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Accelerating progress towards the sustainable development goals for adolescents in Ghana: a cross-sectional study

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ABSTRACT

Since the adoption of the sustainable development goals (SDGs) by the United Nations (UN), the search has been on to identify interventions that have effects on multiple SDG-targets simultaneously. Like other developing countries, Ghana has a youthful population and would require creative, urgent, youth-focused interventions to be able to attain the SDGs by 2030. This paper describes the application of the accelerator model on data from a sample of Ghanaian adolescents to identify potential accelerators towards selected SDG targets involving youth. The data for 944 adolescents, 10–19 years (mean age 12.31 ± 3.51 years), extracted from two cross-sectional surveys on children and adolescents aged 6–19 years in Kumasi, Ghana, were analysed in this paper. Variables considered suitable proxies for SDG targets and potential accelerators were identified from the study instruments. Consequently, four aligned SDG targets (good mental health, access to ICT, school completion and no open defaecation) and five accelerators (cognitive stimulation, no relative poverty, low student–teacher ratio, high caregiver education and safe water) were extracted. Associations between accelerators and SDG targets were assessed using multivariable logistic regression adjusting for socio-demographic covariates and multiple testing. Cumulative effects were tested by marginal effects modelling. The three hypothesised accelerators identified were cognitive stimulation, low student–teacher ratio, and no relative poverty. A combination of all three accelerators was associated with a higher likelihood of adolescents having access to Information and Communication Technology (ICT) by +73% (CI 0.72–0.74), no open defecation by +44% (CI 0.43–0.46), school completion by +27% (CI 0.26–0.27) and good mental health by +9% (CI 0.08–0.10). Three hypothesized accelerators showed association across all four SDG aligned targets. The accelerator model has been further validated in this dataset from Ghana. Robust interventions designed around these accelerators may represent an opportunity for achieving the SDGs in Ghana.


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Introduction

At the forefront of driving support for attaining the sustainable development goals (SDGs) is the United Nations Development Programme (UNDP) through the identification of ‘accelerators’ within the framework of the ‘mainstreaming, acceleration, and policy support’ (MAPS) approach (UNSDG, 2016). Within this framework, an accelerator is described as any service, programme or intervention that impacts multiple SDG targets simultaneously (Cluver et al., 2019; UNDP, 2017). First, the goal is to identify which potential single interventions have significant effects across multiple targets, and then which combination of interventions have a synergistic effect in ‘accelerating progress towards specific SDG targets’ (Cluver et al., 2019). This paper is a contribution towards the efforts at validating this model using an existing dataset from Ghana.

The concept of accelerators for sustained progress towards the SDGs is timely. The literature is replete with evidence of the efficacy of many interventions in achieving one SDG-target (Aber et al., 2017). However, a new approach of targeting multiple SDGs that reinforce each other with one single intervention might be a more efficient use of resources (Nilsson et al., 2016), particularly given the resource constraints of many developing countries in Africa with a growing youthful population (DESA, 2017). Some accelerators identified in the literature include safe schools, promotion of mental health, good school performance (Devries et al., 2014), and parental support to reduce risky adolescent sexual behaviour, substance use and violence perpetration (World Health Organization, 2016). The number and type of caregivers raising children (grand-parents versus biological parents, for example) were found to have an impact on SDG targets such as academic performance (Jingzhong & Lu, 2011; Zai & Chen, 2010; Zhao et al., 2014) and child labour (Castañeda & Buck, 2011; Jingzhong & Lu, 2011; Salah, 2008), although these effects may depend on the nature of kin relationships which are culture-specific (Mazzucato et al., 2015). This paper seeks to utilise the accelerator model on data from Ghana to determine potential accelerators towards reaching selected SDG targets.

