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Impact of Ages and Stages Questionnaire Scores on Pediatrician Referral Patterns

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The American Academy of Pediatrics has recommended an algorithm for identifying children with potential developmental delays. It includes a recommendation that positive screening should result in referral for additional evaluation or intervention. Yet, it is not known whether positive screens do, in fact, influence physician referrals. The primary aim of this study was to evaluate whether positive screens from an Ages and Stages Questionnaire would prompt physicians to refer for additional evaluation or intervention as recommended by the American Academy of Pediatrics algorithm. A sample of 207 physicians read one of three hypothetical clinical vignettes describing an 18-month-old child with ambiguous language development. Vignettes differed on the presence or absence of an Ages and Stages Questionnaire score and, if a score was present, on whether the Ages and Stages Questionnaire score was positive or negative. Physicians indicated what actions they would take including whether they would refer for evaluation or intervention. Multinomial regression analyses showed physicians referred more often for further evaluation or intervention if the hypothetical Ages and Stages Questionnaire score was positive. Likewise, physicians referred less often if the Ages and Stages Questionnaire score was negative. Physicians without the Ages and Stages Questionnaire scores did not choose one action more frequently over another. In this initial investigation, the data show that physicians do refer, as recommended, when presented with positive Ages and Stages Questionnaire screens. This is important because it lends support to one critical component of the American Academy of Pediatrics developmental screening algorithm. Given the use of hypothetical vignettes in this study, it will be important to investigate whether positive Ages and Stages Questionnaire screens impact actual referrals in clinical practice.
Key words: *ASQ, development, referral patterns, screening*

DEVELOPMENTAL disabilities affect an estimated 17% of the children in the United States and have a significant impact on their health and educational functioning (Boyle, Decouflé, & Yeargin-Allsopp, 1994) as well as their quality of life (Sheppard-Jones, Thompson Prout, & Kleinert, 2005). Fortunately, early detection and intervention can lead to improved outcomes for children with developmental delays or at risk for poor

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developmental outcomes (King & Glascoe, 2003). Indeed, early detection has long been considered an important part of good primary care (Rosenbaum, Mauery, Shin, & Hidalgo, 2005), and the American Academy of Pediatrics (AAP) published an official statement confirming the importance of early identification of children with disabilities (Council on Children With Disabilities, 2006).

Consequently, significant effort has centered on improving the early detection of developmental disabilities. The AAP recommends that physicians incorporate both general surveillance methods and more structured developmental screening instruments to improve detection (Council on Children With Disabilities, 2006). General surveillance methods traditionally involve a flexible format with reliance on skilled observation. Developmental screening involves a structured standardized instrument that compares patients with normative developmental standards and then provides objective scores that indicate when referral for additional services should be considered (Squires, Twonbly, Bricker, & Potter, 2009). This coupling of surveillance and screening increases the likelihood that children are detected early.

Numerous standardized screening instruments have improved detection rates (Dworkin, 1992; Smith, 1978); however, one specific screening instrument, the Ages and Stages Questionnaire (ASQ); (Squires, Potter, & Bricker, 1999), has excellent psychometric properties and, more importantly, has good sensitivity and specificity. Indeed, the ASQ can effectively detect children who have developmental delays, whereas excluding those who do not (Squires et al., 2009).

One outcome of the development of effective screening tools like the ASQ is a strong push to disseminate these instruments into primary care settings. Fortunately, this effort has been guided, in part, by research. For example, studies looked at developing and evaluating practical protocols of ASQ administration in community primary care clinics (Rydz et al., 2006). Others evaluated the effectiveness and costs of implementing the ASQ under "real world" conditions (Hix-Small, Marks, Squires, & Nickel, 2007). Still other studies looked at the barriers to implementation and made proposals for how best to overcome these obstacles (Sand et al., 2005).

Although the ASQ is efficacious at detection, investigators have increasingly acknowledged that the process of transferring clinical tools into real world settings is impacted by a variety of factors, only one of which is the efficacy of the tool (Glasgow, Vogt, & Boles, 1999). Equally important is the extent to which the tool prompts practitioners to make referrals for evaluation or intervention. However, previous studies of the ASQ have not evaluated its impact on physician referral rates (Hix-Small et al., 2007; Rydz et al., 2006). Thus, there are no studies to date that have looked specifically at the effect positive ASQ scores have on physician referrals.

