

Development of Child Assessment and Caregiver Advice Manual for Front Line Health Workers to Enhance Early Child Development in Developing World

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Abstract

Early years are critical for the development of neural connections that influence lifelong trajectories of health, learning and behaviour. No universal child development indicators to assess young children at household level are available. This paper describes the development and psychometric properties of "Care for Development, Appraisal Tool for Assessing and Monitoring Child Development: First Three years" (CDA tool) that equips frontline health workers with essential skills to adequately assess child development and educate caregivers about early child development. The tool was developed by multidisciplinary research team after extensive literature review and field trails in three steps. First step was conceptualization of theoretical framework followed by consolidation and development of guide. Second step was field testing and norms development on 1000 children. Finally tool was evaluated by external reviewers. CDA tool has sound psychometric ability in terms of its contents and concurrent validity, is culturally appropriate and easy to administer. It can be used by frontline health workers to identify and track high risk children across the globe thereby helping children from low-resource settings to realize their full potentials.

Keywords: Child assessment; Developmental problems; Early child development

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Introduction

Approximately 200 million children less than five years of age are identified at risk of developmental delays and most of them are from developing countries [1]. Early identification of vulnerable and at risk children of developmental delays as well as effective early intervention improves the lives of these children [2-4]. World Health Organization (WHO) is striving to develop global indicators of child development to promote early child development. Many countries are striving for the development of local indicators that are culturally sensitive, acceptable, and representative that can identify vulnerable children [5]. Moreover, developmental assessment is the integral part of any early childhood development programs. There are many reasons for this, such as sensitive period of brain development in early years, its link with lifelong trajectories of health, education and earning opportunities in later life, that make the track of developmental

assessment crucial during early years particularly from birth to three years [6].

One of the first steps to assess the effectiveness of an ECD programs is to do the accurate child developmental assessment using culturally sensitive and reliable measures. Most of the child development screening tools used in the developing countries were developed and validated on western children and on urban population [7-9]. Although it is a practice to adapt these tools according to cultural settings and norms, some of them are only translated or adapted with minimum consideration of the validity, reliability and cultural relevance [10]. In addition to this because of the non culture relevancy of many items, they just give comparison among group but do not provide true pictures of child abilities and it is not cost effective exercise [11, 12]. Most of the standardized assessment tests are material loaded and require large amount of time for assessment. Majority of the child assessments is done in clinical settings and used for

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diagnosing the deficiencies or disabilities. These are not used for routine checkups to track of child development over different time periods [13]. Some assessment tools only cover one or two domains of development and don't cover all developmental domains in holistic manner. Recently some tests have been developed in developing countries but these have very focused population coverage [14, 15].

Epidemiological studies give evidence that developmental assessment and screening most of the time is confined to the clinical settings and performed by professionals not by community health workers. This point towards, there is a need for more widespread screening at community with a culturally sensitive tool performed by locally trained paraprofessionals. The main objective of this study was to develop such a simple and accurate tool that can be used in community setting, not be material loaded, easy to administer and that can effectively assist parents to identify developmental problems and keep record of child development surveillance [16, 17].

This present study was undertaken to develop simple, inexpensive, easily administered, culturally appropriate, norm referenced tool that covers all developmental domains for children from birth to three years of age. In addition, we wanted a tool that can be included in development surveillance system in early childhood development programme in urban and rural communities of Pakistan and can be used both in community and home settings. Eight million developmental delayed children of total population of the world are living in Pakistan, out of 200 million [1]. The prevalence of disabilities in Pakistan is 2.5% according to the 1998 National Census Report, of these 45% are children under age eighteen [18]. However, the burden of mild to moderate developmental delay is unknown, due to lack of systematic surveillance of children in health, home and school settings. Moreover to develop a simple and easily accessible tool for use by paraprofessionals and professionals who are looking for developmental outcomes, surveillance and plan intervention through parental education of birth to three years old children in developing countries. With the inspiration from WHO's concept of care for development a tool "Care for Development Appraisal (CDA) tool for Assessing and Monitoring Child Development: First Three Years" was developed with multidisciplinary team of experts in a resource poor country. This paper describes the rigorous and tedious process of the development of the CDA child assessment and caregiver advice tool, field testing, analysis and discusses the applicability and acceptability of CDA tool in developing countries. The specific objectives which led to the development of the CDA tool were:

