Southern California CSU DNP Consortium

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USING VALUE STREAM MAPPING TO EXPLORE NEWBORN CLINIC EFFICIENCY AND PROVIDER SATISFACTION

A DOCTORAL PROJECT

Submitted in Partial Fulfillment of the Requirements

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DOCTOR OF NURSING PRACTICE

By

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ABSTRACT

Introduction: Newborns are a unique and vulnerable patient population, especially when born into families of low socioeconomic status. They are commonly blended with the general pediatric population in outpatient community care centers. Because of safety concerns during the global COVID-19 pandemic, a federally qualified health center moved its newborn care (NBC) to a smaller, more controlled women's health center. Statement of the problem: After the move to women's health center, multiple reports of staff dissatisfaction about the newborn clinic (NBC) operations emerged that highlighted the need to explore operational flow. The purpose of this project was to examine operational flow in a newly formed, inner-city NBC and enhance the role of coordinated care delivery. Methods: The Lean Six Sigma and the Donabedian models guided the project. Value Stream Map (VSM) was used to examine flow to identify areas for improvement, and provider satisfaction was measured by a Qualtrics™ survey. Results: Baseline data revealed two areas of 'idle time' within the clinic flow. This allowed for Post-Partum Depression and Social Determinants of Health screening to be implemented without increasing NBC cycle time. After implementation, care delivery satisfaction scores slightly improved with no change noted in the satisfaction of clinic operations. Implications and significance: These results suggest that Lean Six Sigma and VSM are effective tools when identifying areas to improve care delivery. Recommendations: VSM should be applied when attempting to understand clinic flow dynamics.

Keywords: newborn; newborn clinic; FQHC; quality improvement; Lean six sigma, value stream mapping; Donabedian model; provider satisfaction; postpartum depression; social determinants of health; care delivery

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Background

According to the Health Resources and Services Administration (HRSA) (2014), only 51% of patients 0-17 years of age were "always or usually seen within 15 minutes of appointment time" suggesting that there is significant room for improvement in the efficiency of care delivery. Uner et al. (2013) report that pediatric primary care visit lengths are often arbitrary and frequently made in five-minute increments and, commonly, there is discordance between the amount of time needed versus the amount of time allotted for providers (Klassen & Yoogalingam, 2019). On the one hand, there is a growing demand for primary care providers and their services; on the other, the supply of primary care clinicians is inadequate to meet the demand (HRSA.gov, 2013). Tlapa et al. (2020) highlight that poor patient flow and inadequate resource allocation may contribute to delays in care and overcrowding, which may ultimately affect patient care and safety. They further continue to state that patient waiting time and length of stay in the clinic are often used as a proxy measure of clinic efficiency or flow, but there is a lack of consensus around critical time frames for patient visits, and if those time frames are being used effectively.

The problem of care delivery is a multifactorial issue. In outpatient clinics, it often starts with scheduling. The origins of patient scheduling in healthcare, as is known today, began with Bailey (1952) and Welch (1964) who introduced the block and fixed interval systems. Many studies from around the world (Faiz & Kristofferson, 2018; Harding et al., 2018; Klassen & Yoogalingam, 2019; Le et al., 2020) have examined scheduling, flow, and wait times highlighting that the issue of delivering efficient care, which adheres to best practices, is a salient and pressing issue in the delivery of health care.

Scammon et al. (2014) examined the "organizational culture" of 10 community health centers in Iowa and noted that when adequate time and resources are afforded to Patient-Centered Medical Homes (PCMH), providers are generally satisfied in their positions. However, when provider satisfaction is low, this can generally be attributed to barriers to providing care, whether it be administrative work required for patient-centered care (Scammon et al., 2014), poor patient flow, or poor resource utilization (Tlapa et al., 2020).

Clinicians, assistants, and clinical administration all strive to deliver, and patients deserve to receive, effective and efficient care. Klassen & Yoogalingam (2019) highlight that scheduling in healthcare facilities is often focused on patient wait times, reduction of provider downtime, and flow/throughput times. Whether the setting focuses on outpatient newborn care (Glassman et al., 2020), outpatient neurology (Faiz & Kristofferson, 2018), community health (Harding et al., 2018), ancillary services (Le et al., 2020), or outpatient adult primary care (Oktunogbe et al., 2017), the issues of efficiency and flow and the resulting patient and provider satisfaction are universally challenging.

Newborns, specifically Medicaid-insured and jaundiced newborns, are a vulnerable population who require a specialized form of attention (Glassman et al., 2020). It has been known for many years that newborns, and in particular preterm newborns, are at an increased risk for complications. Preterm delivery is known to be a risk factor associated with 50% of neonatal deaths (Blencowe et al., 2013). For a pregnant mother from a low socioeconomic status (SES) area, the risks associated with pregnancy and birth are increased. Darling et al. (2019) highlight that low SES is a significant contributor to complications such as low birth weight, preterm birth, and mortality in newborns. The newborn clinic (NBC) can provide an opportunity

to address important post-birth follow-up issues, such as growth, illness, anticipatory guidance, and to provide breastfeeding support to the mother/parent (Glassman et al., 2020).

Problem Statement

At a federally qualified health center (FQHC) in downtown Los Angeles, newborn care has historically been scheduled with the general pediatric population. Per the Health Resources & Services Administration (HRSA; 2018), FQHC's provide community-based primary health care in underserved areas. With the COVID pandemic starting in March 2020, delivery of care was forced to change at the clinic. It was not known, at the beginning of the pandemic, the extent to which infants and children would be affected (Cruz & Zeichner, 2020) but, historically, respiratory viruses have affected children and infants to a greater extent than adults (Green et al., 2021). Thus, to protect the most vulnerable pediatric population, a swift decision was made by the clinic executives to create a separate newborn clinic (NBC) away from the main clinic site. The newborn clinic would provide care to newborns through two months of age, per clinic policy. In March 2020, the move to the Women's Health Center (WHC), two blocks from the main clinic site, was made. This helped reduce the risk of exposure to the newborn population and afforded a financial benefit given that reimbursement for services at the women's health facility is higher versus at the main clinic site.

No formal evaluation of the NBC at the FQHC had been performed up to the start of this doctoral project. Clinic administration had received reports from staff and providers regarding their dissatisfaction with aspects of the newborn clinic flow, and a January 2022 baseline survey of clinicians and medical staff working at the NBC since its inception aimed to study the perceptions of the staff at the NBC. The survey respondents (n=11) included clinicians (66.7%), medical assistants (MAs) (16.7%) and registration staff (16.7%). Most respondents reported that

the care delivered was high, however, over half of respondents stated dissatisfaction with working in the clinic. The survey showed that most respondents believed that newborn patients spend 60-90 minutes in the clinic. Common narrative themes noted on the survey included a lack of communication and support between the staff at the WHC and the pediatric MAs, poor allocation of supplies at the WHC, issues with scheduling and late patients, no designated room to assess vital signs, patients spending long periods of time in the clinic, and not enough patient rooms. After discussions with the executive management that included the pediatric medical director, the clinic's chief operating officer, and the chief executive officer, they agreed that further investigation into the efficiency of the NBC was necessary.

A limited retrospective review of available baseline electronic medical record (EMR) time stamps between the dates 9/1/2021 through 1/13/2022 revealed that on average it took 17 minutes to navigate the patient from check-in to initiation of vital signs. A significant limitation noted in the retrospective review by this author was the inconsistency of clinician tracking nomenclature which limited the flow/time stamp data that could be extracted. Data manually collected by the clinic over 53 individual visits suggested that, on average, patients visiting the NBC were spending 1.22 hours in the clinic. Time was stamped at check-in to time of discharge. Of note, this time included a short visit with the lactation consultant that typically occurred whilst the patient was in the room waiting for the provider to arrive.

Purpose Statement

The issues in the newborn clinic were fundamentally centered around the delivery of care. Providers aim to provide high-quality care which, if occurring in an inefficient setting, can affect provider satisfaction. Provider satisfaction is an important consideration in the management of care and, since 2014, the United States (U.S.) has seen an increase in provider

burnout which has been associated with negative consequences for providers and patients (Okunogbe et al., 2018). Therefore, this quality improvement (QI) project aimed to examine efficiency in the newborn clinic, improve provider satisfaction, and address areas to improve the quality of care. There were four main components to this project. Firstly, regarding scheduling, this project aimed to evaluate the current system used in the NBC and implement a scheduling system unique to the NBC. Secondly, to evaluate efficiency, this project examined clinic flow to understand the bottlenecks and identify any non-value-added time in patient flow. Once non-value-added time was identified, through careful data collection and analysis, recommendations were made. Thirdly, to improve provider satisfaction through any improvement in the efficiency and effectiveness of the clinic. Fourth, this project aimed to investigate the role of a care coordinator position at the NBC/WHC to support clinic flow and efficiency.

Supporting Framework

This project was grounded in two frameworks, the Donabedian theoretical model and the Lean Six Sigma framework. The Donabedian model was described in three volumes by Avendis Donabedian in the early 1980s (Donabedian, 1980, 1982, 1985). His model centered around three main components that sought to answer the question of how to study quality (Appendix A). Firstly, *structure* defines the staffing, facilities (buildings, physical spaces), and the rules that guide the procedural operations of the clinic. Secondly, *process* defines the products of care such as rates of utilization, treatments, and the like. And third, the *outcome* is defined as the care provided, the health status of the patients, and the satisfaction of the patients (Berwick & Knapp, 1987) or the impact of care on the patient's overall health (Kash et al., 2018). To fully understand quality in health care, the structures, processes, and outcomes are best evaluated synergistically and dynamically (Kash et al., 2018).

Much has changed in the US since the 1980s, when Donabedian first described his study of quality, and the Donabedian model has proven flexible in its application within health care. Studies using the Donabedian model have explored relationships between patient's experiences and outcomes in the age of the Affordable Care Act (ACA), measured team effectiveness in dynamic clinic settings, integrated health records to optimize outcomes, and examined primary care delivery of patients with chronic kidney disease (Haley et al., 2017; Kash et al., 2018; Paula et al., 2016, Tossaint-Schoenmakers et al., 2021). It is important to recognize that the Donabedian model has been used since the 1980s for a wide variety of projects, highlighting its ability to adapt to an evolving and increasingly diverse healthcare environment. An important limitation of the Donabedian model of quality, if one does not know the structure-outcome relationship, is that using this model of quality in a system can be difficult to understand (Berwick & Knapp, 1987).

The Donabedian model was applied to the FQHC to understand the structures and the processes (Appendix B). Structures identified in the NBC include the MAs, registration department, clinicians, and the rules regarding the procedures in the intake and flow of the patients. Processes include the scheduling, time spent in clinic, and visit preparation.

This doctoral project also used the Lean Six Sigma approach as a framework to define and measure change in the NBC. Lean Six Sigma is a blend of two original models. Six Sigma DMAIC originated in the Motorola company and was introduced by Bill Smith in the 1980's with a goal of reducing variability in the products produced (Parikh et al., 2021). DMAIC, the process framework, is an acronym for *define, measure, analyze, improve, and control* (Langley et al., 2009). The Lean approach originated in the Toyota automotive company during the 1990s and is designed to focus on reducing waste via optimizing efficiency in a process and examines

value, value streams, flow, pull, and *perfection* (Langley et al., 2009). Honeycutt & Keller (2018) highlight that Lean is focused on cutting costs and improving efficiency by removing resources that do not add value to a system. There have been challenges to the idea of using manufacturing or industrial models in health care, however. Cozijnsen et al. (2020) argue that there is a moral compass and a level of diversity in health care that makes an industrial approach challenging to apply. Indeed, Parikh et al. (2021) found that using a strict six sigma approach, although valuable, requires significant coordination and 'buy-in' from all levels of the organization. Multiple studies have, however, demonstrated successful results with the use of quality improvement methods when properly adapted to health care (Hung et al., 2020; Godley & Jenkins, 2019; Kam et al., 2021). Kam et al. (2021) point out that, in health care, there is increasingly a marrying of the concepts from Lean and from Six Sigma to form a Lean Six Sigma approach. Godley and Jenkins (2019) successfully applied the Lean Six sigma approach to reduce wait times and improve patient satisfaction in an outpatient interventional radiology setting. Similarly, Kam et al. (2021) used the Lean Six Sigma method to reduce duration and variability in the time the patient spent in the clinic and were able to increase the capacity for patients without increasing resources to see them. Studies have shown success in improving the patient experience in primary care and to improve the time it takes to complete common clinical tasks such as clinical documentation, medication refills, and other administrative duties belonging to the clinical staff using a lean-based approach (Hung et al., 2020). The frameworks used in this project had the scope, context, utility, and logic to fit with the stated purpose of this project.

