

***Grant Final Report***

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**Computer Automated Developmental Surveillance and Screening (CADSS)**

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## Structured Abstract

**Purpose:** The purpose of this study was to determine if a computer decision support system integrated with routine care could improve standardized developmental surveillance and screening within primary care practices.

**Scope:** Developmental delays and disabilities are not uncommon in children. Significant efforts have been made to address the implementation of developmental surveillance and screening practices within primary care settings, but despite such efforts, these practices are not routinely or appropriately implemented in primary care settings.

**Methods:** We conducted a randomized controlled trial to compare surveillance, screening, and diagnosis of developmental disorders after implementation of the CHICA Developmental Surveillance and Screening (DSS) Module in the two intervention practices. The two control clinics utilized the “traditional” CHICA system that DID NOT include the DSS Module. 360 children in the intervention and control clinics were included in the developmental screening portion of the study. 120 children were included in the developmental surveillance practices portion of the study. Additionally, 95 children had parents that agreed to participate in interview sessions and allow us to review their child’s medical record.

**Results:** Using a clinical decision support system to automate the screening of children for developmental delay significantly increased the numbers of children screened at 9, 18, and 30 months of age. It also significantly improved surveillance at other ages. Moreover, it increased the number of children diagnosed with developmental delay, and at an earlier age.

**Key Words:** developmental screening; computerized decision support systems

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# Final Report

## Purpose

The aims of this project are to:

- Aim 1: Expand and modify an existing computer-based decision support system (CHICA) to include the 2006 AAP developmental surveillance and screening algorithm.
- Aim 2: Evaluate the effect of the CHICA system on the developmental surveillance and screening practices of four pediatric clinics.
- Aim 3: Evaluate the effect of the CHICA system on referrals for developmental and medical evaluations as well as early developmental intervention/early childhood services for those children identified as having concerning developmental screening results.
- Aim 4: Develop a cohort of children with identified developmental disabilities that can be followed over time in order to look at the end results/effects of developmental screening.

No modifications were made to the specific aims as stated in the original proposal.

## Scope

Developmental delays and disabilities are not uncommon in children. Approximately 1 in 6 children in the United States have a developmental disability. Early intervention for these children is critical and pediatric primary care providers are uniquely positioned to identify and then refer young children with developmental delays to intervention programs in a timely manner.

In order to ensure that children with developmental delays and disabilities are identified as early as possible, researchers and physician organizations such as the American Academy of Pediatrics (AAP) have called on pediatric primary care providers to institute a standardized approach for the identification of developmental delays that includes both developmental surveillance and screening.

Significant efforts have been made to address the implementation of developmental surveillance and screening practices within primary care settings. Despite such efforts, studies have demonstrated that developmental surveillance and screening are not routinely implemented in primary care settings and that the screening that does occur often does not use standardized protocols or tools. Numerous barriers exist to the successful implementation of developmental surveillance and screening within the primary care setting. Lack of time and staff, logistical challenges in administering screening tools, inadequate reimbursement and language barriers are often cited as obstacles.

Computer decision support systems (CDSS) are a promising strategy to overcome these barriers within the primary care setting. Because CDSS involves the use of integrated systems that routinely store and retrieve patient information, CDSS can improve workflow by providing physicians with patient-specific recommendations based upon integrated data at the time and place of a patient visit. While there have been previous attempts to automate the process of developmental screening, these attempts have not proved successful due to the fact that the decision support was not integrated with CDSS for routine clinical care. The objective of this study was to determine if CDSS integrated with routine care could be an effective approach to improve standardized developmental surveillance and screening within primary care practices.

## **Methods**

### **Setting**

This study took place in four primary care pediatric practices in the Eskenazi Medical Group, the largest safety-net health system in Indianapolis. Two of the four clinics served as intervention sites while the other two clinics functioned as control sites.