- 1)Development of community based monitoring tool to record information of child's physical growth and development during the first three years of life;
- 2)Facilitate caregivers to appreciate the recorded information and educate them to support the critical stages in their child's early growth and development;
- 3)Ensure early identification of growth faltering and potential developmental delays, and timely referrals to health care service provider;

4)Enhance caregivers' understanding of the enabling social environments, and the best health, care and interaction practices to promote child's growth and development; and

5)Empower front line health workers with necessary skills so that they can effectively coordinate a link between family and health services for a better child care.

Materials and Method

The CDA tool development process consisted of three broader steps that overlap with many small steps: (1) Development of the CDA tool (2) Field testing of the CDA tool and (3) External Review (See Figure 1).

Step 1: Development of the CDA tool

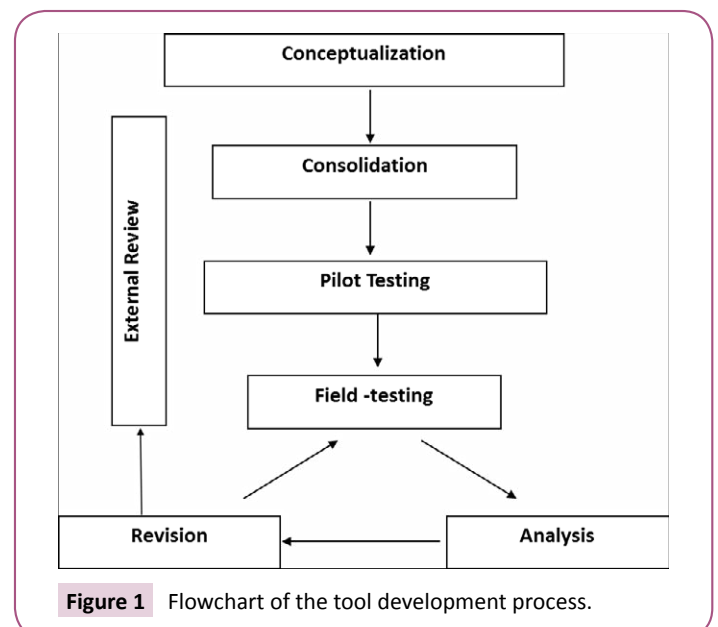
Conceptualization

A multidisciplinary team of experts comprising of psychologist, physicians, community health nurses, public health practitioners, epidemiologist, sociologist and educationists was formed to conceptualize and develop the basic theoretical framework for child assessment and education tool.

The step of reviewing literature is essential for any tool construct. Extensive literature review was done to compile existing tools across many disciplines to assess growth and development. An item pool was generated from several published and unpublished standardized measures for child development to set the basic lay out of the CDA tool.

Compilation of educational material

The next step was to review of pooled indicators and educational material for their cultural relevancy and adaptation. The most appropriate critical and distinguished age appropriate indicators were selected according to the child age, developmental domain and relevancy with the universal and culture norms. For advice for caregiver section evidence based best nurturing practices were selected and adapted related to child health, safety, nutrition,



stimulation, hygiene and sanitation, care practices at birth and disciplinary actions.

Consolidation

The basic structure and lay out of the CDA tool was developed which had divided into 5 main sections:

1. Child profile (basic information about child name, age, gender, family, etc.)
2. Immunization status (Information related to age appropriate vaccinating received)
3. Domains of Growth (length/height, weight, head circumference)
4. Domains of Development (gross motor, fine motor, language, cognitive and social-emotional skills)
5. Advice for caregiver (best nurturing practices related to nutrition, health care, hygiene, safety, play and stimulation, disciplinary practices and at birth practices).