Application of the Framework

The acronym DMAIC is used to summarize the steps needed to accomplish improvements and develop controls in improvement initiatives. The following sections delineate how these steps were applied in this project.

Define

The "define" stage of DMAIC involves the process under examination to be defined from an organizational level (Kam et al., 2021). For this doctoral project, two key processes were defined: 1) Patients are perceived to spend excessive time in the clinic and, 2) Staff satisfaction is perceived as being low. During this phase, a project charter was created that outlined the project information, team members, goals, and some anticipated measurements. A project charter was used as the guide for the defining stage given a need for flexibility in the setting of discordance between the timelines of the clinic and the doctoral program. Appendix C includes the project charter that helped to define this doctoral project.

Measure

During the measure phase, the problem is deconstructed and understood at the granular level (Kam et al., 2021). For this project, baseline data were collected by the clinic from provider surveys, a Gemba walk of the current clinic flow, and value stream mapping to understand the issues affecting the perceived problem. Value stream mapping (VSM) is a method of root cause analysis that has been recommended for a lean approach and allows for dynamic evaluation of a process to identify 'value added' and 'non-value-added' areas. Simply put, a VSM allows a process to be examined to uncover inefficiencies that make the process or system inefficient, and can help to identify areas that need improvement (Langley et al., 2009). The preliminary baseline

data were collected by the clinic to determine how best to examine initial information on throughput and how best to collect data to ensure reliability and accuracy.

Analyze

The analysis phase requires that available relevant data be analyzed to identify any root causes of the issues (Kam et al., 2021). During this phase, an examination of the value stream map to identify value-added and non-value-added areas was performed via an observational time stamp approach. This QI project used the data, in conjunction with clinician input, to build a scheduling template with the goal of improving dynamic access for patients, and more flexibility for providers. QI Macros® was used to analyze the data using control charts, given their utility in tracking dynamic sequential data points (Provost & Murray, 2011).

Improve

During this stage interventions should be developed and implemented that address the root causes of the problem (Kam et al., 2021). With the help of a team, engaging with clinic flow, scheduling, and care coordination occurred in an iterative fashion. Provider satisfaction was followed during the improvement phase to ensure feedback from the ground level was heard. Satisfaction was measured with the use of questionnaires. Improvement in time spent in the clinic, in non-value-added time, and in provider satisfaction scores were measured. This will continue to occur post-doctoral project as part of the continuing commitment to quality improvement.

Control

The control phase describes the shift from implementation to maintenance of the change (Kam et al., 2021). During the control phase, frequent revisiting of value stream mapping and provider satisfaction will help ensure the mindset of constant feedback to ensure quality care

continues to be delivered. Part of the sustainability of this project was and will be reliant on the creation of a new care coordinator position and a blending of the WHC and the NBC staff. Funding for such a position has been earmarked in budget meetings in the clinic, however, grant funding will help to secure a risk-free pilot for the clinic. Additionally, support from both WHC and NBC department chairs and all operational team members has been offered. This level of executive level buy in should help improve the chances of long-term success of the project.

Review of the Literature

This literature review aims to examine existing knowledge regarding flow and efficiency in delivering health care in outpatient settings to best understand the current state of the evidence. For this doctoral project, the focus is on NBC. However, there is a paucity of literature regarding NBCs specifically, especially regarding models of care, so proxies were used to help guide this doctoral project. Much is known about efficiency, care coordination, and scheduling, which were all key metrics to understand for this doctoral project. A Lean Six Sigma approach was used to help apply the existing body of knowledge and evidence in the literature to the project's clinical setting.

Search strategies

The search strategy used for this literature review included databases available through the university library. CINAHL plus and PubMed, and Google scholar were the primary data bases used. Key word searches included "efficiency", "wait time", "scheduling", "outpatient", "pediatrics", "newborn", "infancy", "flow", "ambulatory care", "care coordination", "primary care", "FQHC", "federally qualified health centers", "high risk", "low socioeconomic status". Additionally, search terms were combined and included, but were not limited to, combinations of the above search terms and included "primary care" and "wait time", "scheduling" and "outpatient", "pediatrics" and "flow", "scheduling" and "flow", "care coordination" and "outpatient", "pediatrics" and "wait times", "wait times" and "primary care", "wait times" and "outpatient care" "care coordination" and "primary care". Inclusion criteria were applied primarily to include studies from 2015 through 2022 to uncover all relevant literature. Furthermore, manual searching of reference lists in selected studies was performed, with limitations fitting the aforementioned date ranges. Except for seminal works, all literature that

was outside of the selected date range was either excluded or organized into bibliographic reading. Literature was also identified by following citation links of prominent papers to ensure current evidence was being identified thoroughly. Preference was placed on literature that had been cited repeatedly. Geographic location was kept wide and included studies from both developed and developing countries. Exclusion criteria included studies outside of the date ranges. The only grey literature uncovered were conference abstracts and professional organizational models of care coordination.

Newborn Clinic

A single study was uncovered in the review of the literature that dealt directly with the model of the NBC. Glassman et al. (2020) present the Newborn Clinic as a model for providing comprehensive and timely follow-up care to newborns and highlight the importance of newborn care as a distinct patient population within pediatrics. The study was a hospital-based follow-up clinic on hospital grounds and no NBC was operational prior to the study. There was little organization of the process of newborn care and emphasis was placed on the post-partum parent to shoulder the burden of follow-up. The NBC provided follow-up care whilst coordinating and transferring care to ambulatory care settings. Glassman et al. (2020) found that when emphasis is placed on newborn follow-up, the NBC model can provide prompt and effective care to newborns.

Given the paucity of work published surrounding newborn clinics specifically, this literature review focused on the diverse body of literature that may be applicable to care delivery. After reviewing the literature, efficiency, care coordination, and provider satisfaction were given special attention given the symbiotic nature that exists between these entities. Although settings

varied in the literature, attention was paid to studies conducted in the outpatient ambulatory setting where possible.

Efficiency

Due to a combination of an aging population, decreasing reimbursement rates, the rising burden of chronic disease and mental illness, and a shortage of clinicians, health care in the 21st century is rapidly evolving, and the result is often an inability of clinics to supply health services efficiently (Akhtar et al., 2017; Bard et al., 2016; Celedonia et al., 2021; Freihoefer et al., 2018). Studies have explored ways to improve efficiency and flow in the primary care setting (Bard et al., 2016; Beassier et al., 2015; Freihoefer et al., 2018) and in the specialty setting (Ramly et al., 2019; Pan et al., 2015; Singman et al., 2015) highlighting the commonality of the issue across the healthcare landscape. The urgency to improve flow and increase quality is noted throughout the literature and can be observed by growth in the field of quality improvement (QI) around the world (Akhtar et al., 2017; Bard et al., 2016; Tlapa et al., 2020). A common characteristic of many of the studies is the use of QI methodologies such as Lean, Six Sigma or Lean Six Sigma (Bard et al., 2016; Flannery et al., 2020; Honeycutt & Keller., 2018; Singman et al., 2015). Such strategies have often been applied to improve efficiency in health care given the strength of these approaches in eliminating variability and waste in a system (Tlapa et al., 2020).

When reviewing the literature surrounding efficiency and flow, themes arose that allowed for the categorization of common themes. Scheduling, wait times, throughput, and care coordination, although all symbiotic in nature, are considered discrete elements that can be individually explored and were included in this literature review. This literature review explored the literature surrounding those elements.

Scheduling

Scheduling in healthcare facilities is a frequently studied component of healthcare efficiency and satisfaction and is often associated, either positively or negatively, with patient wait times, reduction of provider idle time, and flow times (Klassen & Yoogalingam, 2019). It was the seminal work of Norman Bailey in 1952 that first documented the common phenomenon of long patient waiting times relative to patient-provider interaction. Scheduling has long been designed with an emphasis on reducing provider idle time and often allocates a volume of patients that exceeds the reasonable ability of the provider to see them efficiently. (Bailey, 1952; Welch, 1964). Additionally, it was noted in the works of Bailey (1952) and Welch (1964) that patient visit lengths vary greatly, with some patients requiring more time and the majority requiring less. The discussion about scheduling patients, noted 70 years ago, is still much the same today, with idle provider time being a heavy focus of clinic scheduling design (Klassen & Yoogalingam, 2019).

The scheduling framework of Bailey dictates that visits are commonly scheduled in 'blocks' with the first block open for two patients and subsequent blocks open for one patient per block. This style of scheduling is commonly known as 'Baileys Rule' and remains the foundational principle underpinning much of the schedule design in the outpatient setting today (Ahmadi-Javid et al., 2017; Klassen and Yoogalingam, 2019).

The fundamental issue with scheduling can be distilled down to the question of how to regulate the inflow of patients to a health service system that inherently struggles with the structural resources of staffing or limited facilities in which to see the patients (Anvaryazdi et al., 2020; Sickinger & Kilisch, 2008). Scheduling has been identified to have several independent variables that prevent effective scheduling templates to be easily designed. These include no-

show rates, delays in check-in, waiting times, and provider or staff idle time (Anvaryazdi et al., 2020; Bailey, 1952; Carerras-Garcia et al., 2020; Dantas et al., 2018; Klassen & Yoogalingam, 2019; Welch, 1964). The common challenge is how to bring patients, who are by nature dynamic, through the health system without the risk of patient dissatisfaction or reduction in quality (Dantas et al., 2018). Multiple recent studies examined how best to schedule patients either with the use of mathematical models, dynamic systems of scheduling, or by trying to qualitatively understand the independent variables that influence patient scheduling (Anvaryazdi et al., 2020; Dantas et al., 2018; Faridimehr et al., 2021; Huang, 2016). The necessity of an individual approach to the application and design of scheduling is prominent in the literature.

Multiple studies used mathematical models that, based on observational time stamps and historical EMR data, were able to generate an enormous variety of scheduling formats (Anvaryazdi et al., 2020; Harris et al., 2016; Klassen & Yoogalingam., 2019; Li et al., 2018; Viana et al., 2020). One study (Klassen & Yoogalingam, 2019) described the use of mathematical modeling that led to a nurse practitioner being hired to improve clinic scheduling. They measured wait times, overtime costs, and physician service time to combat the persisting stressor of patient volume outpacing the ability to see patients in a timely manner. Again, the importance of evaluating the site for its unique characteristics was found to be crucial for a successful project.

Throughput

The US Institute of Medicine (2001) recommended, over 20 years ago, that care should be delivered in a timely manner for both the patient and the staff providing the care. Over 20 years have passed and the amount of time a patient spends waiting is often not only too long but is poorly defined and varies significantly by region and specialty practice (Ahmad et al., 2017;

Harding et al., 2018). Furthermore, perceived excessive waiting time is associated with increased cost, patient anxiety, patient mortality rates, and patient dissatisfaction which can influence a patient's decision to continue care at a health facility (Alam et al., 2017; Ansell et al., 2017). A study by Alrasheedi et al. (2019) found that patients were dissatisfied with excessive wait in multiple areas of their time spent in the clinic from consultations through to medication dispensing. Multiple approaches, many of which utilize a Lean Six Sigma approach, have been attempted to decrease wait time for patients (Cheung et al., 2016; Elkholi et al., 2021; Godley & Jenkins, 2019; Milford et al., 2018). However, the settings vary significantly and highlight the need for an individualized approach to managing wait times in healthcare settings.

