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Title: What do we know about children's access to school and their learning outcomes in Pakistan? Analysis of the risk factors to children's proficiency in literacy and numeracy assessments

Key words: Risk factors, literacy, numeracy, Pakistan

Abstract

This paper discusses the research feasibility of Annual Status of Education Report (ASER), volunteering citizen-led social survey conducted in Pakistan. The paper presents a detailed commentary on the process of ASER data collection, discussing the strengths, limitations and quality of the data maintained. There are also findings of the ASER data analysis from 2013 to 2016 with a focus on 34 risk factors associated with children's cognitive ability at age 8 (N=89,460). The results show that 'not enrolled in school' and 'household poverty' are the biggest risk factors for children to achieve an expected level in learning. However, school type attended by children does not explain variation in the learning outcomes. Children missing information on household characteristics are at high risk of failing to achieve. Social surveys are feasible for understanding the patterns of household poverty and access to education. Following the discussion on results, the paper considers policy implications of maintaining a national database of all children, ensuring a universal access to school education in Pakistan.

Key words: Risk factors, literacy, numeracy, Pakistan

Background

National databases can provide information and access to general population. If the information is meticulously recorded, and efficiently maintained there could be several benefits such as ensuring access to disadvantaged groups, fair delivery of state provisions and tracking the long-term impact of policy initiatives. Achievement of development goals depend on having information about, and access to, the most disadvantaged groups in the population. In context of developing countries ageing population, refugees, asylum seekers, disabled, and LGBT are likely to be hidden population groups therefore vulnerable and almost inaccessible for help and support. Children are also vulnerable and hard to access in absence of policy implementation on birth registration.

In Pakistan, there is no national database for children in which their birth records are registered. When children come to the age of attending school, their information is officially recorded in school database for the first time. Not all children are enrolled in schools therefore; the information on children's background characteristics is not available for those who do not attend a formal school. This has implications on access of the most disadvantaged groups to state-level provisions and analysing long-term policy impact. Children not being able to access education and are also not achieving thresholds in cognitive and physical development are likely to be in any official records or databases. There is very less known regarding the cognitive development of children who do not attend formal schools because they are not in the school registration databases, and therefore, not included in national assessments (Siddiqui 2017). A quarter of children (23 million approximately) in the whole population do not attend school and that those not attending are more from disadvantaged family backgrounds. Their current and long-term educational outcomes by age 5 are already far worse than those children who attend school (Siddiqui and Gorard 2017). These findings are consistent with the End of Childhood Report 2017 where Pakistan ranked 148th out of 172 countries on childhood-ending events. Children severely malnourished and out-of-school are the main challenges for the social and economic development of Pakistan (Mughal and Aldridge 2017, The Lancet 2017).

Annual Status of Education Report (ASER) in Pakistan has emerged as an important data resource since 2012. The ASER is a social survey initiative which begun in Pakistan from 2008. It is a nationwide annually administered social survey based on a representative sampling technique. The survey has developed in terms of quality and consistency over time. ASER data has almost become a reference for research and education policy initiatives in Pakistan. The

survey generates three large data sets, which include information on households, children and schools. Nearly 85,000 households, 250,000 children and 5,000 schools participate in this survey on annual basis.

Volunteering citizen-led approach

ASER is a nationwide survey conducted by volunteering citizens from the local regions. The sample includes 30 villages in each of the 144 districts of Pakistan. Each village is divided into four parts from its centre location, and from each part every 5th household is selected for the survey. Every year since 2009, 10 old villages are dropped and 10 new are selected so that the rotation of old and new villages provides an estimate of changes over a period of year. From each village, one government school is also surveyed, along with one private school if available.

The surveys are administered by volunteering community members who are invited to take part in the activity through website announcements and local newspaper advertisements. The selected volunteers have the educational experience of at least graduate level. They have the knowledge of local community and are fluent in speaking local language. After the recruitment of the volunteers, they attend a formal training session to learn how to identify the households from the village map, approach the households to take part in the survey and children's assessment, and administration of the test on available children age 5 to 16 available at home. The volunteering citizens administer the survey and children's assessment as the ASER trained staff member. This involves showing their proof of identity to the household member, explaining them the purpose of the survey and children's assessment activity, and seeking their consent to record their details.

The ASER household survey and children's assessment activities take place in the home settings, which allows recording the details of children who do not attend schools or have previously attended schools. Assessing children in home settings is a feasible option, which allows visibility to the most vulnerable children who are not enrolled in school or absent from school. These are most likely girls and a large number of boys who work as wage labourers to provide earnings at home. The timing of ASER activity is in the late afternoon when children who attend school or work to earn income for the family are usually available at home. Children are assessed in presence of other household members.

