

# Standardization and adaptation of the Denver Developmental Screening Test (DDST) for use in Tbilisi children

*Gocha Chikvinidze\**, *Nana Geladze\**, *George Natriashvili,\**  
*Zurab Tsigroshvili\*\**

\* Tbilisi State Medical University Pediatric Clinic Department of Pediatric Neurology  
\*\*Georgian Academy of Science A. Razmadze Mathematical Institute, Tbilisi, Georgia

## **Abstract**

Objective - To modify and standardize the Denver Developmental Screening Test (DDST) for developmental screening of children in Tbilisi. Method - The study used a quota sample of 1006 Children of Tbilisi, aged 16 days to 6 years. The study protocol was based on the DDST. The Logistic Regression Analysis established the 25th, 50th, 75th and 90th percentile passing age for achieving all 105 Denver Developmental Screening Test tasks. The composite norms were compared with DDST data. The differences were examined by calculating the percent differences between the comparable items. Subgroup differences in sex were analyzed by stepwise logistic regression. Modifications were introduced to improve on the sensitivity of the test and to make the test more suited to Tbilisi children. Main findings - All 105 items of DDST were used to form the new test "DDST-Tbilisi". Among the comparable items, differences between the norms of Tbilisi and Denver children greater than 10% were demonstrated in 36 items. Within the study sample of Tbilisi children, there were no statistically significant subgroup differences. Conclusions - The "DDST-Tbilisi" is substantially different from the DDST. The use of the local standardized version in clinical practice for developmental screening of Tbilisi children is justified.

**Keywords:** *developmental screening, Denver Developmental Screening Test, standardization, regression analysis*

## **Introduction**

Developmental screening has become an established component of child health surveillance in many developed countries. While the efficacy of developmental screening remains controversial, its value as an integrated part of a total health surveillance programme for young children is well accepted [2, 8].

The lack of clearly defined normative data on child development in Georgia necessitated the development of a structured, standardized developmental screening test based on local norms.

The objective of this study was to adapt and standardize the Denver Developmental screening test (DDST) for

use in Georgia for developmental screening of children aged 4 weeks to 6 years.

The DDST was Chosen because it met our needs for a test that is standardized in administration and objectively scored, referenced to a norm, reliable, valid and broadly focused on all areas of development from 2 weeks to 6 years. It is suitable for use by pediatric neurologists and pediatricians who do not have extensive training in child development. It is also widely used in many countries in the world [3].

## **Material and Methods**

The data for the study were collected between Jan2000 and May 2002. The sample consisted of 1006 children from Tbilisi aged 16 days to 6 years 8 months. The

sample was drawn from the next sources: Pediatric clinic of Tbilisi State Medical University, outpatient clinics, kindergartens and primary schools of Tbilisi. Similar to DDST study, a quota sample was used. Children were recruited to meet the quota proportions in term of sex (50% male, 50%female) and age. Because developmental changes in younger children precede at a more rapid rate those in older children, the sample consisted of a larger proportion of younger children. 4 medical doctors took part in data collection (2 pediatricians and 2 pediatric neurologists). Besides the authors, statisticians were involved in the protocol planning and statistical analysis of the study. Children with conditions, which are known to be associated with delayed development, were excluded from the sample [1, 3].

Selection of items: Data for 105 items were collected and analyzed. The selection of an item for inclusion in the "DDSST-Tbilisi" was based on whether it was:

1. Easy to administer and score;
2. Well liked by the tester and children;
3. Low in the scores for "No Opportunity", "Refusal";
4. Minimal difference between the subgroup and the composite norm;

Data collection commenced only after the testers had achieved interested reliability scores of more than 90%. The result of the "PASS/FAIL" outcome for each item was then used in the computation for the normative data.

**Modifications:** Only 2 items: "Plays pat a cake" and "Dada or Mama, nonspecific" were modified. The modifications were necessary as the social habits; child rearing practices and language of Georgian children are different from the Denver children. Georgian parents and children also react differently to test situations. These differences were reflected most obviously in the language and personal-social sectors. The modifications were also made in order to improve the sensitivity of the test as the DDST had been criticized for lacking in sensitivity in picking out less severe handicaps and for its weakness in the language sector [6, 7].

**Statistical analysis:** Logistic regression analysis was used to determine the 25th, 50th, 75th, 90th percentile passing ages for all items. Several statistical processes, including the goodness of fit statistics suggested by Lemeshow and Hosmer were used to obtain the best fitting of the regression lines. To determine if significant differences existed between subgroups, the statistically significant subgroup variables were identified by running a backward stepwise logistic regression analysis [3, 4, 5].

## Results

The main outcome of the study was the determination the normative data on development for Tbilisi children population, i.e. establishing the 25th, 50th, 75th and 90th percentile passing ages for all 105 items of DDST and production of the "DDST-Tbilisi" test form.