Interestingly, the AAP has called for exactly this type of research to build evidence for the current algorithm recommended to identify children with a potential developmental delay (Council on Children With Disabilities, 2006). In that algorithm, it is expected that positive screening will result in referrals for additional evaluation or intervention. The purpose of this investigation was to conduct a preliminary analysis, using hypothetical vignettes, of whether positive ASQ scores impact physicians' referral as expected within the AAP algorithm. We hypothesized that the presence of positive ASQ scores would result in a referral for evaluation or intervention and that negative scores would be less likely to result in a referral, thus, supporting AAP's proposed algorithm.

METHODS

Participants

We randomly selected 15 states across the United States (e.g., New Hampshire, Georgia, California, Minnesota) and contacted the AAP state chapters to request contact information for its members. Four

states (i.e., Nebraska, Colorado, North Dakota, and Mississippi) returned phone, e-mail, or both inquiries and provided this information without requiring payment for access to the contact information. Because of monetary limitations, states requiring payment for their lists were not included. A total of 1329 physicians were identified as potential study participants, but this number reduced to 1293 due to eight incomplete addresses and 28 surveys marked "returned to sender."

These 1293 potential participants were randomly assigned to one of three survey conditions (Version 1, 2, or 3; described below under Questionnaire). The overall response rate was 19.4% (251 received/1293 mailed surveys); 207 of the returned surveys meet inclusion criteria (i.e., providing services to children 3 years and younger). For further details of participant enrollment and return rates by state see Table 1.

Returned surveys reflected a fairly even distribution across versions—approximately 30% for Versions 1 and 3 and 40% for Version 2 questionnaires. Physicians were more likely to be females (56.2%) and pediatricians (98.1%). Roughly 16% of the physicians saw only 0–19 pediatric patients aged 0–3 weekly, whereas 36% saw 20–39 patients and 48% saw more than 40 weekly. See Table 2 for additional practice and patient characteristics.

Table 1. Participant Enrollment

No. of AAP physician members in four states	1329
No. of surveys distributed	1321
No. of surveys returned	251
Colorado (798 total)	145
Mississippi (241 total)	37
Nebraska (194 total)	71
North Dakota (96 total)	25
No. of surveys meeting inclusion criteria	207
No. of surveys with complete data	201

Note. AAP = American Academy of Pediatrics.

QUESTIONNAIRE

A 14-item questionnaire accompanied the vignette sent to physicians. Tables 2–4 provide a summary of the information requested on the questionnaire. The questionnaire asked about their education (e.g., type of residency), practice (e.g., medical specialty), and patients' characteristics (e.g., number of 0- to 3-year-old patients per week). Physicians were asked about their use of screening tools (i.e., If you use a standardized developmental screening tool, which tool[s] do you use?). A list of example screening tools was provided to choose from with an opportunity to write in additional tools not covered in the list (Table 3). Respondents were also asked to describe their familiarity with and use of the ASQ (i.e., familiarity with the ASQ [please check all that apply]; see Table 4).

Clinical Vignette

Physicians then read one of three clinical vignettes describing a non–gender-specific 18-month-old child with a potential communication delay (Figure 1). The vignettes used in this study were adapted from vignettes previously used in published research on developmental screening (Sices, Feudtner, McLaughlin, Drotar, & Williams, 2004). The primary aim of the study was to evaluate whether the ASQ scores impacted referral; therefore, the vignettes were adapted to reduce the physician's ability to rely on clinical judgment and to create a situation in which the presence of the ASQ scores would facilitate decision making.