### **Participants**

Patients younger than 66 months of age were automatically placed into either the control or intervention group based on which of the four pediatric clinics they attended. No potential subjects were contacted by researchers, their physician, or other staff personnel regarding the study. At the time of this report, there are 35,782 children in the CHICA system. Over 6,000 of these kids received ASQs for routine developmental screening – 1,199 at 9 months old; 1,166 at 18 months old, and 3,819 at 24 through 36 months. Final enrollment in the study includes the following: 360 children in the intervention and control clinics whose charts were reviewed for developmental screening practices, 120 children whose charts we reviewed for developmental surveillance practices, and 95 children whose parents agreed to participate in interview sessions and to allow us to review their child's medical record.

### **Study Design**

We conducted a randomized controlled trial in which we compared surveillance, screening, and diagnosis of developmental disorders after implementation of the CHICA Developmental Surveillance and Screening (DSS) Module (described below) in the two intervention practices. The two control clinics utilized the “traditional” CHICA system that DID NOT include the DSS Module. While the unit of randomization was the primary care clinic, the unit of analysis was the individual patient. The four clinics were matched based on the number of clinicians practicing at each of the clinics before randomization. The clinics with the largest number of clinicians and the smallest number of clinicians were assigned to the intervention group, while the remaining two clinics were assigned to the control group. We chose to randomize by clinic because contamination was a major concern. Physicians in the same clinic who were assigned to

different treatment arms might communicate regarding the CHICA DSS module in terms of its operation and consequences if we chose to randomize at the physician level. Similarly, if we randomized at the patient level, the on and off usage of the CHICA DSS module might lead to irritation and inconvenience for both physicians and clinic staff as they might think that the CHICA system was malfunctioning.

We refined an existing computer decision support system for pediatric primary care practices – Child Health Improvement through Computer Automation (CHICA) – to include the developmental surveillance and screening algorithm published by the AAP in 2006. Outcomes that were tracked during this study included whether children were screened using a standardized screening tool at the target visit, screening results at the target visit, referral status when a child had a positive screening result, diagnosis of developmental delay or disorder following target visit, and age at diagnosis.

CHICA is a CDSS that was developed in 2004 and has served over 36,000 patients in the Eskenazi health system. CHICA is unique in that at each visit the system uses logic rules to select 20 health questions that are printed on a paper questionnaire or electronic tablet for that family to complete in the waiting room. This paper form (called a PSF) is scannable and the answers to the questions are stored in the EHR. CHICA then generates a tailored worksheet (PWS) for the physician to use that includes up to six alerts. Simultaneously, CHICA can produce “just in time” handouts (JIT) that can provide education or standardized forms.

## **Intervention: The CHICA Developmental Surveillance and Screening (DSS) Module**

The CHICA DSS Module had a number of components that we expected would improve the screening and diagnosis of developmental disorders:

1. **Universal Screening** – The CHICA DSS Module was set up to provide universal screening at a child’s 9-, 18-, and 30-month visits through the use of an ASQ form that was automatically printed when the patient checked-in for these target visits
2. **Surveillance** – On the PSF, parents were asked simple questions related to whether they had any concerns about their children’s development at every visit where screening was not scheduled to occur. If a parent responded affirmatively to any of the surveillance questions, then the physician was notified about the parent’s concerns on the PWS and a standardized screening tool was printed as a JIT for use by the physician.
3. **Reassessment** – The CHICA DSS Module also automatically tracked those children whose parents had concerns or who had borderline results on a previous ASQ screening. For these children, CHICA would generate a new ASQ and prompt the physician to rescreen at subsequent visits, consistent with AAP guidelines.
4. **Recommendations** – Based on established guidelines, the CHICA DSS Module prompted physicians to refer for comprehensive evaluation and developmental services those children with positive screening results.

## Data Collection

Data collection began 6 months after the CHICA DSS Module was turned on in the CHICA system. Manual chart abstractions were performed by trained research assistants to assess each clinic's developmental surveillance and screening practices. To assess the reliability of chart abstraction, a random sample of 20% of the charts were abstracted twice. Additionally we were able to collect several items of study data directly from the CHICA system, such as demographic variables. For the developmental screening portion of our study, a total of 360 patient charts of well care visits were randomly pulled from the intervention and control clinics. They were divided equally in windows around the 9, 18, and 30 month visits. A total of 120 patient charts were randomly pulled from the four clinic sites for the developmental surveillance portion of the study. These charts could be any visit not occurring in the 9, 18, and 30 months visits. The agreement on overall chart abstraction was found to be 89%, with a kappa of 0.75.