Face value and layout of the CDA tool was finalized with the concept that child assessment session should be accompanied by advice for the caregiver. Finally, assessment schedule and scoring criteria were finalized i.e. child assessment to be done on monthly basis during the first year of life, and then on quarterly basis in the home setting. The rationale for this routine is based on the growth monitoring schedule already recommended by WHO [19] and is already in practice in various developing countries. It is logically and operationally more feasible to tag on assessment and advice about developmental status to the existing growth monitoring routines.

Development of pictorial messages

The literacy level of many developing countries is very low and much worse in women. Keeping this in mind, all assessment and educational indicators were illustrated to visually communicate the developmental status of a child and to provide educational messages for caregivers (Figure 2).

Selection of assessment material

Child assessment requires some standardized material to reduce the biasness and enhance uniformity in the assessment procedure. A very minimum material loaded kit, consisting of 16 items was arranged, that were easy to administer, low cost and indigenous (Appendix 1).

Development of observer’s guide

In order to facilitate paraprofessionals and parents in improving their day to day interactions with children, the ‘community based workers guide’, was also developed as a CBWs standard protocol for administration of child assessment and caregiver’s education.

Step 2: Field testing for the norms development

Pilot testing

The CDA tool was initially pilot tested in small scale to check the ease of use and to calculate the actual time and item flow before wider field testing. The team of researchers conducted the pilot

testing on children in a private day care center and health care setting (vaccination center).

Field testing

A cross sectional study was planned for field testing of the CDA tool to develop norms and assess the growth, development status and as socio-economic context of the children. A sample of 1002 children was selected from the geographical area Qayyumabad and Manzoor Colony, peri-urban settlements of Karachi. The selected communities represented middle socio-economic status and ethnic diversity that increased the generalizability. The purpose of field testing was to look for these three dimensions:

- 1) Feasibility and operationalization of the CDA tool in a community setting.
- 2) Comprehension of the illustrations by the caregivers.
- 3) Identify the norms of physical growth and mental development in a developing country set up.

Study measurements comprised demographic information, assessed by caregiver’s interview based on a structured questionnaire, child’s anthropometric assessments according to standard WHO protocol, and child development assessment on the basis of CDA Tool’s “community based workers guide”. Opinion and comprehension of the illustrations by the caregivers were also recorded. Ethical approval for the study was taken from University Ethical Review Committee and verbal informed consent was taken from caregivers, while children with diagnosed severe mental retardation, physical disability or having physical illness at the time of assessment were excluded from the study.

Sampling strategy was devised on the basis of assessment schedule that monthly assessment for initial 12 months and for quarterly basis up till 3 years, cumulated to form 20 age groups. On average, 50 children were selected for the assessment in

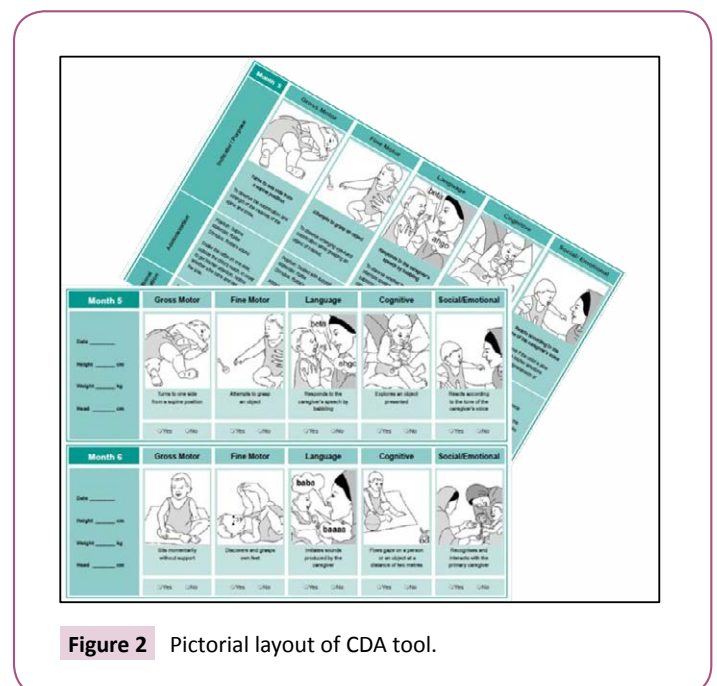


Figure 2 Pictorial layout of CDA tool.