All three vignettes described the child as healthy and growing well along with some communication/language development the child had been exhibiting. The child's language skills made it unclear as to whether the child was delayed in that area. Versions 1 and 2 included a statement that the parents had completed an ASQ in the waiting room. An ASQ score profile and score interpretation excerpt were just below the clinical vignette on Versions 1 and 2. The score profile showed the same fictitious scores for each

Table 2. Physician Demographics and Characteristics of Their Practices and Patients ($N = 207$)

Physician Demographics	**%**	**Practice Characteristics**	**%**
Gender		Medical speciality[a]	
Female	56.2	Pediatrics	98.1
Male	43.8	Family practice	1
Birth year		Other	2.9
M_{year} (*SD*)	1963 (10.94)	Practice affiliation[a]	
Range	1933–1984	None	16.9
Year completed medical school		Community hospital	41.3
M_{year} (*SD*)	1990 (10.95)	HMO	9.5
Range	1959–2009	Academic medical center	19.4
Type of residency		Other	27.5
Pediatric	99	Region of United States[a]	
Family practice	1	Midwest	39.4
Years in practice ($N = 60$)		South	15.3
M_{years} (*SD*)	16.22 (10.73)	West	43.8
Range	1–40	Other	1.5
Patient Characteristics	%	Community type[a]	
No. of patients, ages 0–3, seen weekly		Urban	31.9
0–19	15.7	Suburban	41.8
20–39	36.5	Rural	26.9
>40	47.7	Military base	0.01

Note. HMO = Health Maintenance Organization.
[a]Participants were able to mark more than one option, so percentages may be higher than 100%.

developmental area except the total communication score. Version 1 included a scoring profile with an ASQ score of 10 in the communication domain, which falls below the cutoff (i.e., clinically significant score) and, therefore, is highlighted in black on the profile. The profile showed all other scores on the ASQ above the cutoff range. Version 2's ASQ score profile reflected all scores in the typical range. Version 3 did not include ASQ scores following the scenario. At the conclusion of the clinical vignette, physicians were asked to indicate all possible actions they would take from a list of actions (e.g., no additional action, bring patient back early, refer to early intervention services). Physicians also had the option to further specify actions not listed.

Procedure

A one-page questionnaire with the clinical vignette on the second page was developed, pretested with pediatric residents at the University of Nebraska Medical Center, and revised for content and clarity. Specifically, answer categories were consolidated or expanded on the basis of responses and feedback from the residents. The questions were grouped into sections: physician demographics (e.g., gender, birth year), patient characteristics (e.g., no. of patients ages 0–3 seen weekly), practice characteristics (e.g., medical specialty, practice affiliation), use of development assessments (see Table 3 for answer options), and ASQ familiarity (see Table 4 for answer options). Participants were instructed to continue onto the next page that contained the clinical vignette.

Questionnaires were mailed in envelopes with a cover letter and prepaid return envelope. The cover letter explained the purpose of the study and informed participants the study was evaluating "developmental screening." Surveys were mailed in April 2010

Table 3. Developmental Assessment Used ($N = 207$)

Developmental Assessment Used	%
Do not typically use a standardized screening tool	15.5
ASQ	51.2
CDI	3.4
CDR-PQ	2.4
CSBS DP: infant/toddler checklist	4.3
Denver-II Screening Test	27.5
PEDS	3.9
Other, please specify	8.7
Bright futures	1.4
Physician created	1.4
Mayo Developed Screener	0.5
M-CHAT	3.4
PDQ	0.5
State-specified profile	0.5
Gesell Developmental Observation	0.5
American Academy of Pediatrics Form	0.5
Bayley Scales of Infant and Toddler Development	0.5

Note. ASQ = Ages and Stages Questionnaire; CDI = Child Development Inventory; CDR-PQ = Child Development Review–Parent Questionnaire; CSBS DP = Communication and Symbolic Behavior Scales Developmental Profile; M-CHAT = Modified Checklist for Autism in Toddlers; PEDS = Parents Evaluation of Developmental Status; PDQ = Prescreening Developmental Questionnaire.

to all participants without a second mailing due to monetary constraints. A prescreening question at the top of the survey identified those eligible to participate (i.e., physicians who provide primary care services to children aged 3 and younger). Pediatricians who did not meet the criteria were asked to return the survey after answering the prescreening question.