The issue of throughput is a known problem in health care (Ahmad et al., 2017; Alam et al., 2017; Alrasheedi et al., 2019). The literature has a robust body of evidence; however, the settings are varied and there is little specific focus on primary care settings. In a systematic review of interventions to reduce wait times, Ansell et al. (2017) highlight that open access and patient-centered scheduling, which includes the use of telehealth and primary care teams, may reduce wait time in primary care. Ansell et al. (2017) highlight that same-day scheduling may be more appropriate for younger patients and pre-made appointments may be better for older patients. There are many other models aimed at reducing wait time, face time, and cycle time, but the heterogeneity of the settings further highlights the need for a case-by-case, dynamic approach to improving the time spent in the clinic (Harding et al., 2018; Milford et al., 2018; Munavalli et al., 2017).

Patients are not only concerned about time spent in the clinic. Quality of care is also a key metric of satisfaction and efforts to coordinate care and engage the patient meaningfully have been studied; the literature again highlights the need for an individualized approach to patient

engagement and coordinated care (Anvaryazdi et al., 2020; Pockros et al., 2021; Stucky et al., 2020; Volk et al., 2020). Furthermore, if a health facility can meet the patients' needs through coordinated care and efficient throughput, health facilities may increase revenue (Volk et al., 2020), which is in line with the Institute for Healthcare Improvement's (IHI) Triple Aim of improving the patient experience, improving population health, and reducing per capita cost (IHI, 2022).

Coordinated Care

The Agency for Healthcare Quality and Research (AHRQ, 2018) broadly defines care coordination as being the act of intentionally organizing patient care with the goal of improving efficiency and safety in the delivery of health care. The importance of providing timely care is paramount in meeting the needs of patients in today's world, and the PCMH model focuses heavily on the importance of care coordination, although inconsistently applied (Song et al., 2017; Wakefield et al., 2020). Of note, this author found only one study that examined the importance of care coordination in providing timely care to newborns (Goyal et al., 2016).

Despite a wealth of evidence demonstrating that care coordination is effective at improving efficiency and reducing costs (Bentti Vockel et al., 2017; Berkowitz et al., 2018), and given that it is a metric of Medicaid Managed Care (MMC), one might assume that this trickles down to clinics in an organized and measured fashion. However, one should not rely on top-down models to organize care coordination by default, but rather clinics must develop care coordination systems, from the ground up, that work for their individual health clinics/systems (Gilschrist-Scott et al., 2017). Care coordination has been shown to improve team dynamics, perceptions of safety, referral processes, and improve patient experiences and outcomes (Blumenthal et al., 2018; deJong et al., 2021; Di Cuapua et al., 2017; Fabre et al., 2020) but

requires full buy-in from all levels of care, staffing stability, and significant effort to work properly (Vaz et al., 2018). Care coordination, by design, needs to be able to adapt to the circumstances of the healthcare environment and there are multiple models, each serving to improve the individual organizational goal of the healthcare facility. Appendix C lists a sample of care coordination models, their design, and settings that the author reviewed for guidance in developing this project. The Care Coordination Model (CCM) by MacColl Institute for Innovation in Healthcare (2010) recommends that care coordination be operationalized by designating a care coordinator. Multiple studies have echoed this recommendation and have hired new staff or used existing staff to coordinate care. Studies have demonstrated the hiring of non-licensed coordinators (Di Capua et al., 2017) or the use of existing but separate organizations specializing in care coordination/advocacy to improve outcomes in population subsets (Berkowitz et al., 2018).

In their study of 24 health systems across four states, Harvey et al. (2020) reported that common initiatives that aim to deliver high-quality coordinated primary care used a variety of approaches, including regionalized care coordinators, integrated electronic health records, team-based care, and population management tools. Matiz et al. (2021) hired three RNs specifically to act as Nurse Care Manager tasked with coordinating care of patients. Their group was able to operationalize the skills of the RNs who could help the patient understand their care and address medical device and pharmaceutical issues quickly. When evaluating the implementation of care coordination, studies used patient satisfaction surveys and tracked rates of hospital or emergency room use and observed a decrease in the number of needed follow-up visits, or specialty visits needed to determine if coordination was successful. There was little operationalization of the exact roles and duties of care coordinators, which speaks to the individuality of care

coordination. Furthermore, the heterogeneity of approaches to scheduling, care coordination, efficiency, and outcome measures emphasizes the importance of individually evaluating the needs of a site (Di Capua et al., 2017).

Provider Satisfaction

Gaps exist in the use of provider satisfaction as a primary outcome measure. Where outpatient QI studies discuss provider satisfaction, it is often an aside to further bolster the perception of the success of the QI project (Harvey et al., 2020; Matone et al., 2021; Weigart et al., 2019) but rarely a primary outcome measure. It has been well documented that the burden of responsibility to deliver quality-driven care often falls to providers and as noted previously, the design of patient scheduling often results in patient volume exceeding the provider's ability to see patients in the allotted time to do so (Cox et al., 2016; Hajebrahimi et al., 2019; Klassen & Yoogalingam, 2019). Despite limitations in the literature, provider satisfaction must be considered in the effective delivery of care. With the growth in the field of QI in healthcare, there is a shifting focus to provider satisfaction both in the hospital and the outpatient clinic and is starting to be seen as a key metric running parallel to efficiency and productivity (Baccei et al., 2020; Tlapa et al., 2020; Weigart et al., 2019). The common tool to operationalize provider satisfaction was online surveys (Baccei et al., 2020; Canterino et al., 2022), which is consistent with this author's chosen method of measurement for provider satisfaction.

Investigating Workflow

Efficiency was primarily evaluated using observational time stamps. This was often done as part of the root cause analysis and time was the common metric used as comparative data when either flow and/or efforts to improve coordination of care were implemented (Bard et al., 2016; Dixon et al., 2015; McBeth et al., 2017; Ramly et al., 2019; Singman et al., 2015). The

exceptions were Akhtar et al. (2017), who used discharge rates as a metric for improved efficiency and, Baccei et al. (2020) whose observational studies attached electronic tags to the clinicians to track turnaround time for procedures and overtime expenses.

The studies evaluating or improving efficiency all shared a common theme, which was the need for independent analysis of the site. Many studies used QI methodologies to analyze and improve workflow, such as that used by Kam et al. (2021) who evaluated the variability of patient time in the clinic, and the number of patients seen in a clinic day, via a Lean Six Sigma approach.

Conclusion

This literature review gave the author confidence that taking an individual needs-based approach to clinic improvement via the use of QI methodologies, especially the Lean Six Sigma, is an effective way to improve the delivery of quality care. However, improving clinic efficiency is heavily dependent on an understanding of scheduling, throughput, and robust care coordination. Patient-centered care and an individualized approach are crucial to QI project success. Provider satisfaction, although becoming more of an emphasized metric, and being noted in many QI studies, is not consistently or thoroughly operationalized despite heavy focus on utilization of clinician time in both efficiency and scheduling literature. A significant gap in the literature is noted surrounding the implementation of newborn care clinics and the care of newborns in the outpatient setting; therefore, much of the review of the literature needed to occur in proxy topics such as efficiency, care coordination, and provider satisfaction. The aim of this doctoral project, guided by the literature and Lean Six Sigma framework, was to identify barriers in the clinic process that prevented effective throughput and scheduling, and to improve provider satisfaction and care coordination in the NBC.

Methods

The purpose of this QI project was to examine efficiency, improve provider satisfaction, and implement a care coordinator position in the NBC. With a theoretical underpinning of the Donabedian Model, this QI project was guided by a Lean Six Sigma DMAIC framework, which helped to structure the QI project.

Setting and Design

This was a Quality Improvement (QI) doctoral project conducted in an urban FQHC in downtown Los Angeles. The FQHC provides medical, dental, mental health, and vision services to a largely low-income minority population of Latino and African American patients. As of 2020, the clinic's Uniform Data System (UDS) shows that the FQHC has seven core primary care sites serving 39,698 patients. Forty-six percent of patients are children aged < 18 years, 49.30% of patients are 18-64, and 4.02% are aged 65 years or older. Eighty-one percent of patients identify as Hispanic or Latino and 10.75% are African American. In addition, seventy-three percent of patients also identified as mixed race and 22.86% of patients are best served in a language other than English. Ninety-seven percent of patients are at or below the federal poverty line and 74.50% of patients are Medicaid/CHIP patients. Eighteen percent of patients are uninsured. UDS total cost data for 2020 were $43,785,036 with a total accrued cost per patient of $1,102.95.

A review of data from i2i Tracks, a population data management tool used by the clinic, revealed that between January 1, 2020, and April 6, 2022, 2,614 newborn encounters were seen in the pediatric department. As mentioned, the NBC was quickly established at the beginning of the pandemic (March) and moved to the WHC. The count of NBs, 2,614, includes all newborns

seen and billed through either the pediatric department or the WHC. Of the newborns seen, 314 (12%) were born at 36 weeks or less.

The design of this QI project involved the use of both qualitative and quantitative approaches to gather data on workplace satisfaction of providers and MAs. Electronic surveys using a Likert scale measured perceptions surrounding their level of satisfaction in working in the NBC, whether they believed the quality-of-care was effective and efficient, and how much time patients spend in the NBC. Additionally, a qualitative, open-ended survey question aimed to identify themes among the providers and staff that were important. As mentioned, this QI project was guided by a Lean Six Sigma DMAIC Framework and supported by the Donabedian theoretical model.

Participants/Sample

Inclusion criteria for the study included all deidentified time stamp data reports that were collected using convenience sampling. Baseline data were collected on scheduled newborn visits without the use of any identifying data. Patients were assigned numbers (1-5) based on their arrival time for their scheduled appointment. This occurred as they arrived and did not necessarily correlate with their scheduled appointment time. A notice informing patients of an ongoing project was posted in the waiting room of the clinic (Appendix D).

Convenience sampling involved every other patient arriving at the clinic for their scheduled appointment time. This occurred on Mondays, Wednesdays, and Fridays over the second two weeks of August 2022. The days chosen were based on the availability of the AmeriCorps volunteers once IRB approval had been given.

Stakeholders

The primary stakeholders involved in this project included the pediatric medical director, the clinic medical director, the outpatient operations manager, the clinic Chief Operating Officer (COO), the clinic Chief Executive Officer (CEO), and the women's health director. Stakeholder details can be found in the project charter (Appendix E).

Ethical Considerations

As with any clinical study, the ethical considerations of protecting patient rights are of the utmost importance to this project. Given that children are economically or educationally vulnerable individuals, they are noted to be of the highest risk (Department of Health and Human Services, 2009), and all quantitative observational data were anonymously collected. Newborns are unable to provide informed consent, so consent to collect VSM time stamp data were obtained from the parent. Only time stamp reports were collected for quantitative data, and parents were informed that data collection involved no identifying data (names, street or email addresses, birth dates, ethnicity, gender, income status, etc.). Verbal consent, via consent form (Appendix F), was obtained prior to data collection. Consent was obtained by the AmeriCorp volunteers and was collected by the volunteer not collecting data on that patient/parent. Parents who gave verbal consent were able to leave the data collection process at any time. No follow-up with the parents and their newborns was planned, and no personal information was collected. Once the specified information was collected, data collection ended. At the request of the Institutional Review Board (IRB), AmeriCorp volunteers were Collaborative Institutional Training Initiative (CITI) trained.

The provider survey tool was anonymous and no personal information other than job title was collected. The initial clinic-administered survey did not include a disclaimer (Appendix G).

The post-intervention e-survey gave providers an opportunity to opt out of the survey via a pre-survey disclaimer if they felt uncomfortable providing responses (Appendix H).

This QI project occurred with the approval, and at the request of the clinic, and an institutional approval letter was obtained from the FQHC on May 11, 2022. The clinic name was not used except as requested by Institutional Review Board (IRB). This opt-in approach was to further protect all parties involved in this QI project. The FQHC does not have an internal IRB process and so IRB approval was sought through the California State University Long Beach IRB committee and was approved under 45 CFR 46 103 (D)(2), on August 15, 2022.