each age group. Each and every eligible child according to the assessment schedule was selected from the geographical area. Data collection was performed in two stages. In the first stage, mapping team visited the area and mapped each household. They identified the eligible children by determining their date of birth on the basis of birth records, if available, otherwise primary caregiver information was considered sufficient. In addition, after obtaining informed consent the convenient time of child assessment was also discussed with the caregiver. At the time of assessment, care was taken that the child's age should be in the +7 days of his/her respective age group. During the second stage, assessment team comprised of two members who were part of research team visited the house, assessed the child and collected the required information from the caregivers. The whole assessment took about 20-40 minutes per child. The assessment was done at household level and caregiver was advised to provide non-intrusive environment as well as not to prompt the child during assessment. Team comprised of two members assessed a single child and members of the team were from the same group who participated in the conceptualization and consolidation stage.

Preliminary editing was done immediately after the interview. The data collection forms were checked by a field supervisor for internal consistency, missing information and illegal entries. Office editing was done for coding purposes and completed form was handed over to data management team. For quality assurance, data collection process was regularly monitored by the field supervisor. Daily debriefing were carried out among team members to identify the issues and challenges during the field testing process. In addition, refresher training of the assessment team members was conducted by field supervisor on regular basis.

Results

The study population was heterogeneous in its ethnic distribution. Distribution of boys and girls was almost equal. Overall parental literacy was low. However, as compared to the paternal, the maternal illiteracy was significantly higher. About

10% of the mothers and 22% of the fathers had some level of college education. Primary bread earner for the family was father, while only 7% of the mothers were gainfully employed. **Table 1** summarizes the demographic characteristics of study population.

The basic anthropometric measurements considered in the instrument were body weight, height and head circumference of the child (**see Table 2**). The indices considered in the study were height for age, weight for height, and weight for age. They were categorized at the -2 SD cut-off level according to WHO protocol to form stunting, underweight, and wasting indicators respectively. Stunting children was 23%, underweight 26% and wasting was about 12%. Association between socio-demographic factors and nutritional status is given in **Tables 3 and 4**.

Psychometric properties of CDA tool

Assessment of psychometric properties for the measures of developmental status has been done at various levels. Contents were validated by extensive literature review and expert

Table 1 Demographic characteristics of study population.

Characteristics	n (%)
Sex of the child	
Female	493 (49.2%)
Male	509 (50.8%)
Ethnicity	
Urdu	258 (25.7%)
Pashto	353 (35.2%)
Punjabi	381 (38.0%)
Sindhi	10 (1.0%)
Maternal Literacy	
Literate	662 (66.1%)
Illiterate	340 (33.9%)
Maternal Employment	
Employed	75 (7.5%)
Unemployment	927 (92.5%)
Father's literacy status	
Literate	809 (80.8%)
Illiterate	192 (19.2%)
Monthly income (Rs.)	
Mean ± SD	5,851.16 (133)

Table 2 Physical growth characteristics by age groups.

Characteristics	Child's Age			P-value
	Year I Mean (SD)	Year II Mean (SD)	Year III Mean (SD)	
Height (cm)	64.44(0.28)	75.81(0.59)	84.03(0.66)	0.00
Weight (cm)	6.42(0.01)	9.50(0.10)	11.10(0.10)	0.00
Head Circumference (cm)	41.70(5.1)	46.0(4.0)	97.1(2.9)	0.00
Wasted (wt. for ht.)				
Normal	551 (87.2%)	185 (88.0%)	148 (92.5%)	0.18
Wasted	81 (12.8%)	25 (12.0%)	12 (7.5%)	
Under wt. (wt. for age)				
Normal	497 (78.6%)	124 (59.0%)	113 (17.6%)	0.00
Underweight	135 (21.4%)	86 (41.0%)	47 (29.4%)	
Stunted (ht. for age)				
Normal	548 (86.7%)	116 (55.0%)	105 (65.4%)	0.00
Stunted	84 (13.3%)	94 (45.0%)	55 (34.6%)	

opinions during the conceptualization and consolidation phase. Concurrent validity was performed in the study, for this purpose the association of anthropometric attributes against psychometric assessment was evaluated.