The datasets are comprehensive records of household and children who give their consent to share the information and willingly participate in the survey and assessment activities. However, there are no details included in the datasets that can indicate the non-response of the targeted households. As in any social survey activity, it is likely that some targeted household would refuse to take part or withdraw their information from the survey. It is unclear from the survey protocols how the household non-response is recorded in the datasets. The non-response and withdrawal from the targeted household sample is important for understanding the patterns of limitations and barriers in a large-scale survey activity led by trained volunteers. The volunteering citizens provide their feedback and anecdotal references of the fieldwork. However, this feedback is not systematically collected from all volunteering citizens involved in the study. The volunteering citizens manually complete the survey forms for individual households and children. The individual forms are then sent to the central office where the data is entered and compiled by the central ASER team.

The household survey and children's assessment tools

ASER in Pakistan collects three main sets of information: Household survey, child assessments in reading, English, and maths, and a school survey. Household survey includes information on characteristics such as respondents' age, educational experience and availability of basic resources at home. The household data is mainly based on respondents' reported information combined with the surveyors' observations when present on the site. No validation procedures can be systematically performed, such as confirmation through documented resources (e.g. birth or marriage certificates, academic degrees certificates or TV/car licence registrations). Not all respondents, especially those living in the remote areas of the country, have documented resources that verify their age or assets. Therefore, the options to achieve information rely on respondents' self-report in combination with surveyors' judgement.

Children's information regarding their age, school type and school enrolment status is recorded according to the information given by their parents. Children can be present during this recording of the data as it follows the stage of their assessment. The survey and assessment tools are standardised and are translated into the national language (Urdu) or English so that trained volunteers can easily administer the surveys in a limited time. Children's assessment is also available in two major local languages, Sindhi and Pushto, which can be the medium of instruction in schools located in Sindh and Northwest regions of Pakistan. The volunteers are informed in the training to use their judgement in selecting the translated version of the assessment, depending which language version would best support a child in giving the responses.

The reading test assesses if children can recognise simple letters, read one-word, read short and simple sentences, read a 6-line story followed by a bonus question on reading comprehension. The test of English assesses if children can recognise capitals and small letters, can read and understand two syllable words written in English, and can read and understand five word long sentences in English. The test of maths assesses if children can recognise the numbers 1-9, and 10-99, and can do simple sums using subtraction and division. The tests are scored in five categories from beginner level to highest level. The last section also assesses if a child can tell the time and can name objects in a picture shown to them. In terms of definition, this assessment is neither age standardised nor based on any specified task or taught criteria. The purpose is simply to screen children aged between 5 and 16 years old according to their basic proficiency in reading, English and maths.

The data available on children's proficiency in each test is recorded in five categorical levels. According to ASER descriptions the highest difficulty level in each test can be interpreted as equal to Year 2 (age 5 years) of the national curriculum level. This means that children aged 5 and above should be able to read a short story, be able to read simple sentences written in English, be able to successfully do simple sums (details on ASER assessment tools: http://www.aserPakistan.org/index.php?func=page&page_id=18). The five levels of categories are beginner when children are just enrolled in school with no formal learning experience (Level 1). The second category is recognition of numbers 1-9, recognition of letters and capital alphabets of English (Level 2). The third category is when children can read one-syllable words in reading test, recognise small letters of English, and recognise number 10-99 (Level 3). The fourth category is when a child can read short sentences, can read one-syllable words in English and can do double figures subtraction sums (Level 4). The fifth category is when a child can read a short story of a few lines, read a few words in sentences in English, and can do sums involving division in maths (Level 5).

These levels cannot be assumed to be equal interval, and the cell sizes are varied making them unusable for a multinomial logistic regression. For the regression analysis presented in this paper, a dichotomous variable of ‘Pass’ and ‘Fail’ was created which is consistent with grade retention school practice in Pakistan according to which children failed in any of these tests do not up-grade with their age peers (King et al. 1999; Chohan and Qadir 2013). Children who scored level 3 in reading, English and maths were recorded as passed, and those who were below level 3 in any of these three tests were recorded as failed.

Household and children characteristics

Children’s data is linked with respective household characteristics by matching the common identifier codes between the two data files. The sample included 1,086,489 children aged 3-16 years in the ASER survey years 2013 and 2016. The subgroup of 89,460 children were identified as 8 year old. The data on children’s age and gender has less than 1% missing values, which makes these two indicators very useful for the analysis. However, children’s age has been recorded according to their parental reports. In absence of information from parents, surveyor recorded age based on their observations. There could be a have high level of inaccuracies.

