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Improving lead screening in a pediatric practice: A quality improvement project

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Improving Lead Screening in a Pediatric Practice: A Quality Improvement Project

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Abstract

Background: Detectable lead levels in children's blood have been associated with increased cognitive difficulties, attention deficits, and poorer academic performance. Children enrolled in Medicaid have higher rates of elevated blood lead levels, yet requirements to test all children at age 1 and 2 who are enrolled in Medicaid are not being met. Nationally, 34% of children enrolled in Medicaid do not undergo proper blood lead level screening. The aim of this project was to increase required blood lead level screening rates for children with Medicaid insurance at a private pediatric practice in the Shenandoah Valley in Virginia.

Methods: The Institute for Healthcare Improvement (IHI) Model for Improvement was used to guide this practice improvement. This model stresses the importance of performing a needs assessment, establishing a baseline, and tracking balancing measures to ensure the intervention has no unintended consequences. A baseline rate of screening was collected by retrospective chart review, a physical review of the clinic was performed, and staff interviews were conducted. The Plan, Do, Study, Act (PDSA) cycle was the used to implement the intervention. Run charts were displayed weekly to show progress.

Intervention: Three cycles of the interventions were run. The first intervention was an inservice to update staff to the current guidelines. Second, an official policy change was enacted, and finally an electronic health record (EHR) flag was employed as a reminder.

Results: The initial assessment revealed that blood lead screenings were not being conducted on 2-year-old children enrolled in Medicaid. Interventions to change the practice and screen 2-year-old children enrolled in Medicaid were designed based on a search of the literature.

The IHI Model for Improvement produced statistically significant improvement ($p<0.001$) in screening rates of 2-year-old children enrolled in Medicaid. The run charts further illustrated improvement with each intervention.

This project was undertaken in partial fulfillment of the Doctorate of Nursing Practice.

Key words: Lead, Screening, Quality, Pediatric

Background

Screening for elevated blood lead levels is an important component of the well-child check-up. It is the task of primary care providers to capture children at risk of an elevated blood lead level with the use of screening protocols. Lead is a neuro-toxin, and children with even very low levels of lead in their blood are known to have cognitive impairment, and can show signs of developmental delay, subtle behavioral problems, distractibility, hyperactivity and delayed sexual development. There are also links to increased dental caries in children with mildly elevated blood lead levels (CDC, 2014). Children in lower socio-economic groups and African American children are at a higher risk of being identified with elevated blood lead levels than their white, higher economic class counterparts (Jones et al., 2009).

There have been significant advances in preventing elevated blood lead levels in children. In the early 1970’s the United States began a campaign to lower environmental lead exposure. In 1971 the Lead-Based Paint Poisoning Prevention Act was initiated, and lead based gasoline began to be phased out in 1973 (American Academy of Pediatrics [AAP], 2016). By 1988 residential leaded paint and plumbing were banned, and lead in gasoline was eliminated (AAP, 2016). These primary prevention efforts have been effective, yet the problem of elevated blood lead levels persists, and children in the United States continue to function as the canary in the mine for detection of lead exposure.

Average blood lead levels have declined steadily over the past 4 decades, yet there are still children with detectable lead in their bloodstreams. It is estimated that 24 million housing units in the United States have lead hazards related to the use of lead-based paint and pipe solder. Chipped or peeling paint is a significant risk factor for elevated blood lead levels, particularly in the toddler with their developmentally appropriate hand to mouth behavior. Many families are not aware of their lead exposure, or simply cannot afford to live in modern, or safely refurbished homes (Knighton, Payne & Speedie, 2016).

In 2005 the AAP adopted recommendations by the Centers for Disease Control and Prevention (CDC) to consider a blood lead level above 10 ug/dL a “level of concern” (AAP, 2016). In 2012, the CDC determined that children with very low levels of blood lead may still experience problems, and there is no safe level of blood lead (Raymond, Wheeler & Brown, 2014). Thus, the level of concern was lowered to 5 ug/dL, or the 97.5^{th} percentile of all blood lead levels found in children that year (AAP, 2016). This new lowered level will have significant impact on screening efforts as it has the potential to increase the number of children with problematic blood lead levels. Leafe, Irigoyen, DeLago, Hassan and Braitman (2015) found that in a high-risk urban area, problematic lead levels increased 9-fold with the new lowered blood lead level threshold.