Face validity of CDA tool was found good, because the layout and administration of indicators was acceptable and understandable by the assessors. The pictorial message was understandable by the caregivers and elder children; they appreciated the layout of CDA tool.

No significant difference was found between the male and female children with respect to indicators of psychomotor, language, and emotional development. This finding is congruent with the scientific literature regarding association between gender differences and mental development [20]. **General malnutrition:** Underweight children demonstrated significantly delayed performance for gross motor, fine motor, and language, emotional and cognitive development. **Acute malnutrition:** Wasted children demonstrated significantly delayed development for psychomotor indicators. **Chronic malnutrition:** Stunted children performed significantly delayed for gross motor; language and cognitive development (see Table 3).

Revision of the CDA tool

The CDA tool was revised on the basis of statistical results and through feedback and discussion with caregivers. For child assessment component; distribution of each item of the psychometric assessment was considered in terms of accelerated, normal or age appropriate and delayed development. Those items which got at least 50% of distribution in normal category were retained in that specific age group. The 50% cut-off was kept because it was the least possible number which could have

clearly distinguished the three categories (Table 4). If majority of the children exhibited in the delayed group than that item was shifted to the previous month as it was considered difficult for that age group to perform. If majority of the children performed accelerated development than item from the next month was brought into that category. In this manner 30 items were shifted in overall CDA tool either in previous or next age group.

For field-testing purposes each item was categorized into delayed, accelerated and normal options. These options were only valid for the tool development purposes and establishment of the norms. Then, from operational perspective of research or service provision, normal and delayed development options were kept and accelerated development option was eliminated from the CDA tool. During discussion and feedback from caregivers, items of each domain were reconsidered with respect to its mode of administration descriptor and illustration and modified accordingly.

Step III: External review

The modified version of CDA tool was finally evaluated by a panel of independent multidisciplinary external reviewers including national and international experts from the field of child psychiatry, child psychology, community health nursing and family practice. The objective was to get professional opinion on the construct and content validity of the revised draft of the CDA tool and suggestions about how to optimize its effective implementation in a community setting. Overall expert's response was very encouraging; they appreciated the whole concept of combining assessment and advice together and its use that will be beneficial in any ECD program. Experts agreed that assessment section is constructed to measure the holistic child

Table 3 Development characteristics according to child nutrition status for age.

Characteristics	Underweight			Wasted			Stunting		
	No n (%)	Yes n (%)	P-value	No n(%)	Yes n (%)	P-value	No n (%)	Yes n (%)	P-value
Gross motor									
Delayed	166 (22.6)	91 (34.0)	0.00	217 (24.6)	40 (33.9)	0.07	177 (23.1)	80 (34.3)	0.00
Appropriate for Age	317 (43.2)	117 (43.7)		386 (43.6)	48 (40.5)		341 (44.3)	93 (39.9)	
Accelerated	251 (34.1)	60 (22.4)		281 (31.7)	30 (25.4)		251 (32.6)	60 (25.8)	
Fine motor									
Delayed	144 (19.6)	80 (29.9)	0.00	189 (21.4)	35 (29.7)	0.00	160 (20.9)	64 (27.5)	0.11
Appropriate for Age	327 (44.6)	133 (49.6)		399 (45.1)	61 (51.7)		361 (46.9)	99 (42.5)	
Accelerated	263 (35.8)	55 (20.5)		296 (33.5)	22 (18.6)		248 (32.2)	70 (30.0)	
Language									
Delayed	342 (46.7)	151 (56.3)	0.02	436 (49.3)	57 (48.3)	0.59	360 (46.8)	133 (57.1)	0.03
Appropriate for Age	328 (44.7)	100 (37.3)		374 (42.3)	54 (45.8)		343 (44.6)	85 (36.5)	
Accelerated	63 (8.6)	17 (6.3)		74 (8.4)	7 (5.9)		66 (8.6)	15 (6.5)	
Cognitive									
Delayed	160 (21.8)	85 (31.7)	0.00	212 (24.0)	33 (28.0)	0.23	173 (22.5)	72 (30.9)	0.00
Appropriate for Age	380 (51.8)	147 (54.9)		462 (52.3)	65 (55.1)		397 (51.6)	130 (55.8)	
Accelerated	193 (26.3)	36 (13.4)		210 (23.7)	20 (16.9)		199 (25.9)	31 (13.3)	
Social/Emotional									
Delayed	137 (18.7)	70 (26.1)	0.00	171 (19.4)	36 (30.5)	0.01	150 (19.5)	57 (24.5)	0.19
Appropriate for Age	407 (55.5)	156 (58.2)		500 (56.5)	63 (53.4)		443 (57.6)	120 (51.5)	
Accelerated	189 (25.8)	42 (15.7)		213 (24.1)	19 (16.1)		176 (22.9)	56 (24.0)	