Variables of Interest

The independent variable for this study was the clinical vignette version. The dependent variable for this study was actions taken by the physician regarding the child. The list of possible responses was condensed into three primary categories for ease of interpreting pediatrician response (Table 5). The "no action" category indicated that no further action would be taken on the part of the physicians and included the options "no additional action required at this time" and "wait and see at the next visit." The "physician guidance" category indicated that physicians would engage in additional action themselves and included "bring patient back early" and "do more screening now." The "referral" category indicated that physicians would refer the patient to another practitioner or service agency and included "refer to audiology," "refer to early intervention services," "refer to medical specialist," and "refer to psychologist." Responses included in the "other" category were filtered into one of the three primary categories on the basis of the action listed (e.g., "refer to speech therapy" was placed in the "referral" category).

Table 4. Familiarity With the Ages and Stages Questionnaire ($N = 207$)

Level of Familiarity	%
Not familiar	20.3
Heard of the ASQ	74.9
Seen the ASQ protocol or summary sheet	61.8
Exposed to the ASQ in medical training	5.8
Used the ASQ in practice when assessing infants and children	53.1
Attended a workshop on how to use and interpret the ASQ	14.5

Note. ASQ = Ages and Stages Questionnaire.

Statistical Analysis

Simple frequency and mean values of physician, practice, and patient demographics were calculated as well as for use of developmental screening tools and ASQ familiarity. Covariate analyses were run for the action outcomes (i.e., "no action," "physician guidance," and "referral") comparing action outcomes to gender and familiarity with the ASQ. Significant findings indicated that the variable(s) should be included in the multinomial regressions performed evaluating

VIGNETTE FOR VERSIONS 1 AND 2 OF THE QUESTIONNAIRE: ASQ SUMMARY SHEET EXCERPT INCLUDED

You are seeing an 18-month-old child for a well-child visit. The child is an established patient in you practice, in good health and growing well. The child is walking well, drinking from a cup, saying "mama" and "dada" plus several other words, and can sometimes retrieve a familiar toy or object at the parents' request. While sitting in the waiting room, the parents filled out an Ages and Stages Questionniare (see ASQ results below). Based on this information, what action(s), if any, would you take at this visit? (please check all that apply)

VIGNETTE FOR VERSION 3 OF THE QUESTIONNAIRE: NO ASQ SUMMARY SHEET EXCERPT INCLUDED

You are seeing an 18-month-old child for a well-child visit. The child is an established patient in you practice, in a good health and growing well. The child is walking well, drinking from a cup, saying "mama" and "dada" plus several other words, and can sometimes retrieve a familiar toy or object at the parents' request. Based on this information, what action(s), if any, would you take at this visit? (please check all that apply)

Figure 1. Vignettes included on questionnaires.

vignette version (i.e., ASQ summary sheet below cutoff, ASQ summary sheet in typical range, and no ASQ summary sheet provided) and selected action outcomes (i.e., no action, physician guidance, and referral). Missing data were excluded from analyses, which resulted in a drop in participants included in the final analysis of differences in physician action between vignettes from 207 to 201.

RESULTS

How Familiar Are Physicians With Developmental Screening Tools?

Physicians were provided with a list of some of the more common assessment tools used in primary care but were also allowed to write in other tools used. Of the 207 physicians, 84.5% reported using a developmental screening assessment as part of their well-child visits. The two most common were the ASQ (51.2%) and the Denver-II Screening Test (27.5%). Thus, the majority of physicians reported using a screening tool in their clinic. Table 2 outlines the percentages associated with various developmental screening tools. Regarding familiarity with the ASQ specifically, 79.7% of the physicians reported some familiarity with the ASQ and 53.1% indicated that they have used the ASQ at some point in clinical practice (Table 4).