Virginia is not federally funded for lead reporting, making population estimates of screening rates in Virginia impossible. It is difficult to assess where lead elimination efforts should be focused when screening efforts are not robust. The Virginia Department of Health (2016) guidelines state that all children enrolled in Medicaid are required to be tested at both 1 and 2 years-of-age.

Blood lead screenings are necessary to identify children with detectable blood lead levels. Until screening rates are robust, it is difficult to determine where to focus primary prevention efforts. Flint, Michigan provides an example of the importance of blood lead screening. A diligent pediatrician noted elevations in blood lead levels during routine screenings, which led to the discovery of lead in the public water system. A change in water source increased the percentage of children with elevated blood lead levels from 2.4% to 4.9% (Hanna-Attisha, LaChance, Sadler, & Champney Schnepp, 2016).

Problem

Jones et al., (2009) identified that children enrolled in Medicaid had higher rates of blood lead levels than children with private insurance. Rates of screening for children enrolled in Medicaid vary from state to state. In 2015 the National Committee for Quality Assurance (NCQA) reported that, nationally, just 66.5% of children enrolled in Medicaid were screened for elevated blood lead levels despite the universal requirement for these children to have screenings at both 1 and 2-years-of-age. A study of a Medicaid cohort in Minnesota found that 65% of eligible children were screened for blood lead levels. There was a further problem identified, in that required repeat screens did not comply with regulations in 49.8% of cases (Knighton, Payne, & Speedie, 2016).

The combination of new lower levels of acceptable blood lead levels and poor screening rates of at-risk children is problematic. A needs assessment performed at a private pediatric practice in Harrisonburg, Virginia identified that despite Virginia Health Department requirements, 2-year-old children enrolled in Medicaid were not receiving any blood lead screening.

A Review of the Literature

A review of the literature was undertaken to determine effective methods for increasing rates of blood lead level screening in children under 5 years of age.

Methods for the Literature Review

A search for articles was conducted using CINAHL, PubMED and Ovid databases. Search terms used were: “lead toxicity” and “lead screening”. These terms were also combined with “intervention” and “child”. The search was restricted to English language, and peer reviewed articles. The search included articles between 2000 and 2016, to include studies prior to the change in screening guidelines in 2012. This wide range of years attempts to capture a larger number of studies specific to improving rates of blood lead screening.

Articles were read and analyzed to identify if interventions were implemented to increase blood lead level screening efforts. A challenge faced during the search was that “lead” is a homograph with three meanings significant to health care. All searches required careful screening to eliminate unrelated articles.

Thirty-five articles were selected for closer examination. Studies were excluded if they primarily addressed ways to decrease lead levels in children or causes of elevated lead. Studies were also excluded if their intent was to identify specific geographical areas with high incidence of elevated blood lead levels, or to correlate elevated blood lead levels with cognitive disorders. Ultimately, thirteen articles were selected for review. Five of the articles studied rates of screening in multiple areas of pediatric health promotion, including screening rates for anemia, tuberculosis, and obesity in addition to rates of blood lead level screening (Bordley, Margolis, Stuart, Lannon & Keyes, 2001), (Merepol et al., 2014), (Samaan, Brown, Morehous, Perkins, Kahn, & Mansour, 2016), (Shaw, Wasserman, Barry, Delaney, Duncan, Davis & Berry, 2006), (Fairbrother, Friedman, Butts, Cukor & Tassi, 2000). Merepol et al., (2014) provided the only randomized controlled trial. Five were before and after designs that were non-experimental (Bordley et al., 2001); (Boreland, Lyle, Brown, & Perkins, 2015); (Dowling, Miranda & Galaviz, 2008); (Samaan et al., 2016); (Shaw et al., 2006). Four of the studies were cross-sectional analyses of data (Gioia, 2001); (Kaufmann, Clouse, Olson, & Matte, 2000); (Leafe et al., 2015); (Vivier, Hogan, Simon, Leddy, Dansereau, & Alario, 2001); and one was a qualitative analysis (Thomas, Boreland & Lyle, 2012). One study was an expert opinion analysis (Fairbrother et al., 2000). One was an instrument development study (Burns et al., 2012). All but two of the studies were conducted in the United States.

Results of the Literature Review

Before implementation of any intervention to increase screening rates, the best method to detect elevated blood lead levels needs to be determined. Burns et al. (2012) found that screening questionnaires presented to parents were not effective in identifying children with elevated blood lead levels, illustrating the importance of the blood lead screen. The new CDC 2012 guidelines lowering the lead threshold of concern has the potential to increase numbers of children with elevated blood lead levels that are identified by a blood lead screen. Leafe et al. (2015) found an increase of prevalence of lead elevation from 1% to 9.1% in a Philadelphia, PA neighborhood when new guidelines were instituted. Detectable blood lead continues to be an issue for children in the United States, making robust screening rates an important focus.