Methodology

Data source and study location

The data used in this paper was a combination of two datasets from two separate cross-sectional studies carried out by the first author in Kumasi, Ghana (Kusi-Mensah, 2017). Kumasi is the second most urbanized city in Ghana, a lower-middle-income country (LMIC) in West Africa (Nyarko, 2014), which has a relatively high standard of living because of its strategic location in central Ghana serving as the principal inland transport terminal for the profitable business of the distribution of goods in Ghana and beyond to other West African countries. Kumasi therefore has relatively good access to basic amenities like pipe-borne drinking water, stable electricity, and reliable internet service providers, several of which are SDG-outcomes in this study.

The first was a study carried out in 2017 to establish norms for the Raven’s Standard Progressive Matrices – a test for fluid intelligence (Raven & Court, 1998) on 614 children and adolescents aged 6–19 years in rural and urban schools. In this study, any child of

school-going age within the specified age range of 6–19 years in rural and urban Kumasi was included in the study, with selection of participants being done in 11 (seven urban, four rural) private and government-run schools. The second study was a cross-sectional community-based survey carried out in 2018 to investigate the social determinants of the mental well-being of 672 children and adolescents (aged 6–17 years) in an urban inner-city community. In this study, any child aged 6–17 years who resided in Fante New Town and was given appropriate informed consent was included in the study, with recruitment being done in randomly selected households in the community. Out of the 1286 participants in both studies, data for 944 adolescents aged 10–19 years were subsequently extracted and analysed. In both studies, the same information on socio-demographic details and cognitive functioning was obtained. However, for instruments on mental health information, there were differences. The in-school study used the Patient health Questionnaire-9 (PHQ-9) to screen for depression and anxiety (Spitzer et al., 1999), while the community study utilised the Kiddies Schedule for Affective Disorders and Schizophrenia-Present and Lifetime version (KSADS-PL) to assess for psychiatric disorders (Kaufman et al., 1997). [Table 1](#) has a summary of instruments.

Procedure

The study instruments were reviewed, and items deemed suitable as proxies for measuring different SDG targets were identified by the authors. This is summarised in [Table 1](#).

Mapping of accelerators

Potential accelerators (Cluver et al., 2019) were identified from the variables collected, and all variables were converted into binary measures. In all, five potential accelerators were hypothesized for the Ghana data based on available evidence in the literature on practices or interventions that affect the well-being of adolescents in sub-Saharan Africa (Harris et al., 2014; Luketero & Kangangi, 2019; Nicholas-Omoregbe et al., 2010; The water project, 2018). All potential accelerators and their operational measures are presented in [Table 2](#).

A detailed operational definition of such essential variables as ‘poverty’ and ‘student-teacher ratio’ can be found in the supplemental material 1.

Ethical considerations

For both datasets, ethical approval was sought and obtained from the Institutional Review Board of the Kwame Nkrumah University of Science and Technology (KNUST) (Ref. No: CHRPE/AP/266/17, and Ref. No: CHRPE/AP/266/18). Informed consent was obtained from adolescents who were aged 18 years and above. For adolescents younger than 18 years, informed consent was obtained from their parents and the adolescents gave their assent. Adolescents diagnosed with a mental disorder received further clinical assessments and intervention by the study team which comprised psychiatrists.

Table 1. SDG targets mapped from questionnaires and their measures.