Table 4 Percentage distribution of age appropriate development with respect to item considered in respective developmental milestones -dark shaded areas represents at least 50% of the observations were age appropriate for the item.

Months	1	2	3	4	5	6	7	8	9	10	11	12	15	18	21	24	27	30	33	36
Gross m.	80	33	48	67	74	5	42	32	19	43	44	35	22	44	44	65	40	18	33	100
Fine m.	90	2	19	64	72	26	35	53	58	26	65	45	39	40	23	64	21	80	42	57
Language	68	52	75	45	32	26	87	22	12	13	52	18	80	29	23	22	71	53	31	77
cognitive	82	52	81	27	64	26	42	46	48	72	31	82	57	13	87	24	48	65	54	67
Emotional	90	57	48	78	11	56	79	47	8	89	46	55	63	44	54	69	52	58	40	100

development and individual items are relevant to the domains of development, are discriminatory in nature and arranged in a progression manner. They appreciated the CDA tool face value and item construct for its appropriateness to the culture. Few content and structural changes were suggested that led to further modification in the educational component of CDA tool, e.g.: 11 month-Repeats acts that are praised, experts asked how it was different from Obsessive compulsive, so we added the purpose and made the instruction clearer”.

Discussion

The CDA tool is a resource tool for frontline health providers for child assessment and parent education that fulfills the dire need for community based ECD programs. It can be used as a surveillance tool to track child development during birth to three years. CDA tool provides rapid and comprehensive child assessment in five developmental areas; these are four gross motor, fine motor, language and cognitive development. This tool is an empirically derived measure that assesses growth and development during first year on monthly basis and quarterly in second and third year of child’s life. It is more relevant with Pakistani culture however can be used across the globe in resource poor countries.

Professional assessment is expensive, resource intensive and difficult to cover large populations. This is why in population based research studies parent report questionnaires are widely used [21, 22], but validity of parent report is questionable because of the personal bias and low educational attainment of parent’s especially in developing countries [23, 24]. The CDA tool is intended for use by community based workers (CBWs) that give opportunity for actual and direct child assessment and serve as a guide for mothers to observe the growth and development of their children and refer to the age associated information provided by the CDA tool with the consultation of CBWs. As we have very limited child care assessment resources in developing countries and mostly used milestones checklist which do not have clear child assessment criteria, CDA tool has clear criteria for achievement and risk for development, therefore professionals, pediatricians, psychologists, nurses and other child-care professionals can use CDA tool to screen for developmentally relevant problematic areas and educate caregivers during home visits and routine health checkups. This routine ongoing assessment save time of families and reduce financial cost of over referral and extensive assessment [25].

The CDA tool has high face validity, pictorial presentation of all the content in child assessment and caregiver’s advice section allows the opportunity for caregiver, to understand the messages and child developmental milestones with the consultation of frontline

workers. High face value of the tool and pictorial expression, open the communication between health care providers and parents that increases the collaboration among them and encourages parents to create favorable and stimulating environment for child development and learning, apply positive parenting and increase school readiness [26]. Harkness et al. [27] highlighted that culture has major effect on parenting practices that produce difference in children’s development. All the items included in the CDA tools are socially, culturally and developmentally valid that acceptable to the Pakistani population and are found noninvasive for parents and children [28].