Gioia et al. (2001) found that children with health insurance were 42.6 times more likely to have a blood lead level checked than children without insurance. Among children with insurance, those enrolled in Medicaid were less likely to have a blood lead level checked, yet children enrolled in Medicaid insurance are more likely to have elevated blood lead. Data analyzed from the Third National Health and Nutrition Examination Survey demonstrated that 12.8% of children enrolled in Medicaid had lead levels above 10 ug/dL, while 3.7% of non-Medicaid enrolled children had the same elevations. Children enrolled in Medicaid made up 30% of the NHANES study yet were responsible for 60% of the elevated blood lead levels (Kaufman et al., 2000).

Quality monitoring for Medicaid includes reporting screenings and routine care. Lead screenings are part of the data sets reported to Medicaid (Fairbrother et al., 2000). In their work, Fairbrother et al. (2000) found that providers did not believe that this monitoring was effective at increasing rates of screening. The literature review however, identified several common themes that showed improvement in lead screening rates with the use of office-based initiatives.

Systems-based approaches can be effective, specifically office-based initiatives that address provider and staff knowledge, process improvement, and access for patients. Boreland et al. (2015) showed an increase in the proportion of children screened from 0.39 to 0.60 (95% CI [0.12-0.29]) by implementing a point of care lead screening test in their clinic, increasing access for their families. Samaan et al. (2016) introduced a preventive care service bundle which included lead screening, and preventive care screenings increased from 58% of children to 92%. Bordley et al. (2001) increased screenings in eight primary care offices by having each office develop a tailored system to improve delivery of preventive care services. Age appropriate lead screenings increased from 12% to 48%.

A second theme that emerged was the use of a facilitator to implement efforts to increase screening. Samaan et al. (2016) had personnel dedicated to assisting providers and staff as they implemented and ordered their new service bundles. Meropol et al. (2014) conducted a randomized controlled trial where practice based pediatric preventive care improvement techniques were implemented under the direction of a facilitator dedicated to the process. This facilitator was hired to support the process and had no other clinic responsibilities other than tracking the preventive services. All areas of preventive services, including lead screenings, saw improvements with this process.

Finally, rapid feedback was noted in four of the office-based studies. Frequent evaluations with timely reporting to providers and staff proved beneficial in each study. Bordley et al. (2001), provided sessions for their care teams where chart review information was relayed back to them at various points during the study. Meropol et al. (2014) had their facilitators visit sites weekly with sample chart reviews. Samaan et al. (2016) had data managers pull information from the electronic health record to create evaluative reports for providers. A statewide initiative in Vermont increased lead screening rates from 72% to 85% with practice driven interventions. Feedback was provided by collaborative phone calls, and monthly reports to track adherence to clinic protocols (Shaw et al., 2006).

Provider and patient knowledge were also found to play a role in rates of blood lead testing. Vivier et al. (2001) found lead testing rates in Rhode Island for children enrolled in Medicaid reached 80%, considerably higher than national rates. Rhode Island was known for having a problem with elevated blood lead levels in children, and the state has extensive educational programs for both providers and citizens, as well as a managed care coordinator for the children enrolled in Medicaid (Vivier et al., 2001).

Thomas et al. (2012) conducted studies in New South Wales, Australia to determine why blood lead testing rates were low, and themes that emerged in the interview process included a lack of perceived health risks related to lead, as well as socio-economic factors making blood lead screening access difficult. Similar work by Dowling et al. (2008) in San Diego found that families were unfamiliar with the risks of elevated blood lead levels and were unaware that it was recommended. Other reasons for missed tests included lack of transportation and misunderstanding regarding the blood draw process.

In summary, risk for elevated blood lead remains. Rates of blood lead screening in children are low, particularly with Medicaid children., however, office-based interventions show promise to increase blood lead screening.

Aim

The aim of this project is that by April 1, 2018 we will improve the rate of blood lead screening of children enrolled in Medicaid at their 2-year-old well child check to 90%. This project will take place at a private pediatric practice in the Shenandoah Valley of Virginia. The expectation is that this project will increase the understanding of the guidelines for screening children enrolled in Medicaid for blood lead levels. This more complete understanding and implementation of techniques to increase rates of screening will capture children with risk factors who have elevated lead levels, allowing for remediation to occur. It will also improve adherence to Medicaid requirements for blood lead screening. The process will also introduce this pediatric practice to quality improvement techniques, allowing the office to meet future clinical practice improvement goals.