Measures

The methods section described the plan for achieving the aims of the QI project. Prior to this project, the FQHC QI team had attempted to collect baseline data to examine the issues surrounding the NBC. The QI team at the FQHC conducted two initial steps to understand the NBC, operationally. The QI team data were considered baseline data. First, a short, anonymous provider/staff Likert-based electronic survey (Appendix G) was sent to staff working in the NBC to measure their levels of satisfaction with the clinic efficiency, perceived quality of care, and perceived patient time in the clinic, via Google Forms. Second, limited deidentified time stamp data from the EMR were generated and tracked patient time spent in the clinic through remote observation of provider time stamp data, via the live tracking system built into the EMR. As part of the standard workflow in the NBC, each member of the care team was required to change (track) the patient's status depending on where in the flow they were. For example, once a patient arrived at the clinic, the registration team tracked the patient to 'kept' in the EMR. Once the paperwork was completed, EMR tracking was changed to 'ready for medical assistant (MA)

vitals' and so on until the patient was tracked as 'discharged' at which time it can be assumed that the patient has left or is leaving the clinic.

The baseline provider satisfaction data showed that the perceived patient time spent in the clinic was greater than 60 to 90 minutes. Once the QI team had reviewed and understood the data, the clinic requested a formal QI study be conducted by the FQHC QI department and led by the author. This QI project attempted to answer the following questions: 1) Can cycle time/throughput of patients be improved? and 2) Can provider and staff satisfaction be improved? Through a Lean Six Sigma DMAIC approach these questions were tackled. Data collection and analysis were only performed once IRB approval was obtained.

Sampling Procedures

For time stamp data in the general NBC population, this project collected 40 data points (patients) as data for the subgroups (days). Eight days in total, five patients per day, were collected as pre-intervention data and in six days, 30 patients were collected in post-intervention data collection. This was due to an abrupt cessation of volunteer availability. The data included all patients in the newborn clinic, including those who were seen in follow-up. Seventy data points (patients), over 14 days, were collected. This number of data points allowed for the meaningful use of control charts to observe shifts or trends and for the comparison of data. Data were collected via a VSM (Appendix I). Basic EHR time stamp data, as previously described under measures, were used in spot check analysis of the interventions weekly once interventions were in place to check that flow time was not being negatively affected/increased.

Tools

Provider satisfaction

Provider satisfaction is a key outcome measure of this QI project. Satisfaction was measured using an electronic survey that queried three main themes: provider satisfaction, perceived quality of care provided, and perceived amount of patient time spent in the clinic. Prior to the initiation of this project, the clinic used Google Forms to collect provider/staff satisfaction and input (Appendix G). Given that protecting all sensitive information, however deidentified, was of the utmost importance to this project, Qualtrics was used for the post-intervention follow-up, as it provides a higher level of security when compared with Google Forms (Wang, 2022). The survey (Appendix I), administered to the providers post-intervention, collected the same data as initially collected by the clinic so that a comparison of the pre-and post-data could be conducted with as much fidelity as possible. The survey collected no identifying information other than job title. In the follow-up survey, a disclaimer was present in the instructions to allow providers and staff to understand their risk exposure. This was not included in the initial survey performed by the clinic before the development of this QI project.

Workflow

Timestamp data served as the primary metric for evaluating pre- and post-workflow via EMR and VSM. Timestamp data were collected by AmeriCorps volunteers who collected data from every other patient arrival until 40 data points (patients) had been collected. Data were collected on paper forms and stored in a lock box. Volunteers were afforded breaks, in accordance with California state and federal employment law, and shifts lasted the length of the clinic day, which is eight hours. Volunteers approached every other patient who came into the clinic, asked permission, and gained consent for the volunteer to follow the patient through the

clinic whilst collecting time stamp data. A consent script was provided to the volunteers, per IRB protocol, that dictated what the volunteers said and informed the patient of the nature of data collection (Appendix F). AmeriCorp volunteers were bilingual English/Spanish speakers.

A Lucid Chart™ was used to design the VSM (Appendix I) that the AmeriCorps volunteers used to collect time stamps. Volunteers were trained on how to collect the data accurately via a zoom training session. The tool was simple, and it was not deemed necessary to perform reliability checks.

Scheduling

Scheduling templates were designed within the existing framework of the FQHC block scheduling system. The clinic-wide scheduling format used in the project setting is linked to a sophisticated reminder system that is programmed based on the scheduling system. If a deviation from the block system of scheduling were to occur, it would interrupt the ability of the reminder system to provide reminders to the scheduled patients. The scheduling design was made in Excel and was formed via brainstorming sessions with the clinicians and the operational directors of the clinic.

Data Collection

Limited baseline timestamp data were available before the project began. Therefore, initial time stamp data from clinicians and the EMR and provider/staff satisfaction were measured prior to the initiation of the project.

Preintervention data were collected via a VSM to assess each stage of the clinic process. At least thirty data points were collected pre-and post-intervention. Intervention data were collected weekly, via EHR time stamps once specific interventions have been identified and

implemented and a post-intervention VSM was performed at the end of the intervention window of seven weeks.

Provider Satisfaction

Provider satisfaction data were collected using Qualtrics electronic surveys (Appendix H) and were collected at the end of the project. Data were collected electronically and stored anonymously on the Qualtrics website in electronic form.

Workflow

Timestamp data were collected via AmeriCorp volunteers. Volunteers were cleared to work at the FQHC and had completed HIPAA and CITI training. An IRB-approved consent form was provided to the AmeriCorps volunteers that was used to obtain verbal patient consent for timestamp data to be collected via the VSM (Appendix I). Volunteers were instructed not to follow patients into the exam rooms so no personal information was overheard and no interaction with the provider occurred. They obtained time stamp data based upon time upon check-in to the clinic at registration, idle time post registration, time to MA calling patient, time with MA, idle time post MA, clinician or lactation consultant visiting with the patient, and idle time once the clinician had finished their visit. Time stamp data were organized into days. Data were organized as aggregate data (patients) and plotted as subgroup data (days). Per day, five patients were collected, and plotted as one day until eight days of data had been collected. The process was the same for the post intervention data except that only six days of post intervention data were collected due to abrupt cessation of volunteers.

Outcomes and Measures

A summary of variables/measurements/assessments and analyses can be found in Appendix J. Analysis of the data, once IRB approval was given, was performed using Microsoft

Excel and QI macros®. QI Macros® is a commonly used tool in QI improvement projects to generate run charts and control charts to visually understand data. Data were analyzed and displayed using control charts.

Results and Analysis

Phase One (Scheduling)

Phase one involved the implementation of a new schedule design that was vetted and approved by the clinicians and executive management during operational meetings. A common theme in the baseline survey conducted by the clinic, and anecdotally, was that patient scheduling was problematic, and the volume of patients exceeded the ability to see the patients comfortably. The parameters for schedule change set by the clinic stipulated that an adequate number of patients must be seen to maintain financial viability but that visit length could be varied into long and short visits, within the existing block scheduling system, to accommodate varying complexities of newborn patients. A short visit was able to be 20 minutes, and a long visit 40 minutes. The number of patients needed to be seen for financial viability at the WHC site was determined to be 16 patients per day. This was a dramatic decrease from the general pediatric volume of 20 to 26 patients per day, which had been superimposed to the newborn population. Varying from the block system of scheduling was not permitted. Once an initial version of the schedule was made, it was returned to the clinicians and operational directors for further brainstorming, feedback, and buy-in. Given the value placed on provider and staff satisfaction in this project, buy-in and collaboration with the clinician body were vital to the success of the scheduling template.

The new scheduling template was operational starting on August 29th, 2022, due to operational requests for schedule consistency planned with the larger clinical operational plans for standardization of scheduling. Although earlier than initially planned, VSM data collection had occurred.

Phase Two (Clinic Flow)

Data were collected in August of 2022 on Mondays, Wednesdays, and Fridays. This allowed for a fair representation of average patient flow that accommodated any pre-post weekend patient appointment dynamics and allowed for an average representation of normal operations from a support staff standpoint. Generally, the same MAs rotated through the clinic to support the provider's clinical flow. No new MAs were trained/oriented on the days of data collection and all MAs and providers were already familiar with clinic flow. Baseline data collected in the preintervention stage totaled 40 individual patient encounters over eight days, with five encounters per day. The data, in the VSM, were collected by day. Days in the VSM represent subgroup data. Thirty patient encounters in the post-intervention stage. The control chart most fitting to this project was an XbarR-chart. XbarR charts allow for subgroup data analysis when subgroups contain between 2 and 10 data points. This is appropriate for continuous data and is useful when each data point represents a subgroup (days) observation.

Each day was considered a subgroup and the median time over five encounters per day is the included data point in the control charts. Eight subgroup data points aggregating 40 total patient encounters were captured in the preintervention stage, and six data points aggregating 30 patient encounters post-intervention, were included in the control charts. There were no reported issues with data collection and all parents who were approached agreed to participate, without exception. Data were collected from each of the stations through which patients advance. Stations were broken down into three active sites, as listed in the VSM data collection sheet (Appendix I).

Firstly, station one: *Registration-to-MA* where the patient was given any necessary paperwork, and insurance verification occurred. Inactive/idle time between station one (*registration)* and station two (*MA vital signs)* averaged eight minutes (Appendix K).

Secondly, station two: *MA-to-provider* where the patient was escorted into the vital signs station, and vital signs and a chief complaint were obtained. The patient was then taken to the examination room where they are settled to wait for the provider. Idle time after station two (*MA-to-provider)* averaged 16 minutes (Appendix L).

Thirdly, station three: Provider-to-discharge was when the provider visit happened and where the lactation consultant visited with the patient either before or after the provider saw the patient. Between stations, inactive/idle time was measured. Discharge from the clinic occurred within two minutes of this station and so was not included in idle time. There was no variation in the time to discharge the patient once the provider and lactation consultant had finished.

Control charts revealed that the average time spent with the provider and lactation was 31.2 minutes making an expected total cycle time of 45 minutes, on average. Inactive time totaled 24.3 minutes. Oostrom et al., (2017) reported that Medicaid patients spend longer waiting versus private patients with an average *wait time* for Medicaid patients being greater than 20 minutes. Thus, the wait time for NBC patients was within the expected average wait time for this patient population. This data changed the direction of the project. An opportunity to improve the quality of care became apparent. Rather than the question being can we bring patients through the clinic faster, it became what interventions can be made to improve the quality of care provided to the patient in those areas of idle time.

Based on the Phase Two findings, the pediatric clinicians gathered for a brainstorming session to identify activities that would be of most benefit to the patient. Provider buy-in for the

intervention was important given that provider satisfaction was central to the success of this project. Two screenings were suggested by the providers: screening for post-partum depression (PPD); and social determinants of health (SDOH).

Screening for PPD has been identified as an important subset of perinatal depression and is estimated to affect 25% of low-income parents in the U.S. but only half of pediatric practices conduct formal screening (American Academy of Pediatrics (AAP) (2022). The U.S Preventative Task Force (USPTF) found moderate evidence in integrating screening and promotion of access to embedded behavioral health services to identify and/or prevent PPD (Curry et al., 2019). After a review of the literature and discussion with the pediatric medical director of the pediatric and WHC departments, the Patient Health Questionnaire 9 (PHQ-9) was selected. This was based on several factors. Firstly, the PHQ-9 had the best sensitivity *and* specificity to detect the presence of PPD (Park & Kim, 2021); and secondly, providers and MAs were already familiar with the PHQ-9 given its widespread use clinic wide. Thirdly, the WHC uses the PHQ-9 during the prenatal period, thus the patients are also familiar with the tool, and lastly, the behavioral health team, to which positive screens will be referred, were also familiar with the PHQ-9 as the tool of choice when screening for depression in prenatal parents.

SDOH have been identified by the Centers for Disease Control (CDC) and the Department of Health and Human Services (DHS) as having a significant impact on individual's health, well-being, and quality of life. SDOH includes safe housing, transportation, and neighborhoods, racism, discrimination and violence, education, job opportunities, access to nutritious foods and opportunities for physical activities, access to clean air and water, and access to language and literacy resources (CDC, 2022; Healthy People, 2030).