## Results

### Screening

Characteristics of the patients included in this study can be seen in Table 1. There were no significant differences between the intervention and control groups with respect to gender, insurance and age. There was a significant difference between the two groups with respect to race based on differences in the clinic populations. However, more than 50% of the patients' races were unknown. We controlled for race in all analyses.

We found that the CHICA DSS module led to a significant increase in the percentage of patients screened with a standardized screening tool (85.0% versus 24.4%,  $p < 0.0001$ ) (Figure 2). The odds of being screened in the intervention group were 16.3 (95% CI: 9.0, 29.3) times the odds for a child in the control group. If screening occurred, however, the rate of a positive screen was similar between groups (19.6% versus 18.2%,  $p = 0.69$ ). This implies that the number of children at risk for developmental delay might be similar between groups, but that more children were picked up in the intervention group because of much higher screening rate.

Although our study was not powered to detect changes in the care and management of developmental delay, we also did preliminary analyses in these areas (Figure 3). Because very small numbers of patients (8 in the intervention group and 4 in the control group) were diagnosed with developmental delay, statistical analyses were not possible, and we only present descriptive data. However, 73% of patients in the intervention group with a positive screen were referred for evaluation and services versus 50% of those in the control group. 67% of intervention patients had a visit to a mental health specialist versus 48% of control patients. Finally, referred services were completed in 55% of intervention patients versus 25% of control patients.

A final diagnosis of developmental delay was not significantly more common in the intervention group (10.6% versus 6.7%,  $p = 0.33$ ). However, children diagnosed with developmental delay were diagnosed at an earlier age with a mean estimated age difference of 7.7 months ( $p = 0.02$ ).

## Surveillance

In order to determine if surveillance was occurring, we used scheduling data to select patients who had a clinic visit outside of the three age groups at which routine screening was to occur. We randomly chose sixty patients from each of the intervention and control groups for a total of 120 subjects. Characteristics of the patients included in this study can be seen in Table 2. Though two groups were different in race and insurance, majority of the patients' race were unknown and most of the patients were on Medicaid.

We found that the CHICA DSS module led to a significant increase in the percentage of parents whose parents were assessed for concerns about their children's development (71.7% versus 41.7%,  $p=0.0005$ ) (Figure 4). The odds of parent's assessment of child development for children in the intervention group were 4.3 (95% CI: 1.9, 9.9) times the odds for children in the control group. When concerns were assessed, more concern was noted in the control group than the intervention, although the difference was non-significant, (9.3% versus 16.0%,  $p = 0.61$ ). This suggests that parents were being assessed in the control group only when there was a higher likelihood of a positive concern. The intervention had no effect on whether physicians documented an assessment of developmental concerns (83.3% versus 81.7%,  $p = 0.79$ ).

As with screening, the study was not powered to detect differences in a full diagnosis of developmental delay. We found, however, that developmental delay occurred in 20% of intervention children, versus 8.3% of control children ( $p=0.06$ ).

For the 95 children whose parents agreed to participate in interview sessions and to allow us to review their child's medical record we are still analyzing the results of this portion of the study.

## Implications

This study showed that using a clinical decision support system to automate the screening of children for developmental delay significantly increased the numbers of children screened at 9, 18, and 30 months of age. It also significantly improved consistent surveillance at other ages. Moreover, it increased the number of children who ultimately were diagnosed with developmental delay and referred for timely services at an earlier age. More work is needed to see if this translates into improved outcomes for children. Additionally, we are trying to move CHICA onto commercial platforms to make it more accessible.

## List of Publications and Products

No publications to date. An initial manuscript describing the study results is being drafted and will be submitted this month.

Because analysis of the data from chart abstractions showed a significant difference in developmental surveillance and screening at intervention clinics, the CHICA Developmental Surveillance and Screening Module will be rolled out in the control clinics.