Rationale

Increasing blood lead level screening adherence demands a change in practice, and an increased awareness of screening requirements. Improvement was accomplished by utilizing the Institute for Healthcare Improvement's (IHI) Model for Improvement (Institute for Healthcare Improvement, 2017). The model asks three questions to guide the project. What does the project want to accomplish? How will you know you have accomplished your goals? and What change can be made to accomplish your goals? This model requires a thorough needs assessment. There is also a mechanism to study whether unintended consequences occur following the interventions. These are referred to as balancing measures. The IHI model then provides the platform for continuous evaluation and facilitation by using PDSA cycles. Success is defined by studying the process measures, or, the way the data is manipulated. This framework matched the needs of this quality improvement project, as it addresses change in a rapid format with continuous feedback.

Methods

Context and Stakeholders

The clinic is a privately-owned pediatric office in the Shenandoah Valley in Virginia. Currently, approximately 60% of the clinic's children are enrolled in Medicaid. The clinic employs four pediatricians and two nurse practitioners to provide a medical home for children from birth, to transition to adult medicine. Prior to the quality improvement project the clinic screened for blood lead elevation in every 1-year-old child. There was widespread acceptance of this screening from nursing staff, providers, and parents, but they had not yet adopted the Medicaid requirement to perform a second screen in the 2-year-old. De-identified data from children between ages 1 and 3 were studied to ascertain precise rates of blood lead screening and the effect of an intervention to improve rates of screening.

Input was required from the practice manager, the provider group, and the RN's, specifically the Nurse Manager. The pediatricians and nurse practitioners also needed to be on board with the improvement. The children and their parents were also stakeholders. The RNs and providers had high power and high interest in this project and needed to be engaged.

Interventions

The proposal was approved by the James Madison University (JMU) Investigational Review Board. Before the initiation of the PDSA cycles a needs assessment was performed. The IHI Model for Improvement uses an Ishikawa diagram to study the environment and stakeholders (Appendix 1, Figure 1). A data collection tool was used for a retrospective chart audit of 1 and 2-year-olds who have been seen in clinic over the past year for a well child check. Children 1 and 2 years of age, enrolled in Medicaid, who had a well child check at the clinic during 2017 were included. Once these charts were identified, systematic sampling was used and every third record was chosen to review, which resulted in forty-three charts of 1-year-old children enrolled in Medicaid and thirty-five charts of 2-year-old children enrolled in Medicaid. The data collected was de-identified and included age, sex, number and date of lead screenings performed, and the number of elevated blood lead levels.

The first intervention was an in-service of all staff reviewing the current guidelines, and a posting of new laminated guidelines at weigh station and lead collection station. The rationale for this intervention was that the clinic mission statement is to be the premier pediatric provider in the area, and the staff will be motivated to follow most recent guidelines. Materials for this intervention were laminated lead screening guidelines and an in-service to discuss the new process with the entire staff. The staff were then to deliver the change by screening 2-year-old children at their well child checks. This was the first PDSA cycle and it was to run for three weeks. Necessary changes were made as issues occurred. Run charts were maintained, with data pulled two times a week.

Cycle two was planned to test the results of the additional implementation of an electronic health record flag in the charts of eligible 1 and 2-year-old children. Every child between 1 and 3-years-of-age was to have a reminder flag indicating the need for blood lead level screening. Bordley, Margolis, Stuart, Lannon, & Keyes, (2001) ascertained that reminders such as flags on charts can increase screening rates. Lead screening rates in their study increased from 12% to 48% with the use of reminders tailored to the individual offices' needs (Bordley et al., 2001). The practice manager activated these flags. In the results, it is noted that this became the third PDSA cycle.

Cycle three initially was to implement an intervention with one provider and nurse team initiating a morning huddle to review the day's patients and identify children in need of a blood lead screen. Meropol et al., (2014) showed an increase in testing rates after implementation of a huddle process. This cycle never occurred, again see the results section for details.