The initial field testing for norms development of CDA tool indicates sound psychometric ability in terms of its contents’ validity as well as concurrent validity, especially for physical health indicators and some of the socio-demographic variables. All developmental indicators met the established validity and reliability criteria that are at least 50% child population achieving the indicator. In a study Simien et al. [29] kept the 30% frequency for normal behavior and 10% frequency for problematic behavior.

Most of the child developmental problems and disabilities are detected by front line health care providers during routine health checkups of children and usually used invalid checklists with unclear scoring criteria and consist of number of items that took more than 30 minutes time. The CDA tool has only 5 critical indicators for each age period, only one item in each developmental domain which hardly takes 10-20 minutes to complete. This brief screen is easy to administer and is used to track the child development, identify the child who are at risk of development and who require more intensive assessment and referral for early diagnosis and intervention. We are recommending the use of CDA tool in child health surveillance program both in community setting and health facility setting to get the broader picture of child skills and abilities over different time periods in a continues manner with timely intervention and corrective measures that is recommended, keeping in mind that onetime assessment or observation do not give clear idea about child skills and weaknesses in social environment [30-33].

Cost, staff education and extensive training is another issue that is associated with several standardized tools [31], CDA tool is intended to use by community based workers who have ten to twelve grade of education and requires minimum basic training on concepts of child development, CDA tool’s assessment and ability to develop referral system with health facility is available in the community.

“Advice for caregiver section” of CDA tool gives opportunity for caregivers to develop conducive environment for child’s learning

and development. All the suggestions given in the “advice for caregiver section” emphasized on the best ECD practices that is related to child’s health, nutrition and stimulation” these messages were developed with through literature review and consultation of experts opinion in terms of child health and developmental benefits and cultural relevancy. One of the key feature of these advised is the pictorial expression, so the illiterate women living in the disadvantages neighborhood can easily understand the educational message as highlighted by Akhund et al. [25]. The caregivers’ active interest and enthusiasm during pre testing in this educational section and their comments regarding education component also showed the relevance of information for them.

Limitation

One major limitation of this study was the cross sectional nature, although the study population was heterogeneous however for the population norms development, an extensive equally representative ethnicity, cluster based study recommended. Again for criterion validity, predictive validity was not possible due to the limitation of the cross sectional study design ECD is relatively a new field we tried to compile many best ECD practices in caregiver’s advice section but due to structure and layout limitation many were left that can be incorporated according to the culture while implementing a parenting education program. The field trial of CDA tool gave us very initial findings about psychometric properties of the CDA tool, despite the promising results, future research is necessary to develop population norms and to establish concurrent validity with a referenced goal standard like Bayley or other screening tool. Development of norms on CDA tool for special children and hospital population is also recommended which would provide further evidence that how the tool works on special population. Parents report about child development is also an integral part of child assessment that was not addressed in CDA tool because of the standardized procedure of assessment and reporting bias elements however in a surveillance program addressing parents’ concerns will

be beneficial and support in early identification of delays [34]. Usually, screening tools do not give complete picture and provide diagnosis, so careful through assessment is needed if positively identified on CDA tool and some time has over-referral tendency. Lastly, this study did not assess other contextual factors that effect on child development and should be considered such as family size, neighborhood and day care setting participation.

Conclusion

The thoroughly planned steps of CDA tool development and its field trial suggested that there is great utility of CDA tool in ECD programs and the CDA tool can serve as a useful and valid measure of child assessment and advice for caregivers in an ECD parenting program that can be used by trained frontline health workers. We recommend incorporating the CDA tool in country wide basic health care surveillance system and applied as two stages screening system that can support in early identification of child developmental problems during home visit by frontline health care worker or early childhood practitioners and provide early intervention by educating mothers to develop favorable environment for child development that is followed by multi experts assessment for children who are at risk of developmental delays and disabilities [35, 36].

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