

# INFANTS DEVELOPMENTAL MILESTONE PATTERN OF SHIRAZ (IRAN) IN RELATION TO THE DENVER CHART

S.M.T. AYATOLLAHI, Ph.D., F.S.S., C. Stat, AND A.R. MOGHISI,  
M.B.B.S., M.D., M.P.H.

*From the Department of Biostatistics and Epidemiology, Shiraz University of Medical Sciences, P.O. Box  
71345-1874, Shiraz, Islamic Republic of Iran.*

## ABSTRACT

This paper presents standardized norms of child development in Shiraz (Iran). A birth cohort of 317 randomly selected neonates born at the 14 maternity clinics of Shiraz during 2 random consecutive weeks in 1996 were followed at homes for 2 years at 12 designed occasions and their development examined by 2 trained public health officers and a community medicine expert. In gross-motor and personal-social sectors, girls were earlier than boys in "crying", "head control" and social smile items respectively. In fine motor-adaptive sector boys showed more advancement in the "thumb-finger grasp" and "pass cubes" items. Boys development in language, personal-social and fine motor-adaptive sectors were earlier than girls in items "ooo/aaah", "papa, mama", "recognize relatives", "look for yarn", "recognize own nipple and bottle" respectively. The rest of the items passed by boys and girls were the same in both groups and not favoured to any one. The subjects developed slower than the Denver sample in one item in fine motor-adaptive and personal-social sector. However, Shiraz infants were earlier than Denver ones in the item of other sectors, but, in general, no statistically significant differences were detected. The paper concludes that the Denver Developmental Screening Test (DDST), in general, is a valid developmental screening instrument which may be used in Iran with the adjustments presented. Public health nurses may apply these key item skills, in that the use of a standard gives them an increased insight into child development.

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## INTRODUCTION

The development of the human organism is a very large complex topic, but in order to identify and treat underlying disorders, it is important for all who care for children to be familiar with normal patterns of growth and development, so that they can recognize abnormal variations.<sup>1</sup>

Developmental screening is particularly important in the first two years of children life. These are the years during which infants benefit most from the early identi-

fication of deficits<sup>2</sup> and is of special concern in public health nursing.

The Denver Developmental Screening Test (DDST), designed in 1967, has widely been used as a developmental screening test for children from birth to 6 years of age.<sup>3</sup> The test items are arranged in four areas of gross motor, language, fine motor-adaptive and personal-social development.<sup>4</sup> Reliability,<sup>5-6</sup> validity<sup>7-8</sup> and sensitivity<sup>9</sup> of the DDST were examined since its invention. Several studies have been carried out across the world to apply and standardize the test for different nations.<sup>10-27</sup>

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A Pre-screening developmental questionnaire was then revised and a major revision and re-standardization of the DDST was made and called Denver II.<sup>28,29</sup>

At present no published data is available on child development in Iran. Public health nurses use DDST, which due to cultural differences from the Denver population may fail certain items and would be misleading. The purpose of this paper is, therefore, to study the developmental milestone pattern of 0-2 year old infants of Shiraz (Southern Iran) in relation to the Denver data.

### MATERIAL AND METHODS

Nearly all pregnant women in Shiraz (97.5%) give birth in hospital. A cohort of 317 healthy neonates (164 girls and 153 boys) were selected randomly using probability proportional to size scheme among those born at the 14 maternity clinics of Shiraz during 2 random consecutive weeks from 7th to 20th of June 1996 with a random start. The selected subjects were healthy singleton neonates whose mothers conceived them in Shiraz and their parents did not intend to migrate elsewhere during the study period. They were visited at homes at target ages 1.5, 3, 4.5, 6, 8, 10, 12, 15, 18, 21, and 24 months and their developmental milestone in four different sectors (language, fine motor-adaptive, gross motor, social-personal) were examined by direct observation, if applicable or interviewing with mothers in a check list using DDST. Age of reaching a milestone was recorded exactly as in Denver. Five trained public health officers observed infants in the first year of study. In the second year 4 of them left the study and 4 newly trained public health officers were employed. All observers had a bachelors degree (B.Sc.) in the area of public health and/or nursing and midwifery with distinction. In addition 4 community medicine experts monitored the subjects for 3 months from birth. Once it was needed, infants were referred to a consult-

ant pediatrician for the whole study period. A subject was considered as missing if he/she was not in for any reasons when home visit was performed at least 3 times at that occasion or his/her family migrated elsewhere for unseen reasons or decided to leave the study or the baby died. The selected cohort was a 2.5% sample of neonates born in 1996 in Shiraz.

Ages at each occasion were recorded exactly based on the difference between date of visit and date of birth in days and then converted to months.