SDG target	Operationalised measure	Measure	Instrument used
3.4 Promote mental health and well-being	Good mental health	Absence of internalizing disorders: mood and anxiety disorders in the past 12 months	(1) <i>Patient Health questionnaire (PHQ-9)</i> : A nine-item questionnaire graded on a Likert scale that screens for anxiety and depression (Spitzer et al., 1999). (1) <i>Rutter's A2 scale</i> : A 31-item behavioural screening questionnaire to identify children aged 6–18 years who are at high risk for a mental disorder (Rutter, 1967). From prior studies (O. O. Omigbodun et al., 1996), a cut-off of 7 was used. (2) <i>K-SADS-PL- DSM</i> : A semi-structured interviewer-administered questionnaire diagnostic interview instrument designed to assess lifetime episodes of psychiatric disorders in children and adolescents aged 6–18 years according to the DSM-5 criteria (Kaufman et al., 1997)
4.1 All girls and boys complete primary and secondary school	Improved cognitive functioning	Above age-defined average score of using intelligent quotient Ghana norms	<i>Raven's Standard Progressive Matrices</i> : A matrix-based measure for fluid intelligence. Self-administered test which is divided into 5 sections each with 12 items (Raven & Court, 1998).
6.2 End open defaecation	Practice of respondent in human waste disposal in reference to household access to modern human waste disposal facilities	Self-reported access to either private flush toilet, public toilet or improved pit latrine	<i>International Wealth Index questionnaire</i> : A measure of long-term household economic status using durable asset possession, access to basic services and housing material based on data from 2.1 million households in 97 developing country (including 3 demographic and health surveys in Ghana; Smits & Steendijk, 2015).
9.c Access to information communication technology	Access to a phone, tablet or computer at home with an internet connection	Self-reported connection to the internet	<i>Sociodemographic questionnaire</i> : Obtains information on sex, age, family structure and school-related issues (O. O. Omigbodun et al., 2010)

Statistical analysis

The statistical analysis was carried out in four (4) stages with the Statistical Package for Social Sciences (SPSS) version 24 and R, an open-source data analytic software (Chambers, 2008; Dalgaard, 2008).

In step 1, descriptive statistics of all SDG-aligned targets (Table 2), hypothesized accelerators (Table 3) and covariates were calculated and reported (Table 6). In step 2, multivariable logistic regressions were carried out simultaneously while adjusting

Table 2. Mapped accelerators and measures.

Accelerator	Operationalised measure	Measure	Instrument
Cognitive stimulation	Having an active reading habit	Self-reported reading of at least one novel or non-fiction book per term that is <i>not</i> required reading for school or school textbook	Modified socio-demographic questionnaire
Low student–teacher ratio	Improved contact time with students	Low student–teacher ratio was defined as a student–teacher ratio (number of students per class/total number of teachers teaching that class) at or below the OECD average of 13.1, based on information provided by participant and corroborated with information provided by school head teacher	Modified socio-demographic questionnaire
No relative poverty	Above the relative poverty line	Using the IWI cut-off score of 60.65 which is one (1) standard deviation above the sample mean and thus can be said to be a reasonable cut-off point for ‘relative poverty’ (i.e. compared to peers within this sample) for this relatively wealthy sample	International Wealth Index questionnaire
High caregiver level of education ^a	At least secondary level of education	Having at least secondary level of education	International Wealth Index questionnaire
Access to safe water	Household access to pipe-born water	Self-reported access to privately owned pipe-born water for household	International Wealth Index questionnaire

^aCaregiver was defined as any adult person responsible for the day-to-day upkeep or supervised care of the minor.

Table 3. Socio-demographic characteristics of respondents.

Characteristics	Frequency	Percentage
Age		
10–14	588	62.3
15–19	356	37.7
Gender		
Male	446	47.2
Female	498	52.8
Geographical location		
Rural	157	16.6
Urban	787	83.4
School type		
Private	382	40.5
Public	561	59.5

for similar covariates identified from previous studies. Each model included all hypothesized accelerators and all covariates on one SDG target. In Step 3, to account for the risk of type I error from multiple-hypothesis testing, we checked that the estimated p-values were below their estimated Benjamini–Hochberg critical values specified for five tests at a false discovery rate of 10%. Collinearity was also assessed among SDG outcomes using polychoric correlations, with all being less than 0.3 indicating no multicollinearity (see supplemental material 2). In step 4, we used fitted regression models to calculate adjusted probabilities and probability differences comparing different combinations of the accelerators while holding significant covariates at their individual values, providing probabilities and 95% confidence intervals (CIs).

Results

Sociodemographic characteristics of respondents

Of the sample of 944 adolescent participants, the mean age was 12.31 (SD \pm 3.51 years), with 498 (52.8%) females and 787 (83.4%) living in urban areas. Seven Hundred Sixty Five (81.0%) were from high socioeconomic families (see Table 3). Missing values were less than 1% for all variables.