Missing data

Non-response from the targeted households and it members is not clearly reported in the ASER datasets. It is not possible to assess if the non-response is leading to bias in the overall sample representation. We recommend that the data on household and children non-response be clearly reported so that this information can be included in the analysis. In almost all of the categories, there is missing information from those who participated in the survey in all of the variable categories. The survey coding manuals clearly indicate that in absence of information the volunteering citizens leave the options blank, which appear as missing in the main datasets. There is existing evidence that missing data is not random and likely that the missing information itself can be treated as characteristics of risk (Siddiqui 2019). In the regression analysis, missing is coded as a separate category for all the variables.

This section presents patterns of the missing data and provides possible explanation of the missing characteristics. The category of ‘rich’ indicates that the households have indicted the possession of resources such as electricity connection, house ownership, concrete house, TV, and mobile. ‘Poor’ households have indicated lack or absence of at least one or more than one of these resources.

Table 1: Percentage of missing data

Category	Poor Household	Rich households
Mother attended school	84	16
Father attended school	87	13
Children’s school type (Only enrolled in school)	91	10
Children’s assessments	84	16

There is a clear indication that missing information is not random. Poor households have a higher percentage of missing information on parental school attendance. Children’s school type and assessment data are also missing more from the poor household as compared with those in rich households. In the regression analysis, missing information is included as a separate category because replacing the missing values introduces bias in the results.

Risk factors to achievement of expected level in proficiency assessment

Children's proficiency levels were analysed in relation with all known characteristics. According to World Health Organization (WHO) individual's exposure to any characteristics, which increases the chances of harmful effects to health, are called risk factors (WHO 2009). In the context of current analysis, risk factors are characteristics, which show an inverse relationship with children's proficiency in assessment. A complex analysis shows that these characteristics have a determining power on children's chances of attaining a certain level in proficiency. Nearly 34 individual risk factors emerged from this descriptive analysis of children's 'pass' and 'fail' status in proficiency tests, which are presented in the Graph 1 below. The regression analysis shows that these characteristics have a determining power on children's chances of attaining a certain level in proficiency.

Please see the graph on last page

Children's school enrolment status shows the widest gap in the proficiency assessment. Not enrolled in school appears to be the biggest risk for children's learning at the expected 'Pass' level. However, there are overlaps between school enrolment status and other risk factors associated with household characteristics. Children not enrolled in school are 12% from poor households who do not own house, live in mud-house, no electricity connection and do not possess a mobile phone. In comparison to the households who possess all these indicators of socioeconomic status, 4% are not enrolled in school. For those who are enrolled in school and their proficiency level is 'Pass', 50% of them belong to the poor households and 65% for those who possess all the indicators of socioeconomic status. This means that not all children enrolled in schools and from wealthier household are achieving the expected outcome in the proficiency assessment.

Enrolled in Madrassahs (faith based Islamic schools) is the 2nd risk factor for children failing in the proficiency assessments. There could be several reasons for Madrasah children failing to achieve an expected pass in the proficiency assessment. Household poverty is the main factor for parents, which limits the options for their children to attend any other school than Madrassahs. There are no fee and admission charges and several Madrassahs provide free of cost mid-day meal and accommodation for boys. However, Madrassah teaching is based on a narrow curriculum mainly restricted to teaching about Islam and compulsory rote memorisation of Quran in Arabic language. Majority of children in Madrassah have parents who have not attended any school in their childhood and have no literacy skills (Shaukat 2015). Enrolment rate in Madrassah is relatively lower than other school types but Madrassah have higher intake of children specially boys 8 to 16 years old and from poor household (Population Census of Pakistan 1998). According to the ASER data 91% of the children enrolled in Madrassah belong to households which do not hold any possession of wealth. There is less chance for children who attend only Madrassah schools, that their parental support or direct involvement can overcome the gaps in their children's learning.

Lack of electricity connection, living in a mud house and large family size appears to be the indicators of risk for children's learning. Children not in any formal school types (government, private or Madrassah) are also failing to achieve a pass. Informal learning spaces are not registered schools and they exist in the form of tuition centres or evening classes organised by charity workers and volunteering teachers. As these informal learning spaces are not recognised as school therefore children's attendance is not compulsory. Informal school also depend on the availability of resources such as space, learning materials and volunteering staff to teach.

Being a girl is a 15th risk factor, which could be related with fewer chances for girls to be enrolled in school. It is possible that there is a bias in girls' participation in assessment if conducted by male volunteering citizens. There are no details provided on the participation bias and non-response data, which could be useful in interpreting low performance of girls in the proficiency assessments. Another explanation could be that the percentage of girls enrolled in schools is lower (40%) than boys (60%). If school enrolment determines children's achievements in the proficiency assessment then girls not enrolled in schools are at risk of failure to achieve the expected outcomes.