Study of the Intervention

A brief chart review was completed 9/7/17, to determine blood lead level screening practices. Interviews with staff were conducted to establish knowledge regarding Medicaid screening requirements, and to complete the Ishikawa cause and effect diagram. During this process it was discovered that this clinic does not screen 2-year-old children enrolled in Medicaid for blood lead levels, despite Medicaid requirements to screen children at age 1 and 2-years-of-age. A physical review of work areas and posted guidelines was completed, identifying where guidelines were posted, and whether they were up to date. No physical reminders to collect blood lead levels were found, and posted guidelines were outdated.

Once the PDSA cycles were underway run charts were utilized to study whether the planned interventions were effective. Data points were collected two times a week and plotted against the baseline rate of blood lead screening, and the goal of blood lead screening. There were two concurrent run charts: one for the rate of 2-year-old children tested, and one for the rate of 1-year-old children tested. The total number of children seen each day in clinic was tracked throughout the study.

Measures

Outcome measures

The outcome measure was to increase from baseline, the percentage of 2-year-old children enrolled in Medicaid receiving a blood lead screening at their 2-year well child check. A run chart tracked this percentage. The numerator was the number of 2-year-old children enrolled in Medicaid screened at their well child check, and the denominator was the number of 2-year-old children enrolled in Medicaid attending their well child visits.

Process measures

The first process measure was to identify the number of 2-year old children enrolled in Medicaid who presented for a 2-year well child check each week. This was collected each Tuesday and Friday during project implementation.

The second process measure was to identify the number of 2-year old children enrolled in Medicaid who had a blood lead screening completed at their 2-year well child check each week. This was collected each Tuesday and Friday during project implementation.

Statistical Analysis

Rates of 1 and 2-year-old children screened from cycle one to cycle two of the PDSA intervention were compared with a Fisher's Exact test to determine whether the intervention had effect on the rates of screening. This test was repeated with the rates of 1 and 2-year-old children screened from cycle two to cycle three of the PDSA interventions. The total number of children seen during each PDSA cycle were compared with a one-way ANOVA to ensure that there was not a wide variation in the busyness of the clinic between the cycles.

Balancing Measures

Several measures were tracked to measure unexpected effects on other areas of the clinic. First, the percentage of 1-year-olds with lead screenings completed was tracked to ensure that focus on the 2-year-old did not decrease the already robust 1-year-old screening rates. The number of 1-year-old children enrolled in Medicaid attending their 1-year-old well child check and having a blood lead screen was the numerator, and the number of 1-year-old children enrolled in Medicaid insurance attending their 1-year well child check was the denominator.

The total number of children seen in clinic each week was also determined to understand the effect of clinic volume on children screened for blood lead levels.

Results

Use of the IHI Model for Improvement and PDSA cycles allowed for continuous feedback and adjustment to the intervention cycle. The first intervention, the educational session, not only did not produce any increase in screening rates of 2-year-old children enrolled in Medicaid, but also decreased the screening rate of all 1-year-old children enrolled in Medicaid. After the educational intervention, nurses were dismayed that they were not meeting the Medicaid requirements. However, they hesitated to implement a new screening practice without a written policy from the medical director. Obtaining, verifying and posting this new policy became the second cycle of the PDSA interventions (see Appendix 2, Table 1).

Run charts of the balancing measure to ensure no unintended consequences occurred revealed that 100% of 1-year-old children enrolled in Medicaid were being screened until the educational intervention. After that intervention, the rate dropped to a low of 66%. The nurses were confused about the place of the new screening of the 2-year-olds and became confused about their current practice. Once the policy was signed and in place, the screening rate of 1-year-old children enrolled in Medicaid returned to 100% and remained there for the duration of the project (Appendix 3, Figure 2.)

A Fisher's Exact Test was used to determine the statistical significance of the change in the rates of screening between cycle one and two, and cycle two and three.

There proved to be a statistically significant difference between the rates of screening from PDSA cycle 1 (the educational intervention and PDSA cycle 2 (the policy change). The 1-sided p-value was <0.001. The significance of the difference in PDSA cycle 2 (the policy change) to PDSA cycle 3 (the EHR flag) was less dramatic, with a 1-sided p-value of <0.040. These results are consistent with the run charts.

As a balancing measure an ANOVA test was run on the total numbers of patients seen in clinic each day, during each PDSA cycle. There was no statistically significant difference in the numbers seen in clinic in each PDSA cycle ($P <0.296$), indicating that the null hypothesis cannot be rejected.

