prefer to fund the GiveWell charities listed above or the charities recommended in our report on education which had estimated cost-effectiveness comparable to or higher than the GiveWell recommended charities mentioned above.

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Appendix 1: Guesstimating cost-effectiveness of psychosocial interventions in terms of income

Our cost-effectiveness estimates can be found in this Google Sheet.

Assumptions:

- Discount rate 2.5% (same as used by GiveWell in their preliminary cost-effectiveness analysis of education interventions)
- Number of years for which income is increased: 40, starting 20 years after the intervention

We used the following data from some of these studies to very roughly estimate cost-effectiveness:

- J-PAL program in Columbia with psychosocial stimulation and nutrition components: Cognitive scores initially improved about 0.26 standard deviations and program costs were roughly 500 USD per year per child (Attanasio et al., 2014).

- 45 week (on average) stimulation and nutrition intervention in Columbia added to an existing program improved cognitive scores by 0.15 standard deviations with a cost per child of about 630 USD per child per year (Attanasio et al., 2018)

- 0.3 to 0.38 standard deviation improvement in cognitive scores from parenting program for children aged 3 to 18 months in the Caribbean. Home visits cost 245.1 USD per child per year while health care centre visits cost 134.30 USD per child per year. They do some cost-benefit analysis, assuming impact on wages of the order of 11-12% by comparing the cognitive development benefits with those of the original Jamaica study (Walker et al., 2015).

We assumed, following Walker et al. (2015), that long-term income gains compared to the Jamaica study would follow the same proportion as short-term cognitive gains (obviously, this is both speculative and optimistic). Walker et al. report a 0.8 standard deviation improvement in cognitive development from the Jamaica program (different iterations of this program have had different impacts on cognitive development scores).

For each of the 40 years on the labor market, income increases by a given fraction x with respect to the income without the psychosocial stimulation (baseline income). So increase in the natural logarithm of income for each of these years is:

ln(baseline_income*(1+x))-ln(baseline_income)=ln(x)

Assuming a discount rate of 2.5%, the net present value of the increases in natural logarithm of income over N=40 years is:

$$\sum_{i=20}^{60} \frac{ln(x)}{(1+0.025)^i} = ln(x)\left(\frac{z^{60+1}-z}{z-1} - \frac{z^{19+1}-z}{z-1}\right) \quad where\ z = \frac{1}{1+0.025}$$

The net present value of the increase in the natural logarithm of income per US dollar donated can then be obtained by dividing the result of the equation above by the cost of the psychosocial stimulation program. Table 1 lists results using data from the three studies mentioned above.

Table 1: Increase in net present value of the natural logarithm of income per USD spent based on data from three studies

Study	Walker et al. 2015	Attanasio et al. 2014	Attanasio et al. 2018
Increase in net present value of ln(income) per USD	0.00907	0.00166	0.00116
Ratio to GiveDirectly value (0.0026)	3.5	0.6	0.4