Infants' age was corrected for his/her gestational age (GA) if GA was < 38 weeks as in the Denver study. In this case the infants age was calculated as:

$$\text{AGE (from EDD)} = \text{AGE (from birth)} - 40 + \text{GA}$$

where EDD stands for expected date of delivery which is 40 weeks. Observations were included only if AGE from EDD was greater than or equal to zero.

Birth weights of 9 subjects (2.8%) were under 2500 grams (ranges 2050 to 2450 grams), the distribution was consistent with the Denver subjects. No failure to thrive subjects were observed.

Z test was used to examine sex difference in developmental milestones at each occasion. A comparison was made between our data and the Denver sample in passing developmental items by 90% of all subjects in a given age using D index presented by Ueda<sup>14</sup> and calculated as  $D = \{[(A-B)/A] * 100\}$ , where A is the age of the infant by which item in a given month passed and B stands for age in which item was passed by a Denver subject. If  $D < -20$  or  $D > 20$  the difference would be declared significant. Significant negative (or positive) D's indicate our subjects were faster (or slower) than Denver subjects. Five percent level was used for declaring significance.

### RESULTS

Table I presents developmental milestones in which

**Table I.** Developmental milestone by attained age of Shiraz infants in which girls develop faster ( $G > B$ ) or slower ( $G < B$ ) than boys.

Milestone Item	MARA	P-value	Direction
Crying	Birth	0.0082	$G > B$
Head control	1.1	0.0010	$G > B$
Social smile	1.1	0.0001	$G > B$
ooo/aaah	2.6	0.0434	$G < B$
Pass cubes	8.0	0.0016	$G < B$
Saying papa-mama	8.0	0.0001	$G < B$
Recognizing relatives from distances	14.8	0.0444	$G < B$

In all tables MARA stands for mean age of reaching a milestone (month).

**Table II.** Items of language sector attained by Shiraz infants compared to the Denver sample.

Language Items	Month and number passed by 90%				
	Denver	N	Shiraz	N	D
Respond to bell	Birth	566	Birth	308	—
ooo/aah	2.7	796	2.6	306	-3.8
Laughs	3.1	994	3.9	306	20.1*
Turn to voice	6.6	1136	3.9	298	-69.2*
Single syllables	7.5	1153	8.0	305	6.3
Imitate speech sound	8.8	1309	9.8	306	10.2
papa/mama	9.1	934	8.0	307	-12.1
one word	15.0	1004	11.7	300	-28.2*
three words	18.0	1004	14.8	298	-21.6*
combine words	24.1	994	23.4	307	-3.0

**Table III.** Items of fine motor adaptive sector attained by Shiraz infants compared to the Denver sample.

Fine motor Adaptive	Month and number passed by 90%				
	Denver	N	Shiraz	N	D
Follow to midline	1.3	796	1.1	306	-18.2
Hands together	4.0	944	3.9	307	-2.6
Follow 180 degrees	4.5	1071	5.8	300	22.4*
Reaches	5.6	945	5.8	300	3.4
Look for yarn	7.2	1154	8.0	302	10.0
Pass cubes	7.7	1153	8.0	298	3.0
Thumb finger grasp	10.2	947	8.0	306	-27.5*

girls and boys were significantly different in passing certain items. It can be seen in gross-motor and personal social areas, girls developed faster than boys in “crying”, “head control” and “social smile” items respectively. In fine motor-adaptive, language and personal-social areas, boys developed faster than girls in “pass cubes”, “ooo/aaah”, “saying papa, mama”, and “recognize relatives” items respectively. However, girls developed faster than boys in “crying”, “head control” and “social smile” items. The rest of items passed by boys and girls were the same in both groups and not favoured to anyone.

Items of language sector attained by 90% of Shiraz

infants were compared to their Denver counterparts in Table II. Shiraz infants developed faster than Denver children in three items (turn to voice, one word, three words) while the former is slower in the development of laughs than the latter.

Items of fine-motor-adaptive sector attained by 90% of our subjects were compared to that of the Denver sample in Table III. Denver sample was faster than our sample in the development of one item (follow 180 degrees). However, the case was reversed with thumb-finger grasp item as our infants developed faster.

Table IV presents items of gross motor sector attained by 90% of our subjects as compared with Denver chil-

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**Table IV.** Items of gross motor sector attained by Shiraz infants compared to the Denver sample.