Frequency of SDG-aligned target indicators and accelerator protective factors

Forty (4.8%) of the participants were diagnosed with a mental health condition. Eight Hundred Fourty Five (89.7%) of the participants reported that they were not engaged in open defaecation and 577 (61.1%) reported access to the internet. 580 (61.4%) reported an active reading habit, while 179 (19%) were classified as living below the poverty line. See, Table 4

Multivariable regression analysis of associations between accelerator provisions and SDG-aligned targets

Table 5 shows correlations between the hypothesized accelerators (for correlations between SDG outcomes see Supplemental Material 2). All associations between the predictors (accelerators) were small (tetrachoric correlation coefficient less than 0.24) indicating no co-linearity.

Table 4. Frequency distribution of SDG targets.

SDG target	Measure in the data set	Categories	Frequency (%)
3.4 Promote mental health and well-being	<ul style="list-style-type: none"> No diagnosis of specific mental health disorder 	Yes No	904 (95.8) 40 (4.2)
4.1 All girls and boys complete primary and secondary school	<ul style="list-style-type: none"> Normal cognitive ability for age (scored above mean RSPM score) 	Yes No	766 (81.9) 169 (18.1)
6.2 End open defaecation	<ul style="list-style-type: none"> Self-reported access to either private flush toilet, public toilet or improved pit latrine 	Yes No	846 (89.7) 97 (10.3)
9.0 Access to ICT	<ul style="list-style-type: none"> Access to ICT 	Yes No	577 (61.1) 367 (38.9)
Accelerator protective factors			
Cognitive stimulation	<ul style="list-style-type: none"> Reading of at least one novel or non-fiction book each term that is not required reading for school 	Yes No	580 (61.4) 364 (38.6)
Low student–teacher ratio	<ul style="list-style-type: none"> Student–teacher ratio below the average of 13.1 	Yes No	756 (80.1) 188 (19.9)
No poverty	<ul style="list-style-type: none"> Living one standard deviation below the International Wealth Index mean score for the population 	Yes No	765 (81.0) 179 (19.0)
High caregiver level of education	<ul style="list-style-type: none"> Having at least secondary level of education 	Yes No	662 (70.1) 282 (29.9)
Access to safe water	<ul style="list-style-type: none"> Access to privately owned pipe-borne water for household 	Yes No	699 (74.1) 244 (25.9)

Table 5. Bivariate correlation with predictor variables.

Accelerators	Cognitive stimulation	Low student–teacher ratio	Access to safe water	High caregiver education	No poverty
Cognitive stimulation	1				
Low student–teacher ratio	0.23	1			
Access to safe water	0.11	0.10	1		
High caregiver education	−0.01	−0.03	−0.04	1	
No poverty	0.03	−0.07	0.30	0.001	1
Access to modern energy	0.10	0.07	0.17	−0.03	−0.005

Table 6. Multivariable Associations Between Accelerator Protective Factors and SDG Aligned Targets.

Hypothesised Accelerators	SDG outcomes			
	Good mental health	School completion	No open defaecation	Access to ICT
Cognitive stimulation	1.04 (0.49–2.09; 0.916)	2.26 (1.58–3.24; <0.001)	1.38 (0.82–2.30; 0.212)	3.24 (2.31–4.57; <0.001)
Low student–teacher ratio	0.73 (0.22–1.98; 0.567)	1.73 (1.13–2.64; 0.011)	2.98 (1.66–5.38; <0.001)	7.21 (4.61–11.5; <0.001)
No poverty	5.61 (2.19–13.7; <0.001)	1.34 (0.71–2.46; 0.349)	9.26 (4.38–19.40; <0.001)	4.61 (2.48–8.76; <0.001)
High caregiver level of education	1.07 (0.33–1.66; 0.846)	0.77 (0.51–1.13; 0.194)	0.46 (0.24–0.84; 0.015)	0.78 (0.54–1.12; 0.180)
Access to safe water	0.75 (0.33–1.66; 0.497)	0.86 (0.54–1.34; 0.509)	0.77 (0.44–1.33; 0.352)	2.75 (1.78–4.27; <0.001)
Covariates				
Late adolescence	2.98 (1.45–6.35; 0.003)	0.92 (0.62–1.37; 0.704)	1.89 (1.07–3.35; 0.028)	0.17 (0.11–0.25; <0.001)
Urban	2.63 (1.05–6.28; 0.327)	1.54 (0.93–2.54; 0.089)	12.8 (6.97–24.1; <0.001)	0.71 (0.40–1.24; 0.234)
Female	1.54 (0.79–3.13; 0.212)	1.10 (0.77–1.56; 0.608)	1.09 (0.67–1.77; 0.725)	1.12 (0.80–1.56; 0.521)