When deciding on the screening tool for SDOH, the NBC was able to join in a federally mandated, clinic-wide effort to implement SDOH screening in the general clinic. The NBC had not been considered by the executive management as part of the SDOH screening effort and so after discussion with the QI team and the medical directors, this author advocated that SDOH screening be incorporated into the idle time identified in the NBC. The screening tool used was the validated screening tool, Protocol for Responding to and Assessing Patients' Assets, Risks, and Experiences (PRAPARE).

As of January 4, 2023, 82 families had completed screens for SDOH. This was significant, especially given that the form only had to be completed once by a family. This was usually done at the newborn visit, once, and during subsequent visits. Families were screened once in the NBC. As of 01/04/23, 44 of the 82 patients screened positive for issues relating to utilities, clothing, housing, food, or personal safety issues. Of those that screened positive, 23 were flagged as high need which was restricted to those with housing, food, or personal safety concerns. The remaining 25 positive screens were directed to resources for clothing, utilities, and 'other'. All were referred to internal case managers to be connected to resources.

Cycle time data were plotted during the intervention stage and assessed on a weekly basis to ensure that the interventions were not increasing the cycle time. Data during the weekly collection were collected, via EHR tracking, to roughly gauge if cycle time was being affected over the intervention period. Data were examined via run charts and no major shifts in the cycle time occurred due to the interventions. A trend toward an increase in time spent was observed between days 38 and 44 but self-corrected thereafter (Appendix M). This may correlate with new provider hiring. Of note, according to spot-checking, the average cycle time across the eight

weeks of intervention implementation showed an overall decrease in cycle time compared with the initial preintervention data collection.

Unfortunately, in the post-intervention collection period, VSM data abruptly ended due to the AmeriCorps Volunteers being reassigned to a different project. Collected data were analyzed in the same manner as preintervention data.

Firstly, *registration-to-MA* was grossly unchanged and common cause variation was noted (Appendix N). Inactive time post registration was decreased by 50% to 4 minutes and appears to have a reduction in normal variation compared to the preintervention state (Appendix O). Secondly, *MA-to-provider* remained grossly unchanged at 7.4 minutes indicating stability of MA workflow efficiency (Appendix P). Inactive time post-MA was noted to be unchanged in the post-intervention period (Appendix Q). Thirdly, *provider-to-discharge* was stable. No shifts or trends were noted, clinician time spent with the patient was stable (Appendix R).

Total cycle time was improved from 70.8 minutes to 62.7 minutes (Appendix S) and no shifts or trends were noted to suggest anything other than normal variation was occurring. There were four data points in the post intervention period that were below the control level which may suggest that a shift was occurring but, post-intervention data must be interpreted with some caution due to having fewer data points. More data are needed to determine if a reduction in cycle time was observed. Nevertheless, the data support that the SDOH and PPD interventions did not impact cycle time negatively. After the completion of this project, this author aims to collect the remaining data in the post-doctoral phase.

Phase Three

Phase three involved the creation of a care coordinator position to help the newborn clinic patients understand the process of coming to the clinic, assist with patient follow-up needs, and

schedule patients dependent on the needs of patients on a given day. The role of the care coordinator was defined once the VSM was completed. Coordination with the finance director at the clinic helped to formulate a financial model for the position (Appendix T).

A formal presentation was given to the executive management team and enthusiastic approval was given for the implementation of the care coordinator position. This position will be developed over the first six months of 2023 and implemented as a pilot in the second six months of 2023. A six-to-nine-month pilot was approved and given a shortage of AmeriCorp volunteers, this author is seeking grant funding for this position. A care coordinator position will be piloted by a grant-funded MA, which will help justify the budget line for a full-time care coordinator position if the pilot is a success. Full implementation of the care coordinator will occur outside of the scope of this doctoral project, but success will be measured by a decrease in no showed visits from the current 35.5% to 10% by the end of the pilot project. No shows include missed appointments and patients who rescheduled on the day of service, functionally missing the appointment.

Care coordination is highlighted in the literature as needing an individualized approach based on health facility needs (Gilchrist-Scott et al., 2017). A business plan detailing the specific roles, and responsibilities of the care coordinator was presented to, and approved by, executive management.

Provider Satisfaction

Measurement of provider satisfaction was an important part of this project. After all, it was initial provider dissatisfaction that prompted an investigation into the NBC. Furthermore, provider satisfaction is considered central in measuring the success of this project.

Since the implementation of a new scheduling template and implementation of SDOH and PPD screening the post-intervention survey revealed some interesting data. In total, 16 staff responded to the survey. Staff who did not rotate through the NBC were not required to complete the survey. Unlike the pre-intervention survey, a majority of respondents (12) in the post-intervention survey were MAs. In the pre-intervention survey, only one MA and one registration staff responded. Such an increase is suggestive of a more active engagement in the process of change amongst MAs. Only four clinicians responded, which may speak to the high turnover of medical providers in the clinic over the last three years. Only one provider who participated in the preintervention survey remained on staff in the post-intervention clinic.

The post-intervention survey examined satisfaction in more detail than the preintervention survey. In the pre-intervention survey, satisfaction was measured as a general level of satisfaction at the clinic and showed staff were generally not satisfied with the clinic. In the post-intervention survey, satisfaction with the clinic was broken into two groups.

1) Care delivery was delineated into satisfaction domains of anticipatory guidance, lactation services, management of jaundice, and timeliness of care. The mean satisfaction score was 8.9 out of a total score of 10, across those domains, and satisfaction with lactation services was 9.44, indicating that providers were satisfied with the care provided. This was a slight improvement compared to the pre-intervention survey.
2) Second, satisfaction surrounding operational issues was measured via the domains of timeliness of rooming patients, time allotted to see the patient, availability of medical records, and care coordination, with a mean satisfaction score of 4.1 out of a total score of 10. Fifty-eight percent of respondents perceive that patients spend 40 to 60

minutes in the clinic, which resonates closely with the pre-intervention survey data. The interventions appeared not to affect perceived cycle time.

3) Qualitative themes emerged when respondents were asked what perceived challenges face the clinic now. Overwhelmingly, late patient arrival and rooming space were areas of concern now facing the NBC which speaks to the need for robust care coordination as has been presented to, and approved by, executive management.

Discussion

The literature speaks clearly to the issues of workflow and satisfaction being areas that require significant work to achieve a fairer and more equitable healthcare delivery system. Although the issues can be conceptualized well, a diverse approach is required. For example, although the issue of, say, throughput, is almost universal, the approaches to address throughput differ across primary care and specialty care facilities. An individualized approach is essential. This project was no different. The unique patient population, clinic dynamics, and staffing diversity required a ground-up approach to evaluating workflow. This project hoped to contribute to the body of literature surrounding FQHCs. For this FQHC, a VSM was a useful tool to evaluate the problem and identify areas to provide better care. For others, the tools will differ but the use of QI tools to evaluate efficiency was supported by this project. The findings of this doctoral project echo the literature and were borne of the freedom to approach the issues individually and work creatively to solve the problem at hand.

Limitations and Future Recommendations

The project can be considered successful. The implementation of screenings for PPD and SDOH are undoubtedly important interventions alone. There were several limitations to this study that serve as a 'lessons learned' reflection that will help to guide future projects in the world of FQHCs. For example, cycle time standards lack a yardstick by which clinic cycle times can be measured. The IHI (2022) highlights that a good measure of cycle time, as it pertains to non-value-added time, is to have the overall cycle time be 1.5 times the provider visit. For example, in a 20-minute scheduled time with the provider, the total cycle time should be 30 minutes. Total cycle time can be evaluated as reasonable and unreasonable for the purposes of this project given that, aside from the IHI's calculation of non-value-added time, the literature

regarding appropriate cycle time is sparse and heterogeneous, questioning the external validity of these studies. Cycle time must be assessed as what is acceptable on a clinic-by-clinic basis.

It was evident that EMR patient tracking needed to be standardized across the newborn clinic and clinicians needed to be educated regarding the process. There was no clear cycle time tracking within the clinic and reports on cycle time were dependent on the EMR time stamp data as the patient moved through the clinic. Further education regarding the uniformity of time stamp language will make future cycle time data easier to collect via report generation, rather than manual calculation.

The registration control chart (Appendix O) showed more variability than that of the MA and provider time potentially indicating that more study is needed on the characteristics of the patients and their administrative burden upon entering the clinic. For example, this study did not fully evaluate the burden of newborn paperwork as part of the visit which may account for the variability in registration times. There was a slight decrease in the variability of registration, but significant improvement will likely depend on phase three implementation. Phase three involves implementing a care coordinator. Based on the body of evidence in the literature, once a care coordinator has been implemented improvements in the no-show rate should be noted. Additionally, variability in registration time, patient arrival, and potential impact of newborn paperwork, should be reduced.

A significant limitation of this study was the abrupt cessation of volunteer availability to collect the post intervention data. This data collection phase was only 75% complete before the volunteers were reassigned to a more pressing project by the clinic. Nevertheless, this author does not expect that the cycle times, both total and between stations, would have changed the trend with the addition of 10 extra patients. Whether there was an improvement in cycle times

cannot be confidently reported. As reflected in the abrupt cessation of volunteer availability, VSM is time and labor-intensive. This may be a limitation to many clinics where resources are often limited. That being said, if resources can be made available for periods of time, VSM can be a useful tool in understanding flow, where to make improvements, or use time more effectively to benefit patient care delivery.

A limitation of this study was that the burden of late patient arrival was not considered in the impact of patient throughput time. This may have affected the overall efficiency of the clinic given the inevitable staggering of patient entry into the clinic at their specified appointment time if late patients are accommodated on arrival. The policy in the newborn clinic, for good reason, is to accept newborns whenever they arrive. Further study is needed to evaluate the burden of late patient arrival and can be thought of as a meaningful outcome measure as care coordination is implemented. Tools such as the Area Deprivation Index (ADI) (Yao et al., 2021) may help to understand the no-show rates and help direct the care coordinator's focus when facilitating the punctual arrival of patients.

Care coordination was planned to be a large part of the project. Dissatisfaction from the post-intervention survey confirmed that care coordination may be key when designing an efficient and effective clinic. A clear delineation between care delivery and an ideal state speak to the issue of burnout. If healthcare providers are working in an environment where delivery of care occurs despite the operational environment, this places strain on staff. Perhaps the operational environment is a key driver of satisfaction. Clinicians working in FQHC's are often mission-driven and place value on providing high-quality care despite operational inefficiencies. The role of a care coordinator was defined and refined within the span of this project, but implementation was not able to happen given the post-pandemic environment and the larger

strategic priorities of the clinic. Care coordination is likely key to increasing satisfaction in all areas of the clinic and may contribute to reduced provider turnover. This author presented a plan for care coordinator implementation to the executive management, which was approved for implementation, and is in the stage of acquiring grant funds for a six to nine-month pilot study. However, this implementation timeline falls outside of this doctoral project and will occur starting August/September 2023, pending grant funding.

Limitations existed in staff turnover. During this doctoral project, which encompassed much of the pandemic, clinician and MA staffing was inconsistent. Of the staff surveyed at the beginning of the study, one remained, thus there was little institutional memory of the pre-intervention clinic state. Unfortunately, this appears to be the status quo in health care currently, with provider retention and burnout being issues of significant concern for the FQHC and nationwide. More study is needed on provider satisfaction in both the inpatient and outpatient settings to understand the needs of staff while tackling the issues of a strained healthcare system.

The screening tool for SDOH was administered via tablets placed in the rooms and screening data were uploaded to the cloud. Over the first two to three weeks of the interventions, multiple issues with the tablets occurred. Firstly, the tablets would not hold a charge or would be unplugged by the patients to charge their personal cell phones/devices. Secondly, the tablets did not consistently connect to WIFI and so may not have captured all the data to the cloud. Fixes were made to the issues and data could then be reliably acquired.