Comparison with DDST: There were 25 items (24% of the comparable items) At the 90th percentile passing age and 20 items (19%) At the 50th percentile passing age with more than 10% differences between "DDST-Tbilisi" and DDST.

The format of presentation closely resembles that of DDST. Each item is presented as a bar. Each of the four areas of development, personal-social, fine motor-adaptive, language and gross motor are represented by a set of item bars. Reading against the age scale, each bar depicts the 25th, 50th, 75th, and 90th percentile passing ages for the test item. The items that can be passed by "Report" are preceded by "R". A new behavior sector was added to record the child's behavior during the test, e.g. his alertness, compliance to tester's instructions, to assist the tester in the interpretation of the child's performance and to improve sensitivity of the test.

The sensitivity of "DDST-Tbilisi" was also increased by lowering the failing criteria. An item was scored as "Delay" when a child older than the 90th percentile passing age, failed the item. It was scored as "Caution" if the child who failed, was between the 75th and 90th percentile passing ages. If a child scored two or more "Caution" or up to one "Delay" in the entire set, his development was classified as "Questionable". Development was "Abnormal" if there were two or more "Delays". These scoring criteria may have to be adjusted pending the results of the evaluation study.

## Conclusion

1. The DDST was modified and standardized to suit the Georgia culture. Other modifications were also introduced with the aim to improve the sensitivity of the test.
2. The differences in the norms more than 10% between Tbilisi and Denver children were shown in 36 of the 105 items of the test.
3. Although there were a number of differences among subgroups, they were not significant enough to justify the use of different sets of norms for each subgroup.
4. Based on these reasons, the use of "DDST-Tbilisi" as the preferred test for the screening children in Tbilisi is justified.

## References

1. Naquib N. et al. The standardisation of the Denver Developmental Screening Test on Arab children from the Middle East and North Africa. J.Med. Liban 1999 Mar-Apr;47(2):95-106.
2. David R. B. et al; Child and Adolescent Neurology. Mosby; 1998.17-18,61. (639).
3. Frankenburg W. K. et al. Denver Developmental Screening Test. Manual. University of Colorado Medical center; 1970.3-17. (67)
4. Fung K.P. et al.Denver Developmental Screening Test: cultural variables. J. Pediatr. 1985 Feb; 106(2): 343.
5. Lemeshow S, Hosmer DW, A review of goodness of fit statistics for the use in development of logistic regression models. Am J Epidemiol 1982; 115: 92 - 105.
6. Lim H.C. et al. Standardisation and Adaptation of the Denver Developmental Screening Test (DDST) and Denver II for Use in Singapore Children. Singapore Med. J. 1994; Vol 35: 156-160.
7. Sriyaporn PP et al.Denver Developmental Screening Test survey of Bangkok children. Asia Pac J Public Health 1994; 7(3): 173-7.
8. Swaiman K. F., Ashwal S., Pediatric Neurology. Third Edition.Vol.1. 2-7; 314; 551-575.

## Стандартизация и адаптация скрининг-теста развития Денвера (СТРД) для детской популяции г. Тбилиси

*Гоча Чиквинидзе, \* Нана Геладзе, \* Георгий Натриашвили, \* Зураб Цигрошвили, \*\**

*\*Кафедра детской неврологии Тбилисского государственного медицинского университета, Грузия;*

*\*\*Институт математики им. А. Размадзе Академии наук Грузии*

### РЕЗЮМЕ

Оценка развития является обязательной составной частью неврологического обследования ребёнка. Дети, находящиеся в различной социальной, бытовой и культурной среде, приобретают одни и те же навыки в различном возрасте. Это утверждение основано на многолетнем использовании и последующем анализе данных некоторых систем оценки, в частности, широко распространённого во всём мире скрининг-теста развития Денвера - СТРД (Frankenburg и Dodds, 1975). Крайне важным является разработка маркеров развития для детской популяции Грузии, так как на сегодняшний день нет адаптированной для нашей страны объективной, систематизированной методики оценки развития. Целью нашего исследования являлось: 1. разработка математически и статистически обоснованных маркеров развития для детской популяции Грузии; 2. адаптация и стандартизация СТРД в г. Тбилиси для его последующего применения в клинической практике. Обследовано 1006 здоровых детей в возрасте от 16 дней до 6 лет 8 месяцев (2430 дней), проживающих в различных районах г. Тбилиси. После статистической обработки полученного материала установлены показатели возрастных норм развития для тбилисской детской популяции, а также создан скрининг-тест развития "СТРД-Тбилиси".

**Ключевые слова:** *скрининг развития, СТРД, стандартизация, регрессивный анализ*