Gross Motor Items	Month and number passed		by		90%
	Denver	N	Shiraz	N	D
Reflexes	Birth	875	Birth	308	—
Lift head	Birth	875	Birth	306	—
Head up to 45 degrees	2.7	876	14.8	306	-81.8*
Head up to 90 degrees	3.6	874	2.6	305	-38.8*
Sit head steady	3.7	879	2.6	302	-42.3*
Bear weight on legs	4.4	944	5.8	298	24.1*
Roll over	5.4	1071	5.8	300	6.9
Sit no support	6.8	1008	8.0	307	15.0
Stand holding down	8.5	730	8.0	298	-6.3
Stand 2 seconds	11.6	675	11.7	306	0.9
Stand alone	13.7	730	14.8	308	7.4
Walk well	14.9	572	14.8	301	0.7
Walk backwards	16.6	704	17.9	300	7.3
Walk up steps	21.6	572	20.3	307	-6.4
Kick ball forward	24.9	904	23.4	306	-6.4

dren. Shiraz infants developed faster than Denver children in two items (control head up to 90 degrees, sit head steady). In “control head up to 45 degrees” and “bear weight on legs” the Denver sample developed faster than ours.

Table V shows items of personal social sector attained by 90% of Shiraz children as compared with that of the Denver sample. Our infants developed faster than Denver in five items (social smile, wave bye-bye, drink from cup, remove garment and play ball).

Apart from the significant differences between Shiraz and Denver infants, as mentioned here, the developmental milestone pattern in the two samples was comparable.

### DISCUSSION

Girls developed faster than boys in an item of personal social sector (i.e., social smile item). A similar result in the same sector (i.e., self-learning) was observed in Turkey,<sup>20</sup> a neighbouring country with some common cultural interests.

In the language sector of development, our boys developed faster than girls, but in other items of this sector no differences was seen in a given month between sexes. This finding was in contrary to some other studies<sup>14-15, 20</sup> The reason may be that boys are more attractive and attentive to families in developing countries and are paid more attention in language practice in in-

fancy.

In the gross-motor sector of development, boys were similarly developed as girls, which concurs with other studies in this regard.<sup>15, 20</sup> In the same sector of development, our infants developed faster than Denver data in one item at infancy period. However, Denver children developed extremely faster than their Japanese counterparts in gross-motor sector<sup>14-15</sup> indicating that our children developed faster than Japanese infants.<sup>14</sup>

Denver children developed highly significantly faster than ours in fine motor-adaptive, except in one item (thumb-finger grasp). Similar findings were observed in a study in Japan, reflecting the differences in the life style of the two nations. The same reason for the differences could be applicable in Iran, whose children are more dependent to their families than in the west.

No significant difference was seen between Denver and Shiraz infants in three sectors of development. However, in fine motor-adaptive sectors, depending on the degree of autonomous personality, Denver children developed faster than ours.

Comparison of our results with other studies shows that Shiraz infants generally developed more faster than children of the developing world, but slower than the standard children (Denver). Nevertheless, comparison of our findings with that of Denver or other studies should be treated discreetly, due to differences in the methodologies applied.

**Table V.** Items of personal-social sector attained by Shiraz infants compared to the Denver sample.

Personal social Items	Month and number passed by 90%				
	Denver	N	Shiraz	N	D
Regard face	Birth	643	Birth	306	—
Social smile	1.5	786	1.1	303	-36.6*
Spontaneously smile	2.1	784	2.6	308	19.2
Regard own hand	4.0	645	3.9	300	-2.6
Work for toy	5.9	1050	5.8	305	-1.7
Wave bye bye	14.0	973	9.8	308	-42.1*
Indicate wants	12.9	761	14.8	306	12.0
Drink from cup	17.1	812	9.8	300	-74.5*
Remove garment	23.9	973	14.8	299	-61.5*
Play ball	15.7	783	8.0	300	-96.3*
Body part	24.4	793	23.4	306	-4.3
Walk well	14.9	572	14.8	301	0.7
Walk backwards	16.6	704	17.9	300	7.3
Walk up steps	21.6	572	20.3	307	-6.4
Kick ball forward	24.9	904	23.4	306	-6.4

Clearly, clinical work in Iran requires more relevant norms. Our development data are based on a representative sample which comprises all regions and classes of Shiraz infants in a well designed longitudinal study, while most earlier surveys were gathered from children attending clinics or health centers, who are unlikely to form a representative sample. Therefore, the charts provided here may be regarded as standard reference values for infants of Shiraz, which can be applied to the urban population of Iran due to the representativeness of our data. The methodology provided here has proved to be successful for conducting surveys in other areas. However, we suggest that due to changing characteristics over time local developmental milestone standards are to be updated periodically.

Use of this standard is an economical and efficient way to screen the development of infants by nurses. The establishment of screening programs in which local education systems offer free developmental assessment is recommended in which nurses would be active. A major reason that primary health care providers do not routinely use developmental screening tests is a lack of time and personnel. Thus brief yet accurate developmental screening procedures are needed as presented here in the key items, which can be applied easily by nurses for preventive measures as well as in interventional follow ups.

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