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Effect of Violating the Indicated Age Window For a Parent-Completed Child Development Screening Questionnaire[1]

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ABSTRACT

The sensitivity of developmental screening tests depends on age-referencing. We investigated the effect on screening positive on the Ages and Stages Questionnaires (ASQ) — parent-completed questionnaires for children 4 to 60 months — depending on being within or outside the indicated age window for a questionnaire. Data came from a Norwegian population sample including 2,633 questionnaires. 10% of appropriate-age children screened positive in comparison to 22% of 1-2 months too young and 5% of children 1-2 months too old. The results highlight the importance of paying close attention to the child's age in developmental screening.

INTRODUCTION

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The age of the child is part and parcel of developmental assessment. Developmental screening tests tap children's normative, age-referenced development with the purpose of detecting states and conditions that bring with them general or specific developmental delays. Possible delays are then assessed against the actual age of the screened child. Because the sensitivity of the tests thus depends on age-referencing, the effect of age variations on the results of the screening test needs to be controlled for.

Brief parent-completed child development screening instruments such as the Ages and Stages Questionnaires (Bricker & Squires, 1999; Squires, Potter, & Bricker, 1999) control for the age of the child by defining an age window for the administration of a specific form of the questionnaire. In the specific case of the *Ages and Stages Questionnaires*, an age frame of ±1 month from the target age for a specific form of the questionnaire is defined as appropriate. For example, the 12-month questionnaire may be administered to children whose age (adjusted for premature birth according to certain criteria) is from exactly 11 to exactly 13 months.

However, to our knowledge, there are to present no studies of the sensitivity of development screening questionnaires to violations of the age window for completion. In the present study we had access to parent-completed child-development screening questionnaire data from a population sample of children, gathered for normative purposes. While the intention was to sample only children who fell within the indicated age frame, because of the effects of premature birth and late completion of questionnaires, the data set included some children whose adjusted ages were both too old and too young for the questionnaires. In the present study, we investigated the effects of screening positive on the ASQ, depending upon the child being within or outside — either too young or too old — the indicated age window for the questionnaire interval.

While being born prematurely by a few weeks to a great extent has the effect of a corresponding delay in development (such that the child's age adjusted for premature birth more or less will represent the expectation of development), very premature birth brings with it a heightened risk for qualitatively different consequences which are not comparable to an age delay. In an effort to single out such consequences from the results of a slight delay, we performed a separate analysis excluding children born more than six weeks prematurely.

METHOD

Participants

The sample consisted of 2,392 mothers in total, after eight untraceable mothers had been excluded from an initial 2,400 sampled from the Norwegian population and birth registers by Statistics Norway. Norwegian-born mothers of children born on specific dates (±3 days), in order to be of appropriate ages at the time of receipt of questionnaires, were included. Equal proportions of boys and girls were sampled for each age group. No more than one child per mother was sampled; twins were not included. Two hundred and forty mothers of children aged 4 months were sampled, and 120 mothers of children aged 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 27, 30, 33, 36, 42, 54, and 60 months.

Materials

The present data stem from a nation-wide population-sample normative-data collection for the Norwegian translation of the Ages and Stages Questionnaires (ASQ), 2nd edition (Bricker & Squires, 2003; Janson, 2003b). The ASQ is a series of 19 parent-completed screening questionnaires for child development, specific to the ages of 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 27, 30, 33, 36, 42, 48, 54, and 60 months. Each questionnaire consists of five 6-item scales: Communication, Gross Motor, Fine Motor, Problem Solving, and Personal-Social. Children's scores on each scale are compared to age-specific cutoffs, and if the score falls on or below the cutoff, the screen is positive, suggesting that the child may need further evaluation. The questionnaires were back translated into Norwegian (versions in both standard forms — Bokmål and Nynorsk — were produced). Janson (2003b) presented

descriptive results of the study along with details of the translation and adaptation. Janson and Squires (2004) compared the Norwegian and U.S. normative findings. Richter and Janson (2007) studied associations between continuous ASQ scale scores with several socio-demographic background variables and premature birth.