Table 6 shows the results of the overall multivariable regression analysis spanning the five hypothesized accelerator protective factors and four SDG aligned targets while simultaneously controlling for three (3) covariates which were age-category (early versus late adolescence), area of residence (urban versus rural) and gender (male versus female). After correcting for multiple comparisons using the Benjamini–Hochberg correction, three factors (cognitive stimulation, low student–teacher ratio, and no relative poverty) emerged as hypothesized accelerators (predictors significantly associated with two or more SDG outcomes). For example, adolescents who had adequate cognitive stimulation were two times more likely to achieve school completion (OR: 2.26; CI: 1.58–3.24) and three times more likely to have Internet access (OR: 3.24; CI: 2.31–4.57). However, access to safe water, although positively associated with access to ICT (OR: 2.75; CI: 1.78–4.27), it was not associated with any other remaining SDG outcomes. See, Table 6

Table 7. Adjusted probability of SDG outcomes considering different combinations of identified accelerator protective factors.

SDG outcomes Hypothesised accelerators protective factors	No mental disorder	School completion	No open defaecation	Access to ICT
No accelerators	0.87 (0.65–0.96)	0.59 (0.40–0.76)	0.47 (0.28–0.65)	0.06 (0.03–0.13)
Cognitive stimulation	0.85 (0.66–0.94)	0.83 (0.71–0.91)	0.69 (0.55–0.81)	0.17 (0.08–0.29)
Low student–teacher ratio	0.84 (0.64–0.94)	0.69 (0.52–0.82)	0.65 (0.49–0.77)	0.29 (0.17–0.43)
No poverty	0.96 (0.91–0.99)	0.75 (0.65–0.83)	0.90 (0.84–0.94)	0.21 (0.14–0.32)
All accelerator protective factors	0.96 (0.92–0.98)	0.87 (0.80–0.91)	0.92 (0.87–0.95)	0.79 (0.73–0.85)
Probability difference comparing 'no accelerators' and 'all accelerators'	0.09 (0.08–0.10)	0.27 (0.26–0.27)	0.44 (0.43–0.46)	0.73 (0.72–0.74)

Data are adjusted odds ratio (95% CI, p-values). Potential accelerators were defined as predictors that were significantly associated with two or more SDG targets. None of the SDG targets were dropped after corrections for multiple comparison using the Benjamin-Hochberg corrections.

Associations of individual potential accelerators and combined synergy provisions with SDG-aligned targets

Accelerator synergies were presented for four of the SDG-aligned targets: good mental health, school completion, no open defaecation and access to ICT, in that, the chance of achieving the SDG targets increased when two or more of these accelerators were combined compared to just one accelerator. Table 7 shows the marginal effect models which identified the probability of achieving the SDGs when the participant was not exposed to the accelerator versus when the participant was exposed to all three accelerators combined. For example, results showed that, whereas adolescents who had none of the accelerators had 6% likelihood of having access to ICT, those who had all the accelerators (i.e. had cognitive stimulation, were not living in poverty and had a low student–teacher ratio) had 79% likelihood (a 73% increase) of having access to ICT. Similarly, adolescents who had none of the accelerators had an 87% chance of not having a mental disorder, while those who had all three accelerators had a 96% chance of not having a mental disorder. The remaining results are shown in Table 6 and summarized in Figure 1 and 2.