Sustainability

The sustainability of the interventions is of paramount importance. The issues of timely and effective care and provider satisfaction are of universal concern in health care. This project evaluated clinic time and identified areas of inactivity. It quickly became apparent that

decreasing the overall throughput time of the clinic was not the area of most concern, but rather how using time spent in the clinic more effectively could improve the quality of care delivered. With workflow in mind, this author proposes that care coordination will be a large contributor to the sustainability of provider satisfaction, efficiency and will be operational in a pilot capacity within six months of the completion of this doctoral project. This author aims to pilot and demonstrate the efficacy of the position by 1) decreasing no-shows in the clinic, 2) addressing the administrative needs of the clinicians, and 3) improving clinician satisfaction surrounding patient punctuality. The issue of limited rooming space is a larger problem to tackle. Although clinic expansion is always a goal of a growing clinic, space allocation falls under the larger strategic plans for the clinic and may take many years to achieve.

This author is hopeful that the interventions of SDOH and PPD screening will persist and continue to improve over time and will continue to be measured monthly until at least the implementation of the care coordinator, six months after the completion of this doctoral project. Furthermore, the implementation timeline of the care coordinator will ensure that close monitoring of the NBC will occur for at least the six to nine-month pilot phase.

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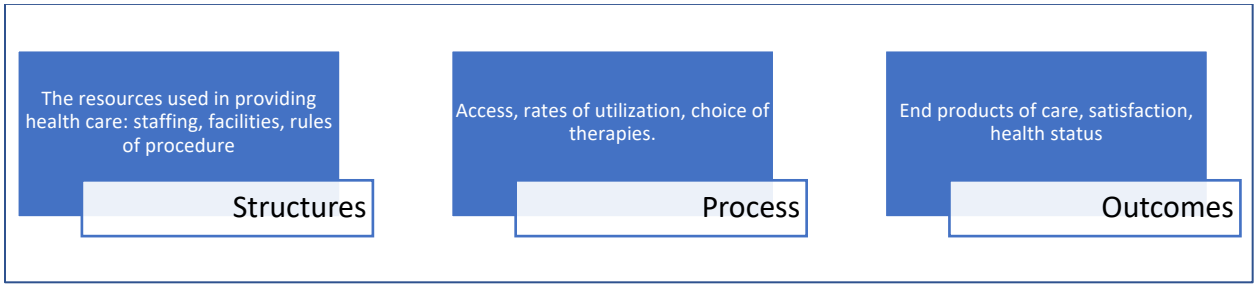
Appendix A

Donabedian Model

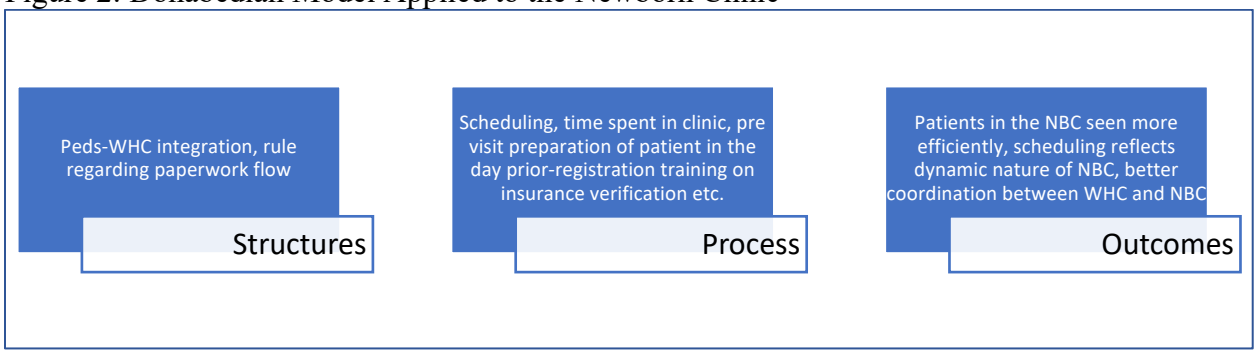
Figure 1: Donabedian Model



Appendix B

Donabedian Model Applied to the Newborn Clinic

Figure 2: Donabedian Model Applied to the Newborn Clinic



Appendix C

Care Coordination Models

Care Coordination Model	Design	Setting
Parent Model (Bentti Vockel et al., 2017)	Uses parent coordinators to promote preplanning for newly diagnosed patients entering the health care setting.	Inpatient, pediatrics, complex medical conditions
Person Centered Coordinated Care (P3C) (Fosh et al., 2018), (Lloyd et al., 2019)	Fosh et al. (2018) developed a Patient Centered Coordinated Care Experience Questionnaire (P3CEQ) to measure patient experience to drive quality care improvements. Helpful in highlighting strengths and identifying weaknesses in operations so that QI projects could be directed to areas needing work.	Outpatient, QI focused
Care Coordination Model (CCM). MacColl Center for Health Care innovation (2010)	Focused on innovation and is a model designed to promote efficient and high-quality transitions between facilities.	Patient Centered Medical Home (PCMH), outpatient
Johns Hopkins Model (Berkowitz et al., 2018)	Focused on significant care coordination involving pre discharge planning, education, med management, home care coordination or visits, a daily dynamic patient needs assessment. Strong Behavioral Health (BH) component. Effective at improving care and reducing costs	Inpatient and outpatient

Appendix D

Clinic Notice

Dear Valued Patients,

During 2022 the newborn clinic will be collecting data on how long it takes for patients to move through the clinic. This is occurring to ensure that we are providing the most efficient and thoughtful service we can and to improve the services we provide to you. This process will involve, with your consent, a trained volunteer noting how long it takes you to move through the stages of the clinic during your visit. It is your right to not participate in this project and your care will not be affected at all if you choose not to participate.

If you have any questions please contact Chris Gentry, CPNP.

Appendix E

Project Charter

Project Charter: To improve efficiency and staff satisfaction of a NBC through robust care coordination implementation	**Process Measurements** **1)** Improved throughput time **2)** Improved provider satisfaction scores
Project Information **Leader:** Christopher Gentry **Project Start**: August 2021 **Project End:** May 2023	**Process Importance:** Prompt and efficient care of newborn patients in low-income urban population is important to reduce the risk of newborn complications such as jaundice and failure to thrive. Shortened post birth hospital stays demand improvements in the NBC to ensure timely and efficient follow up and care.
Team Members: Chris Gentry (Champion), Pediatric Medical Director/mentor, Clinic Medical Director, Operations Manager, Clinic COO/Mentor, QI manager/mentor	**Project Goals:** **1)** To improve efficiency in the clinic **2)** To improve provider satisfaction

Appendix F

Notice of Informed Consent

Notice of Informed Consent

Project Title: Using value stream mapping to explore newborn clinic efficiency and provider satisfaction

Investigator(s): Christopher Gentry and Dr. Margaret Brady
Project Contact: chris.gentry@csu.fullerton.edu
California State University, Long Beach (CSULB)
Office of Research and Sponsored Programs, CSULB: 1250 Bellflower Blvd., Long Beach, CA 90840

You are being asked to participate in a research study.

The purpose of this study is to learn about clinic flow and efficiency so that care can be more effectively delivered. If you decide to participate you will be asked if a research volunteer can follow you through the clinic and observe the time it takes for you to proceed through each clinic station. All data collection is for research purposes only. The total time of your participation is expected to last the length of your visit today. The risks to participating in this study include feeling pressured to participate. The investigator will make every attempt to reduce these risks by ensuring that you understand you can refuse to participate in this study, which will not in any way affect your ability to receive services at this clinic. You will not directly benefit from participating in this study. However, the results of this study may benefit future patients to the newborn clinic.

Only time stamp data will be collected in this study, will be completely anonymous and stored in a secure location and will not be shared with anyone who does not have appropriate provisions to access the information.

You may contact the Office of Research and Sponsored Programs at ORSPCompliance@csulb.edu, or calling (562) 985-8147, if you have questions about your rights as a research participant.

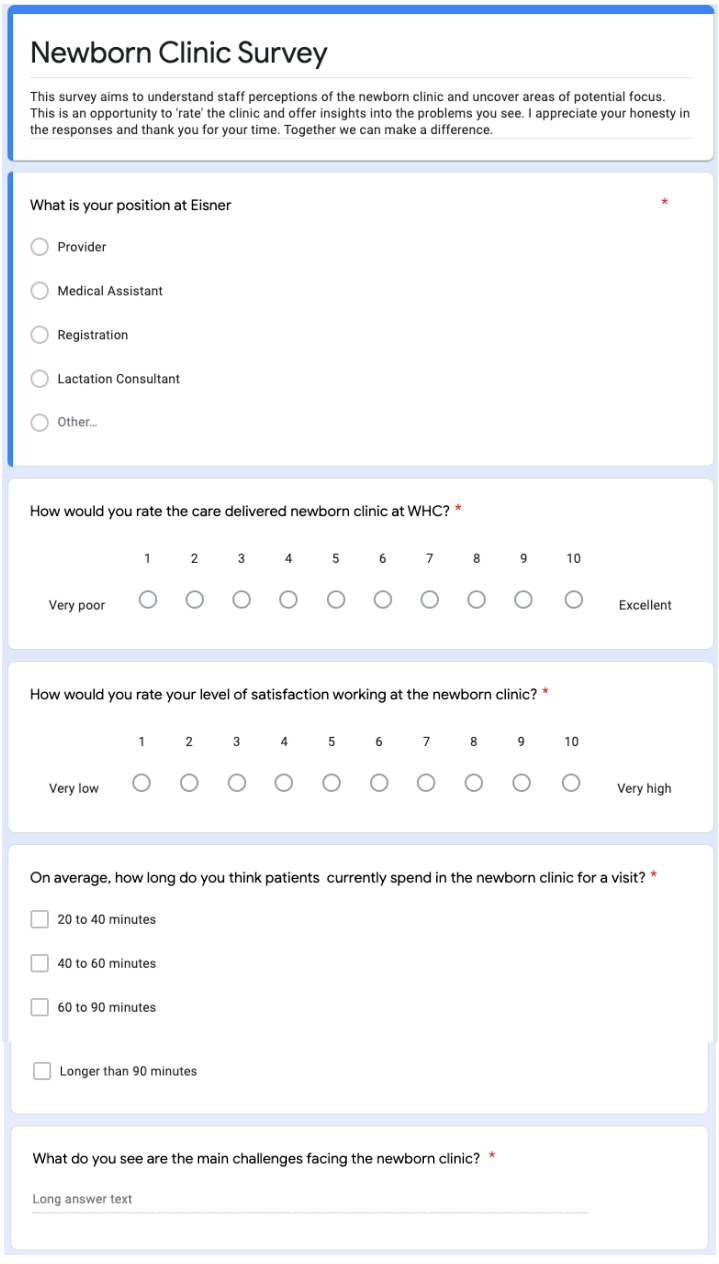
Verbally agreeing to the information in this document means that all information about the study has been explained to you orally, the investigator has answered any questions you have about the study and that you voluntarily agree to participate.

_____
Name of Subject (Printed)

_____ _____
Subject Signature Date

Appendix G

Newborn Clinic Baseline Survey



Newborn Clinic Survey

This survey aims to understand staff perceptions of the newborn clinic and uncover areas of potential focus. This is an opportunity to 'rate' the clinic and offer insights into the problems you see. I appreciate your honesty in the responses and thank you for your time. Together we can make a difference.

What is your position at Eisner *

- Provider
- Medical Assistant
- Registration
- Lactation Consultant
- Other...

How would you rate the care delivered newborn clinic at WHC? *

	1	2	3	4	5	6	7	8	9	10	
Very poor	○	○	○	○	○	○	○	○	○	○	Excellent

How would you rate your level of satisfaction working at the newborn clinic? *

	1	2	3	4	5	6	7	8	9	10	
Very low	○	○	○	○	○	○	○	○	○	○	Very high

On average, how long do you think patients currently spend in the newborn clinic for a visit? *

- ☐ 20 to 40 minutes
- ☐ 40 to 60 minutes
- ☐ 60 to 90 minutes
- ☐ Longer than 90 minutes

What do you see are the main challenges facing the newborn clinic? *

Long answer text

Appendix H

Post intervention Survey

Welcome to the Newborn Clinic Provider Survey. This survey is intended to evaluate provider satisfaction and so that providers can have a voice in the clinical improvement effort to improve the efficiency and throughput of patients through the clinic. No personal information will be collected and, other than job title, no identifying information will be collected, aggregated or shared publicly or privately. If you choose not to take part in the survey, your decision will be respected completely.