A number of risk factors are the indicators of socioeconomic deprivation such as no electricity connection, living in mud-house, receiving support allowance from government, family size with more than 4 children, house not owned etc. Percentage of 'Pass' achievement level is consistently low on these indicators of poverty. The level of achievement almost becomes equal between 'Pass' and 'Fail' at the indicator of 'electricity connection' and then the percentage of 'Fail' starts declining where indicators are associated with socioeconomic and household literacy status.

Children's achievement is not equal in government and private school types. Children in private schools have higher percentage of achieving 'Pass' level. However, this indicator also overlaps with household socioeconomic status. Private schools have 64% of children from households who do not own house, live in mud-house, no electricity connection and do not possess a mobile phone. The proportion of children from the same characteristics of household poverty is 84% in government schools. The low 'Pass' rate in government schools could be due to the intake of children from poor background. Private schools have a wide range in terms of fees, admission policies and other educational standards. However, the common policy of private school sector is that they charge monthly fee as little as \$5 and some as high as \$500 (Bharara 2016). The ASER data does not have a category that discriminates low or high cost private schools. Therefore, several private schools, which have the minimum fee, would have the intake of children from poor families. It might be that the low-cost private school children have the same outcomes as children from poor households but attending the government schools. Additional information is required in the form of average school fee charged by all private schools, which will also help to understand the category of low-cost private school and its relationship with children's enrolment and learning outcomes.

The ASER data 2013 to 2016 for 8 year olds shows that the overall pass rate is 48%. The assessment data included 12% missing information, which were coded as 'Fail'. This near half split is suitable for constructing a logistic regression model for predicting a binary outcome of 'Pass' or 'Fail'.

Table 2: Percentage 'Pass' or 'Fail'

Proficiency status	Total
Pass	42,971
Fail	46, 489
Total	89, 460

The categorical variables were added in two blocks. The first block included all background variables, which increase the percentage correctness from 52% to 64%. Adding school type in the second block did increase the percentage correctness of the regression model any further. This means once controlling for the background characteristics the school type attended by children does not explain their proficiency in the assessment.

Table 3: Standardised coefficients (Effect size)

Variables	Standardised coefficient
Attending Madrasah school (versus Private)	0.38
Missing school type (versus Private)	0.49
Missing information on house ownership	0.77
Missing information on TV	0.87
Missing information on tuition	0.91
Missing Mother went to school	0.96
House not owned	0.97
Attending Non-formal (versus Private)	0.97
Boy (versus girl)	0.98
Possess mobile phone	0.99
Possess TV available	1.06
Father went to school	1.11
Missing information on electricity	1.14
Missing information on mobile	1.15
Electricity connection available (or not)	1.25
Father went to school (or not)	1.32
Living in mud house	1.32
Pay extra tuition (or not)	1.36
Living in concrete house	1.40
Mother went to school (or not)	1.44
Attending government school (versus Private)	1.54
Enrolled in school (or not enrolled)	7.71

The coefficients are odds ratio explaining the likelihood of the binary outcome. Boys are more likely to achieve a pass than girls. This means being a girl is a risk factor. House not owned, and attending Madrassah or non-formal education are risk factors for achievement in learning. Missing categories in all the variables show that these cases are highly at high risk of failure. Replacing with means or deleting the cases with missing information can give biased results.

Enrolment in schools has the highest effect size on children's achievement of 'Pass' status. Children enrolment in school means that they are likely to be attending a school and this is related with their learning and performance in the proficiency assessment. The school type they attend does not add any explanation to their learning outcomes. Percentage correctness of the model was 64% when background characteristics were added in the models, and it remained unchanged when school types were included at the second step. Once controlled for all the background information, children enrolled in Madrassah and other non-formal education provisions are not achieving at the same level as their counterparts in government and private schools.

The need for state-maintained national database on children

Children's universal access to education in Pakistan is the biggest challenge in the social and economic development of the country. No elected government in Pakistan has implemented a national action strategy in setting up a universal system of free and compulsory education for all children. A constant neglect has led to the situation where the sixth largest in population country has 58% literacy rate, 25 million children aged 5 to16 are not attending school, and

49% of girls who should be attending schools are not even enrolled in schools. These literacy figures are only estimates because there is no nationally maintained official database that registers all children's birth. This has implications on developing universal education policy and implementing state levels provisions for the most disadvantaged groups.