Data are adjusted probabilities (95% CI), except for the final row which summarises the probability difference in percentage points (95% CI) comparing a scenario with no accelerator protective factors and one with all three accelerator protective factors.

Discussion

This study on adolescents in Ghana identified cognitive stimulation, low student–teacher ratio, and no poverty as accelerator protective factors associated with a higher likelihood of reaching 4 SDG targets, with each showing positive associations across at least two

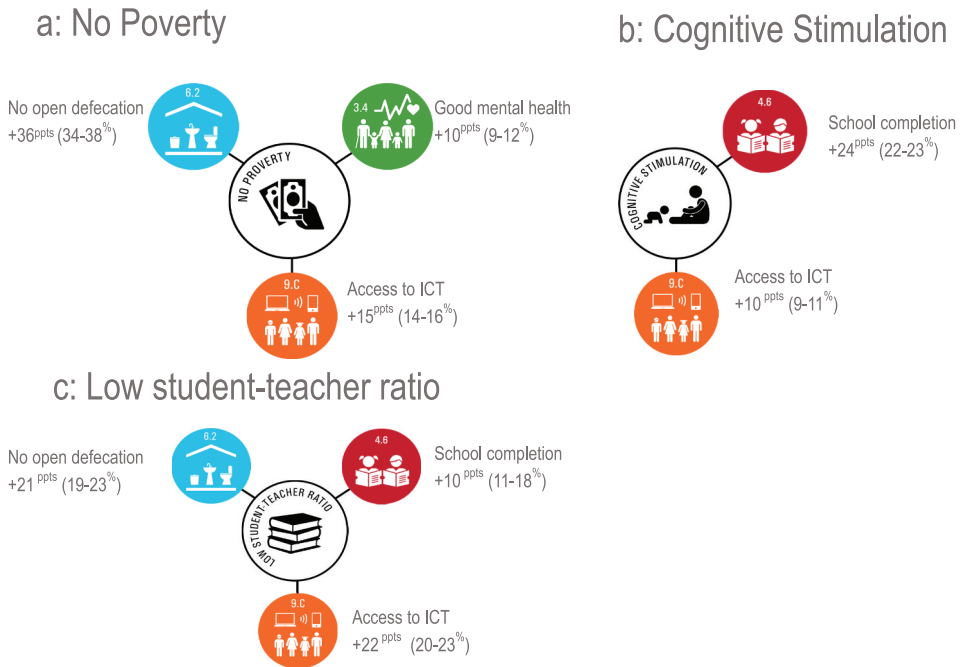


Figure 1. Probability differences comparing adjusted probability of achieving sustainable development goals in the absence and presence of identified accelerator protective factors. The accelerator protective factors identified are no poverty (a), cognitive stimulation (b) and low student-teacher ratio (c).



Figure 2. Probability differences comparing adjusted probability of achieving sustainable development goals in the absence and presence of all three accelerator protective factors. Data are percentage point improvements (95% CI) in percentage probabilities. Double lines indicate where two protective factors are associated with an outcome, and triple lines indicate the where three protective factors are associated with outcomes. Lines are colour-coded to reflect which exact accelerators are having the effect indicated in the data reported next to the SDG-target.

SDG targets. Furthermore, three accelerators combined additively across SDG targets such that cognitive stimulation, low student-teacher ratio and not living in poverty

synergised for good mental health and internet access. Cognitive stimulation and low student–teacher ratio synergised for school completion, no poverty and low student–teacher ratio synergised for no open defaecation.

Cognitive stimulation

The association between having an active reading habit (a proxy for cognitive stimulation) and self-reported access to ICT may not have an intuitive causative link on the initial examination. However, further examination suggests a bi-directional relationship with ICT exposure affecting reading ability and reading ability affecting internet access.