Do you consent to take part in the provider survey?

- ○ Yes (1)
- ○ No (2)

Skip To: Q2 If Welcome to the Newborn Clinic Provider Survey. This survey is intended to evaluate provider satis... = Yes

Skip To: End of Survey If Welcome to the Newborn Clinic Provider Survey. This survey is intended to evaluate provider satis... = No

Q2 What is your position at the clinic

- ○ Nurse Practitioner (1)
- ○ Medical Doctor (2)

Page Break

Q3 On a scale of 0-10 (0 being bad, 10 being good), Do you feel the scheduling patterns allow you enough time to deliver anticipatory guidance, ensure breastfeeding support and manage jaundice?

	0	1	2	3	4	5	6	7	8	9	10
Anticipatory Guidance ()											
Lactation ()											
Management of Jaundice ()											

Page Break

Q4 On a scale of 0-10 (0 being bad, 10 being good), how would you rate your satisfaction with the following?

	0	1	2	3	4	5	6	7	8	9	10
Patient roomed in a timely fashion ()											
The time allotted to see the patient ()											
Availability of medical records ()											
Care coordination ()											

Page Break

Q5 On average, how long do you think patients spend in the clinic

- 20 to 40 minutes (1)
- 40 to 60 minutes (2)
- 60 to 90 minutes (3)
- Longer than 90 minutes (4)

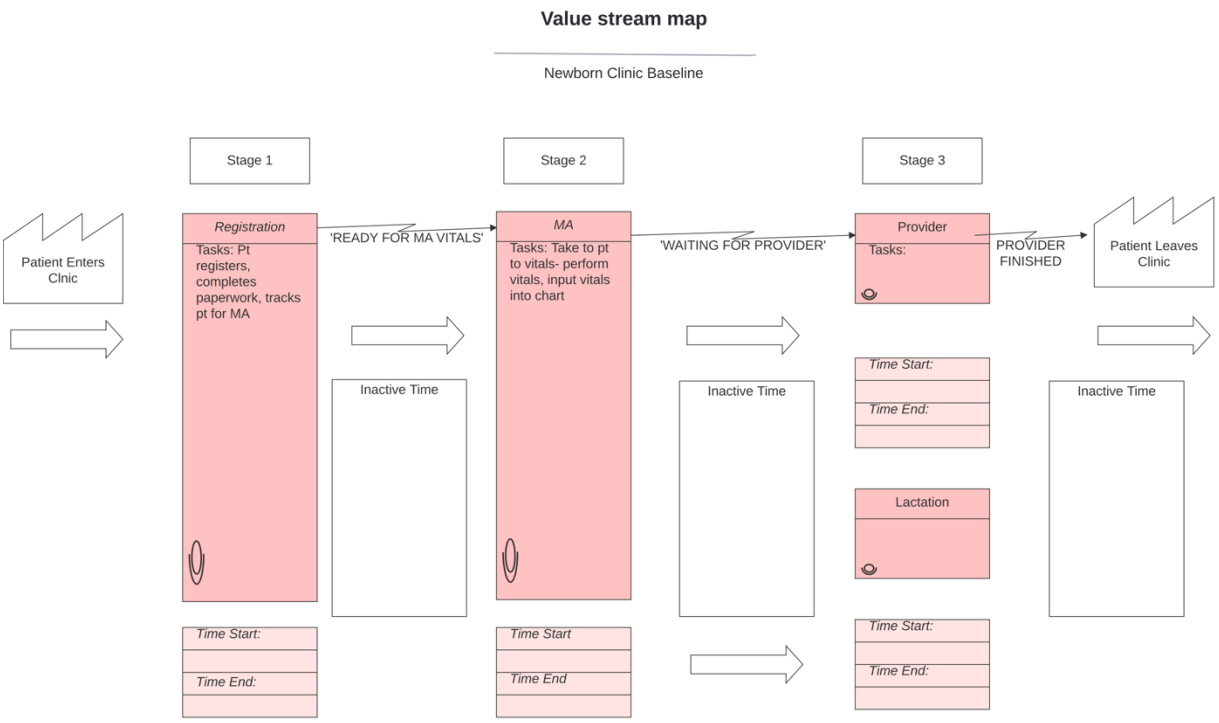
Q6 What do you see are the main challenges facing the newborn clinic?

_____

End of Block: Default Question Block

Appendix I

Value Stream Map



Appendix J

Summary of Planned Outcomes and Measures

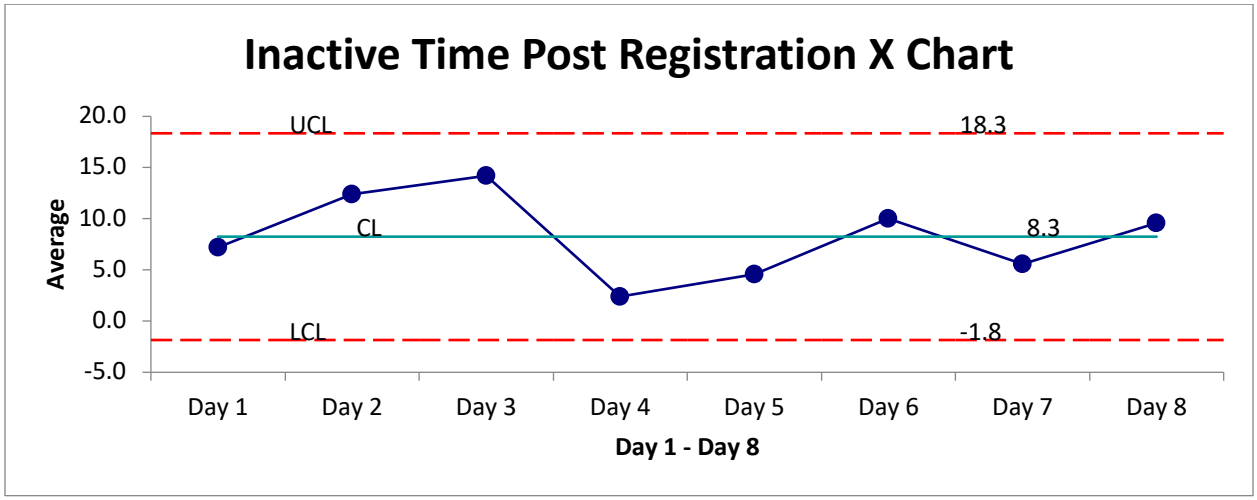
Summary of planned outcomes and measurements							
Variable Name (Definition)	**Pre-implementation 1-month pre implementation of improvement**	**Post Implementation-1-month post implementation of improvement**	**Follow Up 2-, 3 and 6-months post intervention as part of control phase.**	**Source**	**How it will be measured? Level of measurement**	**Why used in project**	**How it will be analyzed/used in analysis?**
Satisfaction	X	X	X	Qualtrics Surveys	-Likert scale -Open ended question	Outcome measure	Run charts
Workflow	X	X	X	Time stamp observational data and EMR	Minutes (total time) and minutes (at each station in process)	Outcome measure	Pre and post Run and control charts of each stage of the VSM, organized by days (subgroup). Separate charts will be created for each stage of the VSM by subgroup.

Table 1 Planned outcomes and measurements

EMR: Electronic Medical Record**; VSM:** Value Stream Mapping

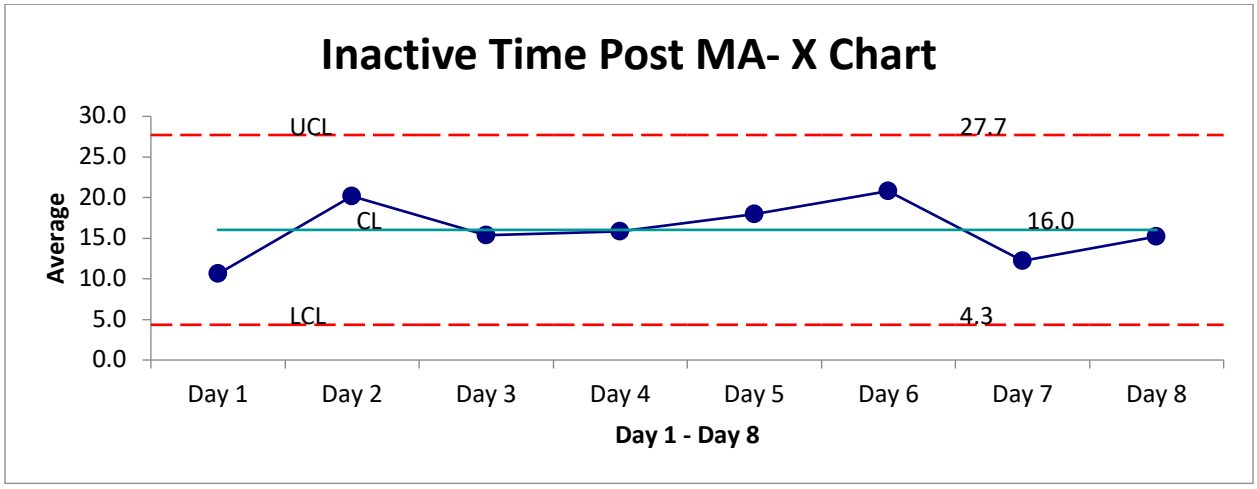
Appendix K

Control Chart: Inactive Time Post Registration



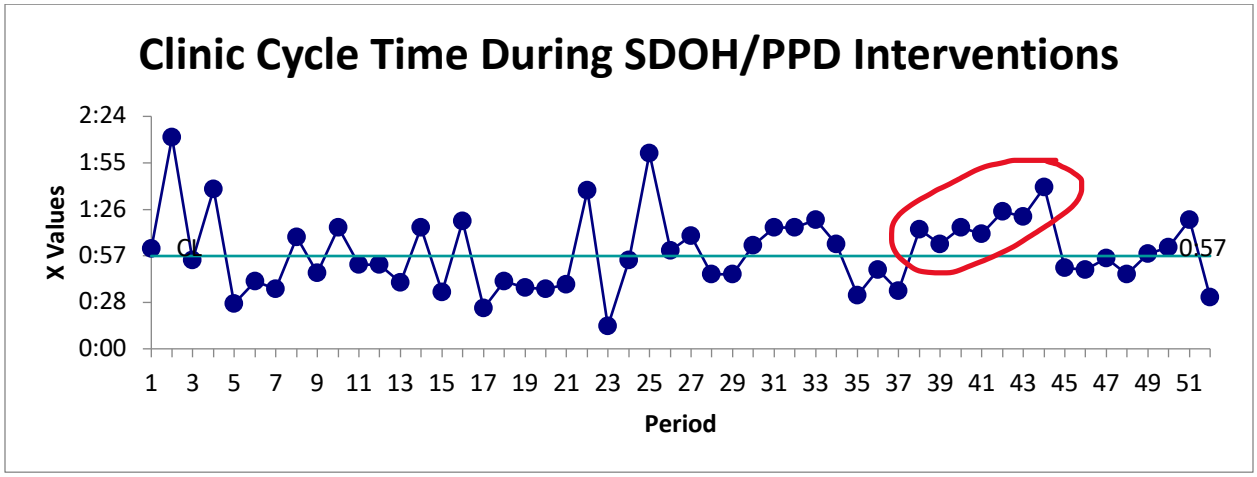
Appendix L

Control Chart: Inactive Time Post MA



Appendix M

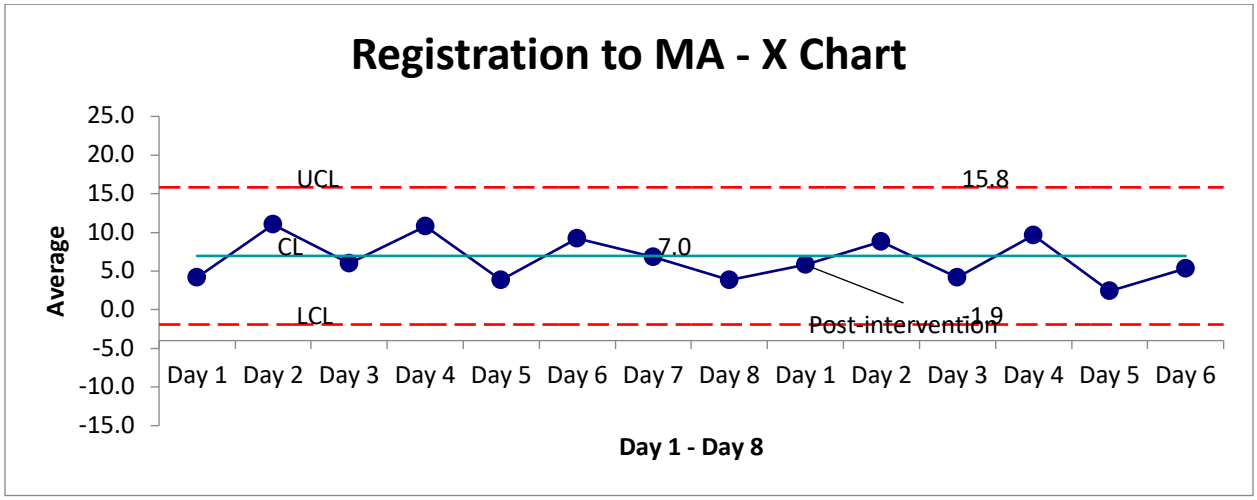
Run Chart: Cycle Time During Interventions