Table 5. Impact of ASQ on Physician Actions ($N = 201$)

Outcome Variable	%	Version	Comparison Version	*OR* (95% CI)	*p*
No action	51.2	Version 2	Version 1	9.13 [4.4, 18.93]	.000
			Version 3	3.32 [2.06, 5.35]	.000
		Version 3	Version 1	2.75 [1.22, 6.18]	.014
Physician guidance	19.9	Version 1	Version 2	0.286 [0.48, 3.45]	.618
		Version 3	Version 1	2.67 [1.24, 5.74]	.012
			Version 2	3.43 [1.48, 7.96]	.004
Referral	28.9	Version 1	Version 2	8 [3.16, 20.27]	.000
			Version 3	3.08 [1.65, 5.75]	.000
		Version 2	Version 3	0.39 [0.14, 1.08]	.069

Note. ASQ = Ages and Stages Questionnaire; CI = confidence interval; OR = odds ratio.

Does Gender or Familiarity With ASQ Impact Action Outcome?

To evaluate the impact gender and ASQ familiarity had on the action outcome selected by physicians, three different covariate analyses were conducted. First, the relationship between the vignette version and ASQ familiarity was evaluated, which yielded a nonsignificant finding ($\chi^2_{2,205} = 1.12, p = .572$). A second analysis was run to evaluate the association between the physicians' familiarity with the ASQ and their selected action outcomes. To determine the impact of familiarity, physicians who marked any of the options indicating that they had contact via seeing, hearing, being exposed to, using, or attending a workshop on the ASQ were considered to be familiar with the ASQ. Results from this analysis indicated no significant relationship between ASQ familiarity and action outcomes ($\chi^2_{2,199} = 3.85$, $p = .146$). The third covariate analysis explored the relationship between the physicians' gender and their selected action outcomes. Results indicated again no significant relationship between the two variables ($\chi^2_{2,197} = 0.82$, $p = .663$). As a result of these findings, gender and ASQ familiarity were not classified as covariates in the subsequent analyses.

Does the Presence of an ASQ Summary Sheet and Score Impact Outcome?

Vignette versions were compared to evaluate the impact the presence of the ASQ had on physician referral behavior using two multinomial regression analyses (Table 5). Statistically significant findings indicated that physicians who received Version 2 (i.e., ASQ scores in the typical range) were 9.13 and 3.32 times more likely to take no action than physicians who received Versions 1 and 3, respectively ($p < .001$). Physicians who received Version 3 (i.e., no ASQ scores) were also 2.75 times more likely to take no action compared with physicians who received Version 1 (i.e., ASQ below the cutoff; $p = .014$). Physicians who received Version 3 were 2.67 ($p = .012$) and 3.43 ($p = .004$) times more likely to select physician guidance than physicians who received Versions 1 and 2, respectively. No difference was found between Versions 1 and 2 on likelihood to select physician guidance. Physicians who received Version 1 were 8 and 3.08 times more likely to refer than physicians who received Versions 2 and 3, respectively ($p < .001$). However, no difference in likelihood to refer was found between physicians who received Versions 2 and 3.

DISCUSSION

The results of this investigation suggest that, for this sample of primary care physicians, the hypothetical ASQ scores impacted referral for additional evaluation/services as recommended by AAP's algorithm. More specifically, physicians were significantly more likely to refer a child with positive ASQ scores than if there were no ASQ scores to guide them or if the ASQ scores were negative. Likewise, physicians were also significantly less likely to refer a child who had negative ASQ scores than if they had no scores to guide them or if a single ASQ score was positive. These findings provide initial support for the use of the ASQ as a developmental screener in accordance with the AAP algorithm (Council on Children With Disabilities, 2006).

The presence of the ASQ score may have served as a means to reduce ambiguity. Physicians who did not receive an ASQ score were more diverse in their action outcomes compared with their counterparts who received ASQ scores (Table 6). Specifically, if the ASQ score indicated that the child was at risk, 70.2% of the physicians referred, and if the ASQ score indicated that the child was within the typical range, 85.9% of the physicians selected no action necessary. However, if the ASQ score was not provided, 37.3% indicated no action, 40.7% engaged in physician-guided actions, and 22% made referrals. Physicians were not more likely to choose one action over the other, which indicates that the presence of the ASQ score may have helped physicians

Table 6. Physician Action Outcome by Vignette Version Percentages ($N = 201$)

	Outcome Variable		
Version	No Action	Physician Guidance	Referral
Version 1	14	15.8	70.2
Version 2	85.9	8.2	5.9
Version 3	37.3	40.7	22

distinguish between children who needed to be referred and those for whom no action was necessary.