The aim of the project was to increase screening of 2-year-old children enrolled in Medicaid. While the needs assessment revealed a screening rate of 0, the first week of data collection prior to the educational intervention (PDSA cycle 1) showed a screening rate of 25%. After the educational intervention, the screening rate dropped to zero once again. Upon the implementation of the policy change (PDSA cycle 2) the rate of screening for 2-year-old children enrolled in Medicaid increased to 100% but remained there just two weeks. Five weeks after the policy change the screening rate of 2-year-old children enrolled in Medicaid dropped to 33%. At this time the addition of an EHR flag was implemented (PDSA cycle 3). This increased the screening rate of 2-year-old children enrolled in Medicaid to 50% in the first week, but it was determined that the flag was not functioning properly. The flag was fixed, and the screening rate for 2-year-old children enrolled in Medicaid increased to 100% and remained there for the final five weeks of the project. See Appendix 3, Figure 3.

Discussion

While the educational intervention was necessary to this project, the results show that in and of itself, education is not enough. It was surprising how effective the simple act of implementing a written policy signed by the physician proved to be. However, the effect of this policy implementation showed signs of not persisting. The final cycle of the added EHR flag cemented the change. PDSA cycles in this project were only effective with the constant feedback and facilitation by the study team.

Facilitators and Barriers

The final success of this project was dependent on the dedicated staff at at the clinic. The project was consistent with its organizational mission, and the values of the nurses and providers. The practice manager was on board with the project and provided an important role as facilitator and bridge between the staff, providers and study team. Without they buy-in from the practice manager, the adjustments to the PDSA cycle requiring a written policy change would not have been possible. The relationship of the investigator to the practice manager was key.

While the staff were the reason for the success, they were also one of the barriers. As predicted, there was hesitancy from a handful of the nurses to simply adopt best practice and work to the full scope of their license. The IHI framework allowed for continual assessment of the environment, and adjustment to the PDSA cycle, which resulted in the adoption of the new practice of screening the 2-year-olds enrolled in Medicaid. While the hope was that the all RN staff would adjust their screening practice with the educational intervention, the reality of the clinic environment showed that education alone was not enough.

An unintended but not unexpected occurrence during the PDSA cycle implementation was the initial drop in the robust rate of 1-year-old lead screening. Fortunately, the project design anticipated this and provided for careful tracking of these screenings as the 2-year-old screenings were addressed. Close work with the practice manager resulted in a quick course correction. Again, the PDSA rapid feedback was crucial to catch and address this issue.

Limitations

This project was carried out in a small, local practice. While the interventions are evidence based, implementation in a variety and larger number of clinics would be necessary to determine if the results are replicable. My proposed chi-squared statistical analysis needed to be modified to a Fisher's Exact test due to small numbers. These small numbers were due, in part, to an extremely virulent flu season which necessitated the cancelling of well child check appointments to accommodate the influx of ill children at the clinic.

Conclusion

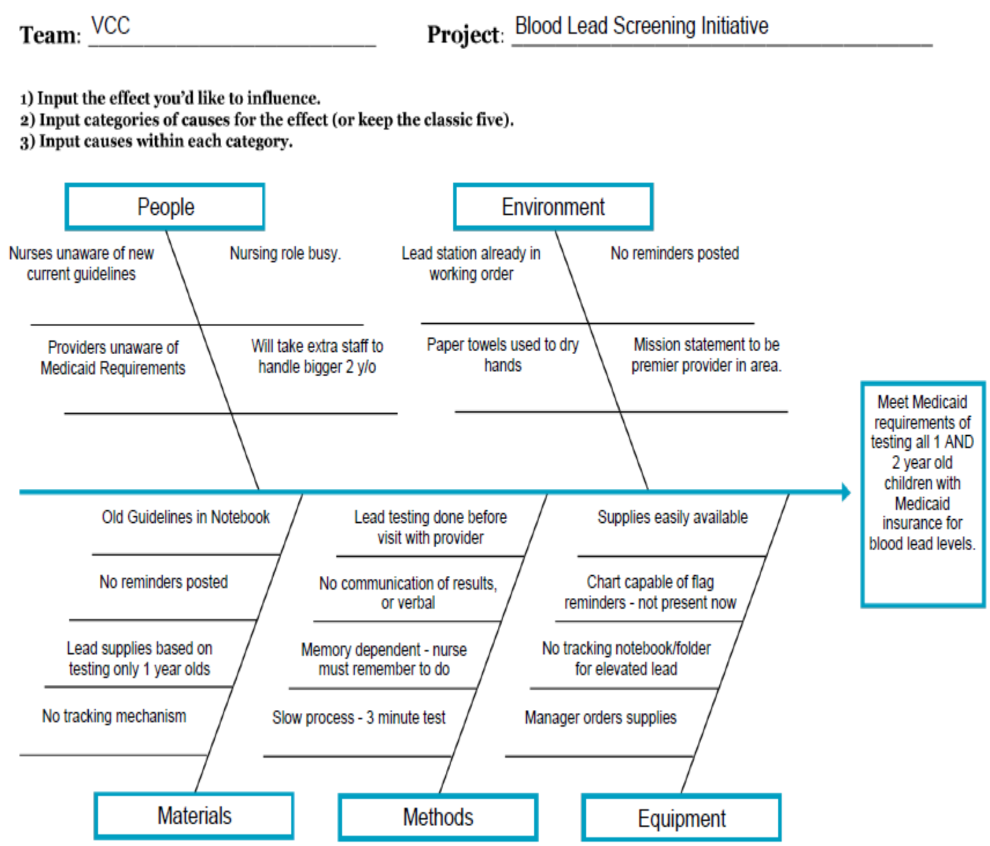
National trends show that children with increased risk of lead exposure are not appropriately screened. Environmental improvements have made a significant impact on the levels of lead in paint, gasoline and water pipes, however, children continue to experience new lead exposures. This fact highlights the importance of robust screenings for blood lead levels in children known to have high risk of exposure, such as those enrolled in Medicaid.