SDOH: Social Determinants of Health; **PPD:** Postpartum Depression

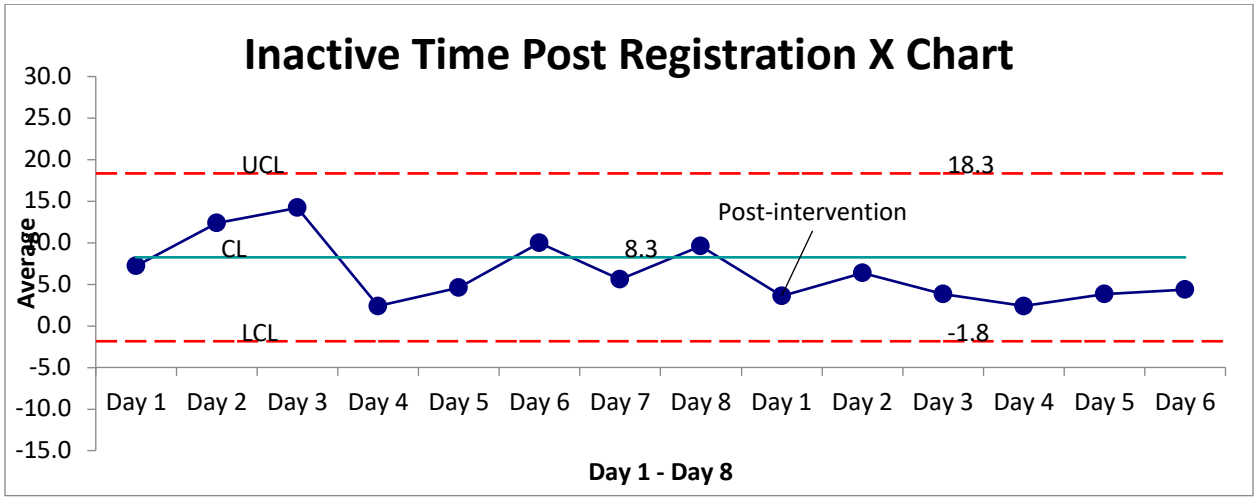
Appendix N

Control Chart: Registration to MA



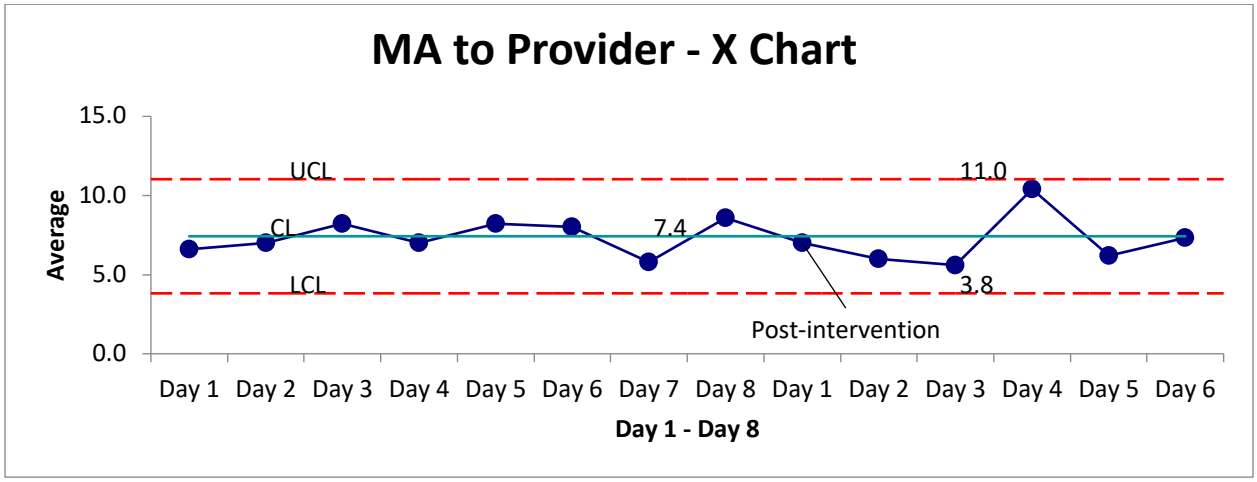
Appendix O

Control Chart: Inactive Time Post Registration



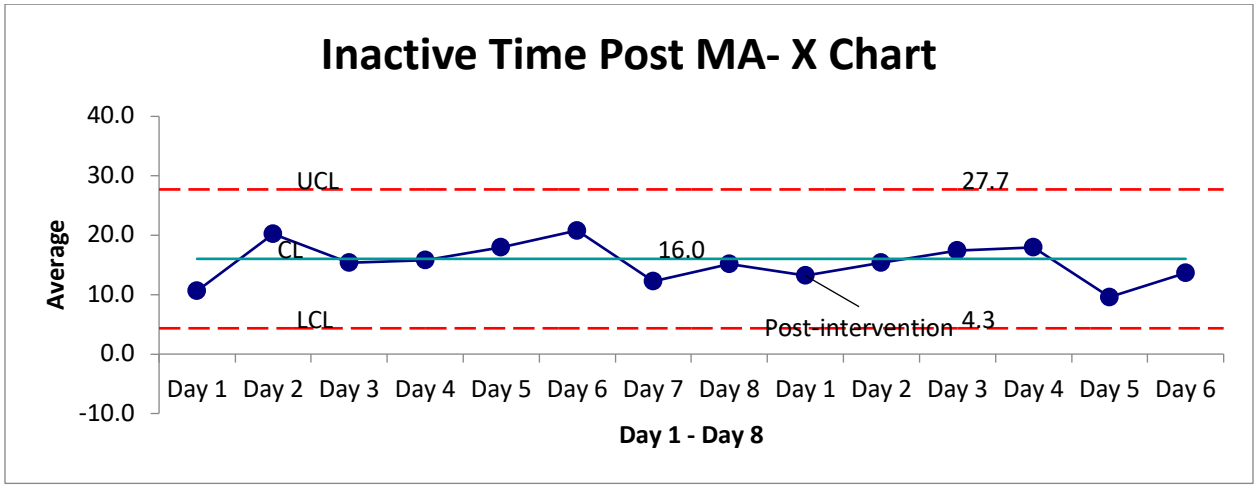
Appendix P

Control Chart: MA to Provider



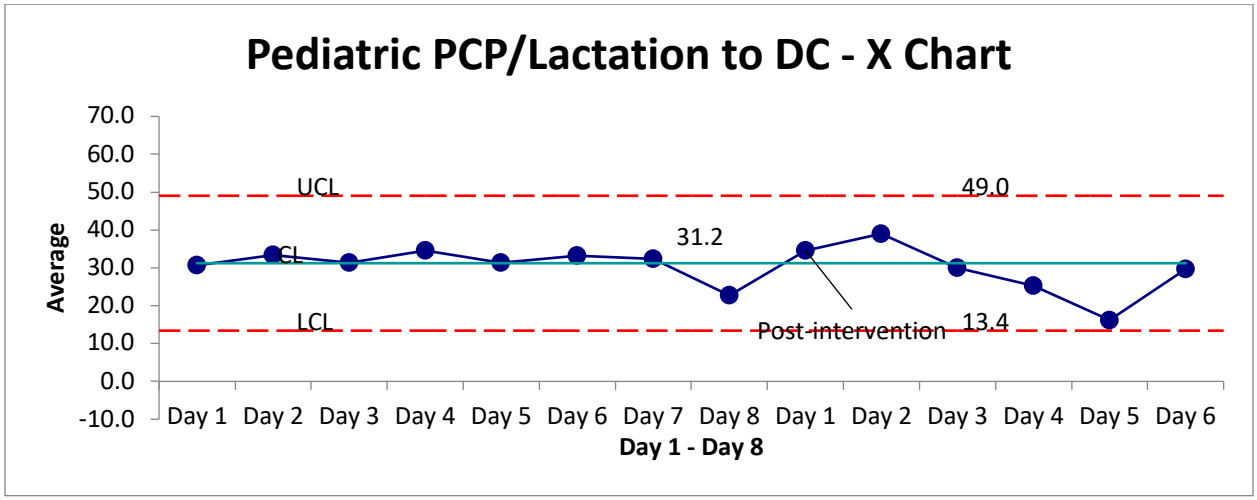
Appendix Q

Control Chart: Inactive time Post MA



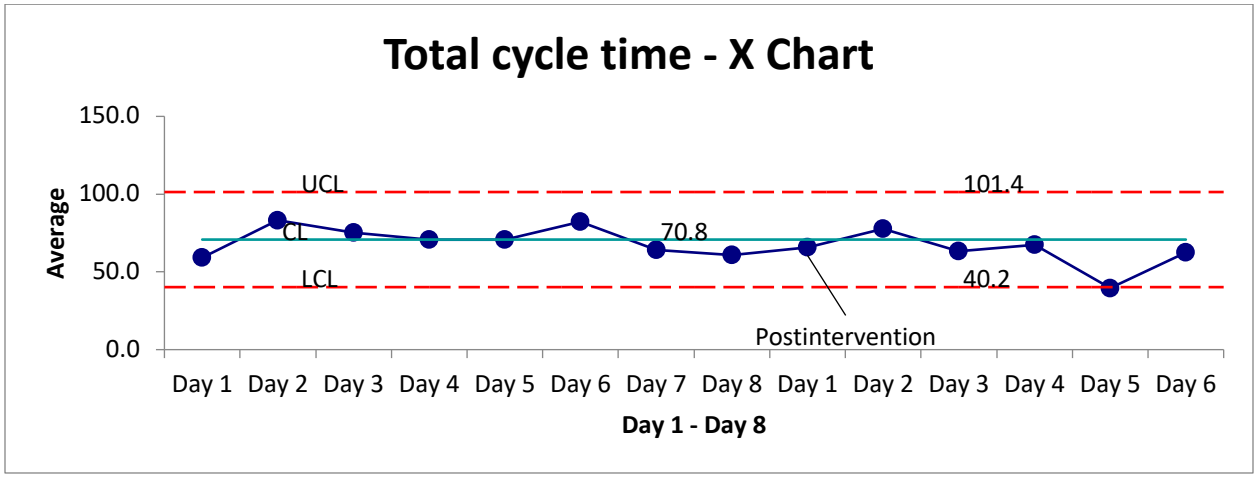
Appendix R

Control Chart: Pediatric PCP/Lactation to DC



Appendix S

Total Cycle Time



Appendix T

Care Coordination Costs

Costs	Year 1	Year 2	Year 3
Medical Assistant (annual)	$56,450.80	$56,450.80	$56,450.80
Medical Assistant Set up	$1,400.00	N/A	N/A
Travel Expense	$1,000.00	$1,000.00	$1,000.00
Projected revenue	$1,138,329.48	$1,138,829.48	$1,138,829.48