Procedure

About 7 days before the day when the children would be of the target age, the appropriate ASQ for the child's age was mailed to the mother along with information about the project and a prepaid, pre-addressed response envelope. One reminder was sent. 1,461 questionnaires (61%) were returned. After an age interval of 2, 3, or 6 months, as appropriate, the next ASQ form was mailed to those who had responded the first time (except for half of the mothers of children aged 4 months, and the mothers of children aged 60 months at the first mailing). 1,172 out of 1,331 mothers (88%) responded to the second mailing (one reminder was sent). In total, 2,633 questionnaires were returned. Further details of the procedure were presented by Janson (2003a; 2003b).

Data treatment

The child's birth date (±3 days) was given by the sampling criteria. A record was kept of the date of return of each questionnaire. In those cases where a mother had not filled out the date of completion, the assumed date was imputed based on a linear regression of actual date of completion on actual date of return of questionnaires with non-missing completion dates (adjusted for varying mailing times depending on region). Based on these data, an estimate of each child's exact age in days at the time of completion of the questionnaire was obtained. Mothers were asked whether the child was born more than two weeks prematurely, the number of weeks premature if applicable, and the date of completion of the questionnaire. These data were used to calculate the adjusted age in days of children who were born at least 2.5 weeks prematurely. For the purposes of the current analyses, the difference in days between the adjusted age of children and the appropriate age for the administered form of the ASQ (in days, based on equally long months), was calculated.

Ethical considerations

The project was approved by the Regional Medical Research Ethics Committee, Health Region South (II), Oslo, Norway. The information accompanying questionnaires included a statement that participation was optional, a guarantee of confidentiality in data treatment (including the information that the key to subjects' identities was kept by Statistics Norway and destroyed after data collection), a statement that the project would not contact the subjects again if they did not reply to two mailings, and a statement that a respondent could withdraw participation and ask for deletion of collected data.

RESULTS

Table 1 shows the proportions of children who were screened by one or more area scores falling on or below a cutoff value on the completed ASQ (using the Norwegian cutoff scores published in Janson, 2003b), by the difference between the age of the child at completion of the questionnaire (corrected for premature birth) and the target age for the questionnaire. The table combines data for the 19 age-specific forms of the ASQ. The leftmost two data columns show data for all 2,633 questionnaires. The total numbers of children falling within each age difference category is given, along with the percentage of children who screened positive according to the cutoff-score criteria. The proportion of screened-positive children varied significantly and importantly as a function of the adjusted age of completion of the questionnaire. While the proportion of children screened positive was 10% in the large group of children of the appropriate age for a questionnaire, the corresponding numbers for children 1-2 months too young and 1-2 months too old were 22% and 5%, respectively. With greater departure from the appropriate age, the proportion of children screened positive departed even more from that in the age-appropriate group.

The rightmost two data columns of Table 1 show the results when children born more than six weeks prematurely had been excluded from the analyses. It can be seen that even excluding these children, the results for children 1-2 months too old or too young seem to hold: Compared to the appropriate-age group, about twice as many children screened positive among those 30-60 days too young for the questionnaire, and about half as many in the 30-60 days too old group.

Table 1: Percentages of Children Screened Positive on the ASQ According to Norwegian Scale-Cutoffs, by Child's Corrected Age at Time of Completion of Questionnaire. Collapsed Data for 19 Age-Specific Questionnaires.

	Whole sample[a]		Excluding >6 w premature[b]	
Corrected age at completion	N	Positive	N	Positive
Too young by >60 days	11	64%	0	--
Too young by >30-60 days	55	22%	32	19%
Appropriate age	2502	10%	2499	10%
Too old by >30-60 days	60	5%	60	5%
Too old by >60 days	5	0%	5	0%
Total	2633[c]	10%	2596[d]	10%

Note.
[a]Linear-by-linear $\chi^2[1]=31.1$; $p<.001$ (two-tailed). [b]Linear-by-linear $\chi^2[1]=4.6$; $p=.03$ (two-tailed). [c]Including two separate age-specific questionnaires from 1,172 children, and one questionnaire from 289 children. Based on 1,461 first completed questionnaires, percentages corresponding to the five age-categories in this column were 67%, 22%, 11%, 3%, and 0%, respectively (linear-by-linear $\chi^2[1]=17.8$; $p<.001$). [d]Including two separate age-specific questionnaires from 1,155 children, and one questionnaire from 286 children. Based on 1,441 first completed questionnaires, percentages corresponding to the five age-categories in this column were --, 16%, 11%, 3%, and 0%, respectively (linear-by-linear $\chi^2[1]=2.8$; $p=.09$).