According to the United Nations, Convention on the Rights of the Child, Article 7, every child has a right to name and nationality, which depends on the registration of a child's birth in the official records. In rural regions of Pakistan, 80% of births take place in homes assisted by local midwives and there is no requirement by the government to record homebirths (Chasney and Davies 2005). In absence of an efficient birth registration system, the administrative records are not reliable and it is highly likely that children from socioeconomically deprived regions are not included in the estimated figures (Shaheed and Warraich 1995, Dow 1998). There are not many education policy initiatives or large-scale programmes introduced in Pakistan. However, the ones implemented failed to achieve the expected outcomes (Ali 2006). Lack of officially recorded data is one of the main impediments in evaluating the outcomes of educational outreach programmes (Jamil and Qureshi 2002).

In the absence of a national child registration database, social surveys have been collecting child and household data using sampling techniques. In order to ensure that each child's right to education has been protected, children's enrolment in school need to be matched with nationally maintained administrative records of birth ensuring that all children access school when they reach appropriate age. There could be various benefits of maintaining official records can assist in planning for children's security, welfare and access to educational provisions. Maintaining official records and national database assist in achieving national operation of state policies. Records alone might not ensure that each child is protected and receiving all that a state law has promised. However, official records are a stepping-stone towards approaching the vulnerable groups in the society.

Conclusion

There is no study available on children's cognitive development and progress that has included a large sample of children in Pakistan who do not go to schools. The reason for lack of evidence on children's cognitive assessment at pre-school age and their readiness for school and for those who dropout or never go to school is mainly because the assessments are conducted via schools. The school level samples are biased in Low-Middle Income Country or Territory (LMICT) where school enrolment status are not high such as in Pakistan. Children's access to school and regular school attendance is a choice of their parents, which is mainly determined by parental socioeconomic status and education (Siddiqui 2017, Siddiqui and Gorard 2017).

The ASER data is feasible for understanding the nature and patterns of household poverty in relation with children's access to schools and their cognitive abilities. It is perhaps the only data about Pakistan, which is accessible for analysing the cognitive proficiency of children who attend or do not attend schools. However, there are challenges in maximising the use of this information. The interlinkage between the data set is only possible between the household data sets and children's cognitive assessment. The information on schools cannot be linked with individual children included in the survey. Therefore, it is not possible to conduct analyses such as school segregation, peer-effects and school effectiveness. The sampling frame rotates by including 10 new villages and dropping at least the same number each time. This is a useful sampling strategy to maximise the participation and capture the changes in demographic patterns each year. However, this limits the options for conducting longitudinal analyses at the individual household or children level. It is not possible to measure the changes in household

patterns of poverty or improvement in the learning levels of children because the sample is different each year.

In this survey activity, there is a scope of retaining a random sub-group in the sample for assessing longitudinal effects of household poverty, school enrolment and attendance and disaster effected areas. Moreover, there is also a need to improve interlinking of the data sets, which is possible by including one extra question on school information in the assessments for children. Good quality data can have an enormous positive impact in developing countries, thus highlighting the incredible value of such data sources in countries such as Pakistan; a value relevant in both the developing and developed world. Studies from developing countries can and should contribute to the debates surrounding improvements and innovations in survey methodologies. Especially when we consider the innovative approach taken by ASER to effectively collect data on highly disadvantaged and remotely located groups of interest and that they broke ground in an area with no relevant large-scale data sources. ASER are arguably at the forefront of innovations in participant engagement.

This study has shown that attending a school is an important determinant of learning outcomes of children. Not attending a school could mean that children will not be able to learn to read and write. There is social and economic stratification among children who have access to school and those who are out of school. The highest risk factors to achieving expected learning outcomes are not attending school and living in poverty. Financial incentives to schools and conditional cash transfer to families of children have the evidence base for increasing the enrolment targets. However, meeting the full enrolment targets needs national level reforms for primary education. School enrolment policies must start from developing national database of all children and their families, indicating children's school enrolment status when they come to the age of attending school. A state-level universal school enrolment strategy cannot meet its target without maintaining a national database of children in Pakistan. Without exactly knowing who are of the age to attend school, and should be attending a school, there is no possibility of ensuring access to the state-level provisions for education. There can be useful implications on access to state-funded provisions, accountability of the system, and quality of the programmes delivery if children's national database are developed and maintained by the state departments. International aid programmes also need to encourage and support the government in establishing national databases before implementing large-scale development initiatives. This could develop better understanding of the global challenge targets, focused programmes for the eligible groups and access to robust measures for the programme evaluation outcomes.

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Graph 1: Percentage of 'Pass' and 'Fail' and risk factors