In addition, without the ASQ scores present, physicians were less likely to follow the AAP guidelines. The most recent recommendations by the AAP indicate that if concerns are raised at a visit, then screening should be done. Notably 36% of the physicians endorsed actions in line with this guideline, which left 64% either referring without further evidence of necessity, bringing the child back early, or not engaging in action. Given the unique role physicians have in the process of identifying children with developmental delays and connecting them with services, the use of the ASQ could lead to an increase in utilization of early intervention services through referrals made by physicians. Using the ASQ could also help reduce burden on the system by not referring children who do not meet objective assessment for referral.

The lack of impact of gender on action outcomes was unexpected given previous research that has indicated that female physicians are more likely to refer (Sices et al., 2004). The presence or absence of the ASQ score profile could have reduced the impact of gender on referral patterns. To determine whether this might be the case, an additional follow-up analysis was run evaluating only physicians who received Version 3 to determine whether a gender effect was present in just this group. Findings indicated no difference between genders on action outcomes ($\chi^2_{2,58} = 0.6$, $p = .742$). Thus, the presence of the ASQ summary sheet was not impacting the potential gender effects. Another possible explanation could be that physician specialty is a more significant predictor of referral patterns than gender, which was the other factor that increased the likelihood of referral in the study by Sices et al. (2004). Unfortunately, the current sample consisted predominately of pediatricians (98.1%); therefore, this could not be further evaluated.

An unexpected finding was that the presence of the ASQ score reduces the amount of follow-up the physician engages in for hypothetical vignettes. Particularly, physicians who received Version 3 of the vignette without the ASQ scores were more likely compared with their counterparts who received Versions 1 and 2 to select physician guidance options (e.g., asking additional questions, seeking clarification). In addition, physicians who received Versions 1 and 2 showed no significant difference between their selections of physician-guided actions. Given the increased demands placed on physicians during an office visit, the use of the ASQ may ease the burden of collecting additional information. One study found on average the monetary cost per patient of implementing the ASQ was $1.61–$2.43 and the average time required to explain, score, and provide referrals was 4–5 min (Hix-Small et al., 2007). Another found that the cost per child of implementing the ASQ in each well-child visit from birth to age 3 was $11.11–$15.56 dependent on the screen reflecting scores above or below the cutoff range (Dobrez et al., 2001). Thus, whereas one argument against standardized assessment of developmental delays is the burden of time, this study's findings argue that the overall investment of the physician may be less when the ASQ is used.

Another unintended finding from this study was that more physicians reported using developmental screeners in their everyday practice than in the past. Previous data suggested that approximately 70% of the physicians did not routinely use screening tools (Sand et al., 2005; Sices et al., 2004). However, nearly 85% of the respondents to this survey reported using a developmental screener in their practice. This high percentage could be

the result of a biased sample—pediatricians using developmental screeners were more likely to respond. In addition, our survey did not differentiate if the physicians routinely used these screeners in every well-child visit.

Several limitations exist with this study. The study relied on physicians from four states who were a member of their state chapter of the AAP and the state chapter did not charge for access to their list of physicians, which reduces the generalizability of these results. In addition, the response rate of 19% is lower than hoped for. As with any survey study, the confinement to predetermined responses may have also impacted the findings (e.g., researcher bias). An attempt was made to counter this by allowing physicians to write in responses on some questions. Finally, the physicians in this study were responding to hypothetical vignettes and not real-life patients. Of course, the responses of physicians "in theory" may not reflect what actually happens in practice. However, the vignettes used in this study were adapted from previously used vignettes in published research (Sices et al., 2004).

Despite these limitations, these findings provide initial support that in hypothetical vignettes the ASQ influences physicians' referral of children with potential developmental delays as intended by the AAP's recommended algorithm. Studies are currently underway to move the evaluation from hypothetical situations into the real world (i.e., actual referrals made on the basis of ASQ scores).

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