DISCUSSION

The proportion of children screened by the Ages and Stages Questionnaires was significantly different when the corrected age of the child departed from the target age for the questionnaire by 30 days or more. Twice the proportion children who were 1-2 months too young screened positive, and half the proportion of children who were 1-2 months too old.

The finding that the ASQ was sensitive to children's age is an indicator of the test's validity for developmental screening. At the same time, this finding underscores the importance of the child's corrected age being within the indicated age frame for the test's ability to screen for developmental delays. When too young children are screened, the great number of false positives lessens the value of the screening procedure. When, on the other hand, too old children are screened, too many false negatives (made up of children who should screen positive but whose late-achieved skills cover up the delay) threaten the screening test's integrity.

Our findings highlight the importance of paying close attention to the child's age when using a developmental screening tool (such as the ASQ). Age should be calculated exactly (that is, by days, not months on the calendar), and corrected for premature birth when appropriate (Janson, 2003b; Squires et al., 1999).

The present results stem from the data set that was used for defining cutoff scores for the relevant population. It might be expected that replications of these findings would be subject to shrinkage. This risk, however, seems to be diminished by the fact that the calculation of descriptive data and cutoff scores was based only on children of appropriate ages, excluding those who fell outside of the indicated age frame for a questionnaire. The present results are thus to a large extent independent of the considerations for cutoff scores, and the risk of shrinkage in replications would seem lessened. One further particularity of the present sample was the fact that most mothers had contributed questionnaires concerning their child at two separate occasions, 2-6 months apart, with different forms of the questionnaires. Separate analyses conducted on only the first returned questionnaire for each child reported in notes to Table 1 showed that the results did not change markedly when this possible source of dependence was removed. (However, the effect of violating the age frame did not reach statistical significance in the comparison excluding both children born more than six weeks prematurely and second questionnaires.)

Because we had access to a large population sample and the response rate was fair compared to other studies (Janson, 2003a), it would seem possible to place confidence in the generalizability of the results. The present data set, however, also had some limitations. In particular, the sampling was designed to target children of the appropriate age for questionnaires. A child's age of too old or too young for the questionnaire age window occurred as a result of mothers delay in completing questionnaires, or the child being born prematurely. Although it seems likely that these findings would generalize to parents who were asked to complete a screening questionnaire when their typically developing child was either too young or too old, this remains to be verified in further studies.

REFERENCES

Bricker, D., & Squires, J. (1999). *Ages & Stages Questionnaires: A parent-completed, child-monitoring system* (2nd ed.) [Questionnaires and scoring sheets]. Baltimore: Paul H. Brookes Publishing Co.

Bricker, D., & Squires, J. (2003). *Ages & Stages Questionnaires: A parent-completed, child-monitoring system* (2nd ed.; H. Janson, Trans.) [Questionnaires and scoring sheets in Norwegian]. Oslo, Norway: Regionsenter for barne- og ungdomspsykiatri, Helseregion Øst/Sør.

Janson, H. (2003a). Influences on participation rate in a national Norwegian child development screening questionnaire study. *Acta Pædiatrica, 92,* 91-96.

Janson, H. (with Smith, L.) (2003b). *Norsk manualsupplement til Ages and Stages Questionnaires* [Norwegian manual supplement for the Ages and Stages Questionnaires]. Oslo, Norway: Regionsenter for barne- og ungdomspsykiatri, Helseregion Øst/Sør.

Janson, H., & Squires, J. (2004). Parent-completed developmental screening in a Norwegian population sample: A comparison with U.S. normative data. *Acta Pædiatrica, 93,* 1525-1529.

Richter, J., & Janson, H. (2007). A validation study of the Norwegian version of the Ages and Stages Questionnaires. *Acta Pædiatrica, 96,* 748-752

Squires, J., Potter, L., & Bricker, D. (1999). *The ASQ User's Guide* (2nd ed.). Baltimore: Paul H. Brookes Publishing Co.