In one direction, exposure to ICT has been shown to improve reading self-efficacy and reading academic achievement (Walters, 2013). In the other direction, according to information-foraging theory, people who habitually read (because of high cognitive stimulation) seek out access to the internet more aggressively because it is a more efficient means of obtaining information about what they read (Czaja, 2008; Pirolli & Card, 1999; Sharit et al., 2011; Trewin et al., 2012) and are more likely to be comfortable and adept with using the internet (Sharit et al., 2015). Therefore, it is not difficult to imagine an adolescent engaged in active reading seeking for the use of a smartphone to enable access to the Internet for further learning. More so, given that this association remained significant after controlling for possible confounders (such as SES and parental education), the association may not simply be because adolescents of better-educated parents have greater access to books and the Internet. However, this study suggests that the connection between active reading and access to the Internet is real and independent, but this does not detract from the known dangers of excessive screen time and Internet use (Hale & Guan, 2015; Lissak, 2018).

Our study also found that Cognitive stimulation (by way of having an active reading habit) was also associated with higher cognitive functioning (by way of above age-defined average fluid intelligence scores), which has been found in the literature to be a strong predictor of the SDG target ‘school progression and completion’ (Knighton & Bussière, 2006; Lloyd, 1978; Nakajima et al., 2017; Polidano et al., 2013; Reschly, 2010). There is a direct connection between an active reading habit and higher cognitive functioning (Walker et al., 2005) bearing out findings in the present study. This lack of cognitive stimulation is also in turn linked with failure of school completion in the literature, as suggested by a study from India where the lack of reading skills by age 12 puts girls, for example, at risk of school dropout (Singh & Mukherjee, 2018). Indeed, reading interventions in grades 2 and 3 significantly improve high school completion (Blachman et al., 2014). There are other important factors associated with school completion, but the role of reading skills in school completion is clearly highlighted here.

Further, as found in this paper, there is extensive documentation on the link between reading and having a lower risk for mental disorders (another SDG target; Carroll et al., 2005; Martin et al., 2007; Maughan & Carroll, 2006; Willcutt & Pennington, 2000b). For example, children who do not read outside of school are much more likely to have externalising disorders such as ADHD (Willcutt & Pennington, 2000a). Carroll and colleagues (Carroll et al., 2005) found a robust association between reading difficulties and mental disorders such as ADHD, Conduct disorder and Anxiety disorders among both boys and girls, and self-

reported depressed mood in boys. This is a significant finding particularly in a LMIC setting such as Ghana, where children from low SES backgrounds often experience significantly fewer opportunities for literacy-enriched activities and are less likely to develop intuitive reading skills (Leslie & Allen, 1999). Further studies are therefore warranted.

Low student–teacher ratio

The association of low student–teacher ratio with cognitive functioning and by extension school completion was unsurprising. Reducing the size of primary school classes seemed to have positively affected school completion (Rumberger & Lim, 2008), and educational performance (Wandera et al., 2020). Educational performance has been reported to be the highest predictor for dropout or completion (Lyche, 2010; Markussen, 2010; Markussen et al., 2008; Nakajima et al., 2017; Rumberger & Lim, 2008; Traag & Van der Velden, 2008), even when other factors such as SES were taken into account (OECD, O. for E. C. and D, 2010; Polidano et al., 2013; Treviño et al., 2010; Zoch, 2017). The converse (large class sizes) has also been shown to have adverse effects on school completion rates (Bickel et al., 2001; Buckman & Tran, 2015; Kim et al., 2018; O’Sullivan & Weiss, 1999; Rumberger & Lim, 2008; Stanard, 2003).

This positive association between low student–teacher ratio and cognitive functioning may be explained by better one-on-one interactions (SESRIC & Alpay, 2014), a stronger student–teacher bond, greater teacher’s influence on the students to complete school (Ancess & Wichterle, 2001; Rumberger & Lim, 2008) and greater cognitive stimulation (Ancess & Wichterle, 2001). This is not to suggest, though, that student–teacher ratio and educational performance are the *only* predictors of school completion as several other factors (poverty, parental supervision, etc.) have also been shown in the literature to affect school dropout rate (Lyche, 2010). However, cognitive ability and educational performance are still the strongest predictors of school completion among these.