The IHI model is an evidence-based method to change practice and behavior and proved to be an effective method to increase screening in one private pediatric clinic.

The results of this project proved to be consistent with the literature as noted in the literature search, and the IHI model produced lasting results and could be used for many office-based practice improvements.

Appendix 1

Figure 1 Ishikawa Diagram



Appendix 2

Table 1 PDSA Cycles

Planned PDSA cycles	Actual PDSA cycles
1. An educational lunch and learn was held to increase staff knowledge on appropriate lead testing.	1. An educational lunch and learn was held to increase staff knowledge on appropriate lead testing.
2. An EHR flag was to be implemented to capture all children requiring lead screening.	2. Fallout from the educational session necessitated a formal written and signed policy change to be put into place.
3. A morning huddle to increase communication between nurses and providers was to be held each morning before clinic.	3. The EHR flag was put into effect and brought screening rates to 100%, no further cycles were implemented.

Appendix 3

Figure 2, Balancing Measure Run Chart

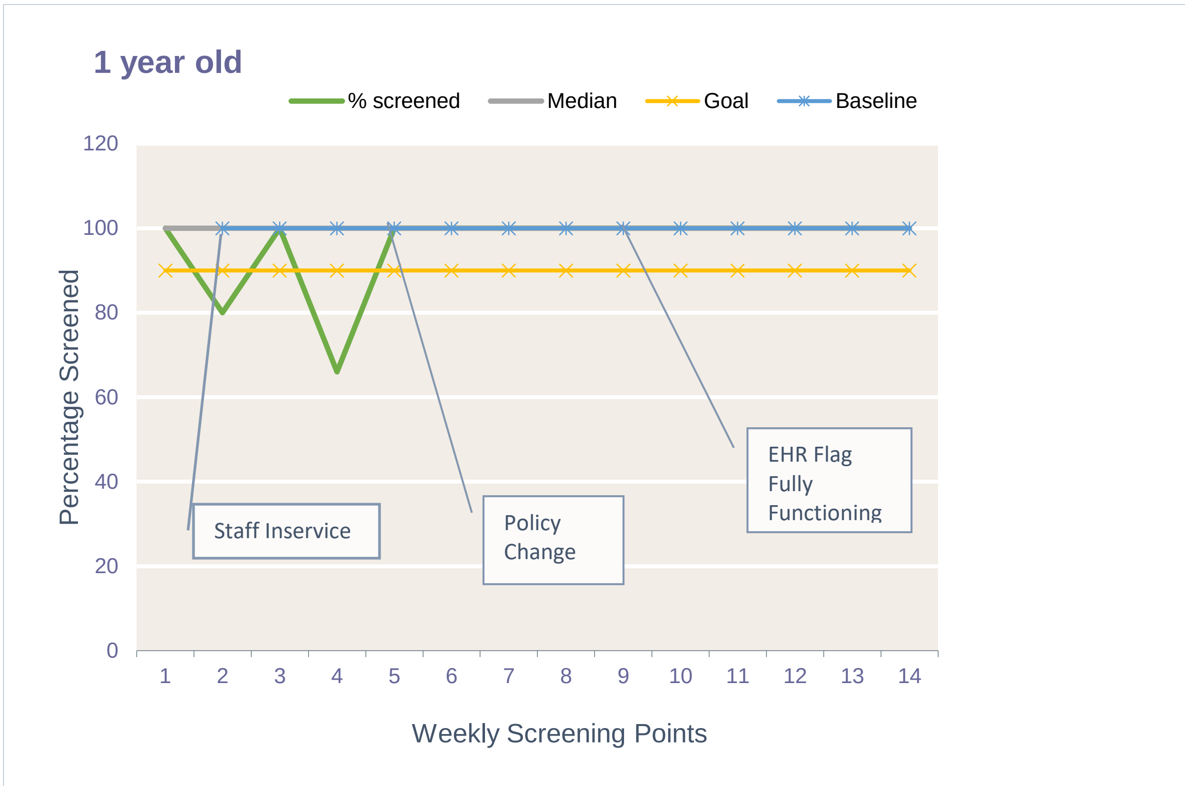
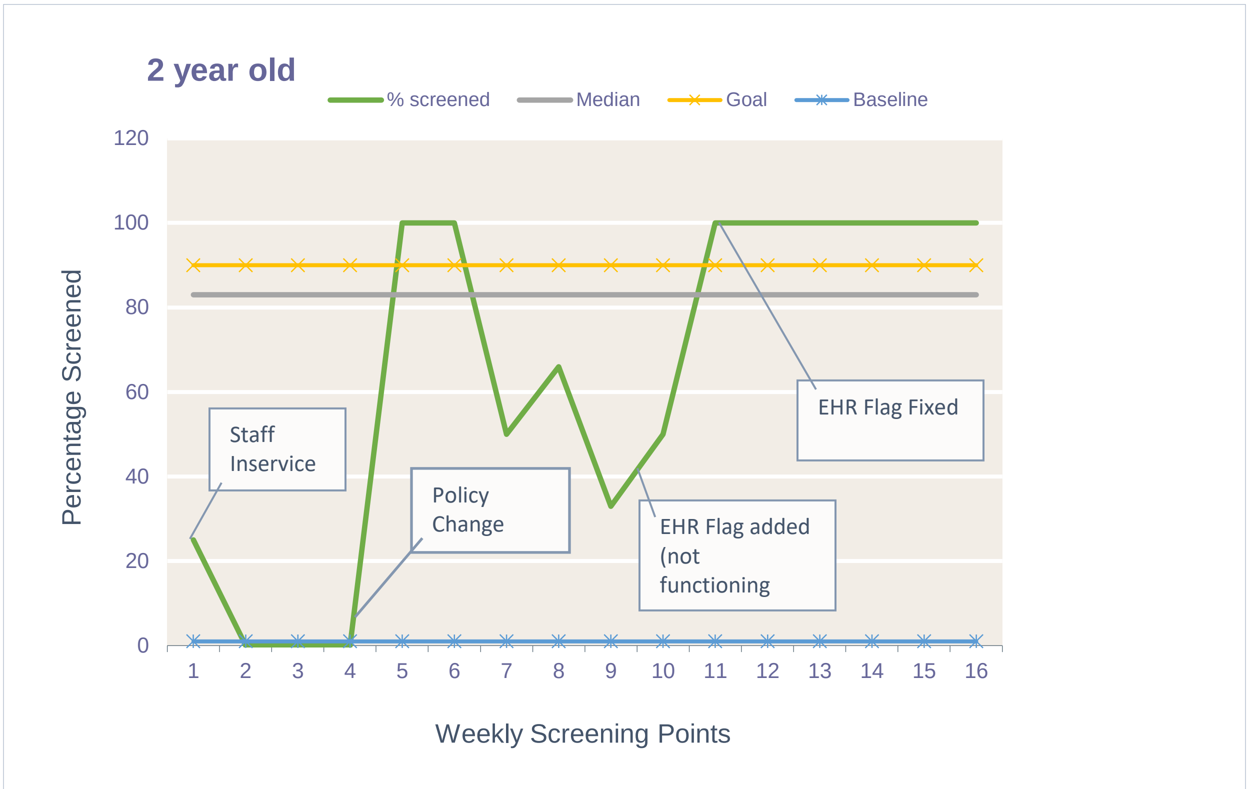


Figure 3, Outcome Measures Run Chart



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