Low student–teacher ratio was also associated with a second SDG-target: improved ICT access, but here the picture is a bit more nuanced. There are published data to support this association even if sometimes confounded by SES (Krüger, 2011); although, on the other hand, both factors were significantly associated with access to ICT, it might be possible that there might have been some residual confounding if there was some measurement error in ‘no poverty’. In a similar vein, the association between low student–teacher ratio and no open defaecation is also likely not to be direct, although there is support for this association in the literature mainly because both are indicators of good-quality schools (Sachs Leventhal et al., 2018). Nevertheless, it seems more plausible that the closer interaction that a low-student teacher ratio provides between pupils and teachers could lead to greater influence of the teacher on the sanitation habits of students, similar to the parental influence reported in several studies (Bauza et al., 2019), including from Ghana (Ritter et al., 2018; Teunis et al., 2016) although admittedly this is speculative.

Poverty

While not living in relative poverty showed a strong independent association with good mental health, no open defecation and improved internet access, one might consider poverty not just an ‘accelerator’ but a ‘super accelerator’ because of how broad-based and far-reaching its impact is on other accelerators as well as SDG-targets. Nonetheless, there are several anti-poverty interventions that could be explored such as cash transfers and microfinance, but these would nevertheless require high-level political commitment. However, given that the data shows an independent association with various SDG targets, poverty still needs to be addressed.

There is ample evidence in the literature to support the association between poverty and mental health difficulties (Bøe et al., 2014; Rutter, 2003; Wickham et al., 2016). Poverty-related factors such as food insecurity, poor economic protection and exposure to work at an early age increase the risk of children developing mental health problems (Cluver & Orkin, 2009; Cortina 2012; Das-Munshi et al., 2016; Omigbodun et al., 2010; Sturrock & Hodes, 2016). Specifically, parental emotional well-being and parenting practices are two potential mechanisms through which low socioeconomic status is associated with child mental health problems (Bøe et al., 2014; Omigbodun & Olatawura, 2008). It is worth observing that poverty is an underlying factor running through all the other accelerators.

Accelerator synergies and policy implications

Accelerator protective factors combined additively on 4 SDG targets: ending open defaecation, improving internet access, school completion and good mental health. The results showed a dramatic change in the probability of these outcomes in the presence of the accelerators when combined in synergy indicates that additional gains could be achieved by acting on multiple protective factors simultaneously.

The policy implications of the associations observed in this study have been alluded to previously, such as reading interventions in grades 2 and 3 significantly improving high school completion (Blachman et al., 2014) and, therefore, the need for not only improving access to education but also school quality (such as focusing on reading and writing skills) to solve the problem of school dropout. Shared reading programmes where parents are given an active role in encouraging reading have particularly shown real promise in encouraging reading in children (Chang et al., 2022). Actively promoting reading clubs, library use (both physical and virtual) and other forms of reading activities, particularly at the early education levels, is a form of cognitive stimulation and a worthwhile investment for governments and stakeholders to have maximum impact across multiple SDG goals. It may also be worthwhile to invest in the promotion of leisurely reading in school, public and virtual libraries. To improve the student–teacher ratio to OECD levels, it is also recommended that greater investment is made into teacher-training programmes at the tertiary institutions specialised in education. This would be an intervention that not only targets educational outcomes but will also drive other SDG targets for adolescents such as ending open defaecation, improving access to ICT and school completion.

This study had various strengths and limitations. The data were collected in one city (urban and rural) Kumasi, Ghana, which was a relatively wealthy cohort, hence limiting the generalizability to other parts of Ghana. The cross-sectional design means causation cannot be determined, and results need to be interpreted with caution. Finally, the measures were based on self-report, which has limited reliability.

Conclusion

In conclusion, this study has contributed to the growing evidence for the concept of accelerators and the potentially important roles they could play in achieving the SDG targets. Robust interventions designed around these accelerators may represent the best opportunity for achieving the SDG goals, particularly for developing countries such as Ghana.











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