

## Designing Preventive Care Bundles for Pediatric Primary Care Dental Clinics

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**Citation:** William J Riley, Kailey Love, Megan Phillips, David Leard and Jessica Robertson (2024) Designing Preventive Care Bundles for Pediatric Primary Care Dental Clinics, J Dent Oral Care Med 11(2): 205

**Received Date:** August 02, 2024 **Accepted Date:** September 02, 2024 **Published Date:** September 07, 2024

### Abstract

Policy makers and payers are expressing a growing interest in oral health value-based payment approaches to improve the oral health care of patients. Episode of care bundles have the potential to become an important value-based approach in oral health and are already a prominent value-based approach used in health care. In this study, we design two episode of care bundles for oral health preventive services and retrospectively analyze over 16,000 visits in a pediatric dentistry clinic in an urban city in Arizona to evaluate the extent of bundle compliance. Findings from the 16-month study (May 1, 2019 – September 1, 2020) indicate that approximately 61% of the Comprehensive Examination Bundles were completed in a single visit while approximately 44% of the Periodic Examination Bundles were completed in a single visit. An item analysis indicated that radiographs were the most commonly absent bundle element for both bundles with fluoride application and prophylaxis the most commonly absent bundle elements in the Comprehensive Examination Bundle.

**Keywords:** Oral Health; Value-Based Payment; Bundles

## Introduction

The predominant payment approach in dentistry is based on a fee-for-service (FFS) mechanism [1] which rewards volume over value. However, this reimbursement model is characterized by a lack of accountability for health outcomes over time [2] and associated with disparities in access to oral health services.<sup>3</sup> In contrast, value-based payment (VBP) models shift the focus of the payment system to outcomes rather than services, [4] leading to development of new care models to enhance the value proposition in oral health. VBP is a reimbursement model that has been extensively used in the broader health care system [5, 6] where payors and policy makers are steadily developing VBP approaches.

Value-based approaches are beginning to be used in oral health care, [1, 7-10] on the expectation that VBP strategies improve quality and lower the cost of oral health care [11]. State Medicaid agencies are interested in exploring oral health VBP approaches to improve access, reduce disparities, and improve population oral health [12–15] and payment models designed specifically for oral health care are needed that have clinical and financial credibility [16]. Oral health VBP strategies are best developed to address the specific dental needs of patients, rather than directly importing VBP approaches from general health care.

In this study, we design and analyze two oral health bundles as one method for oral health VBP. This method is among eight VBP approaches identified by the Centers for Medicaid and Medicare Services (CMS) Health Care Payment Learning and Action Network (LAN) alternative payment model framework [17]. A care bundle is a set of evidence-based practices that have been demonstrated to improve outcomes when performed collectively and reliably [18]. Each bundle typically consists of four to five interventions and is based on the best available evidence, published best practices, and national standards established by leading professional healthcare associations [19]. Originally developed by the Institute for Healthcare Improvement (IHI) in 2005 [20] care bundles have been applied in a number of health care settings [21, 22]. However, there is limited research on how a bundle could be developed and assessed in an oral health care setting.

## Methods

This is a retrospective analysis over a 16-month period (May 1, 2019 – September 1, 2020) that examines the extent of bundle compliance in a pediatric dental group in urban settings in Arizona.

We sponsored two oral health summits to engage a number of stakeholders in the design and feasibility of developing oral health care bundles. The summits included dental provider groups, health plan representatives, oral health administrators, the Arizona Dental Association, Arizona oral health leaders, and national experts. Through focused discussions, the participants reached agreement regarding two preventive care bundles as well as the clinical best practices which should be included in each. We considered three factors in creating an oral health care bundle. First, each of the clinical interventions in the bundle is scientifically based and known to improve oral health outcomes. Second, all bundle items must be delivered in order to receive the bundle payment. Third, bundle implementation will result in improved oral health outcomes for the patient. Following the two oral health summits, we hosted four small group meetings to review and interpret the data findings. The small group sessions included 4-5 practicing dentists, who provided feedback and recommendations for the bundle items.

Based on stakeholder recommendation, we designed and analyzed two care bundles: 1) Child Comprehensive Examination and Preventive Care Bundle, and 2) Child Periodic Examination and Preventive Care Bundle. Table 1 shows each care bundle and the five items included in each bundle. Each bundle was initiated by a triggering event designated by a current dental terminology (CDT) code, D0150 (for a Child Comprehensive Examination and Preventive Care Bundle) and D0120 (for a Child Periodic Examination and Preventive Care Bundle). When a CDT occurred to trigger a bundle, we then analyzed the visit to determine how many bundle items were included during that same visit. All relevant CDT codes for the remaining four items in each bun-

dle are also shown in Table 1. Unlike episode of care bundles used in health care, this design relies on Codes on Dental Procedures and Nomenclatures rather than diagnostic codes.

**Table 1:** Oral Health Bundle Components

Child Comprehensive Examination and Preventive Care Bundle	Child Periodic Examination and Preventive Care Bundle	CDT Code
Dental Examination*	Dental Examination**	D0150, D0120
Radiographs	Radiographs	D0220, D0230, D0240, D0270, D0272, D0274, D0330
Treatment Plan	Treatment Plan	
Prophylaxis	Prophylaxis	D1110, D1120
Fluoride	Fluoride	D1206

\*A child comprehensive examination is allowed only one time for a patient with a provider or group.

\*\*A periodic examination is allowed two times per year.

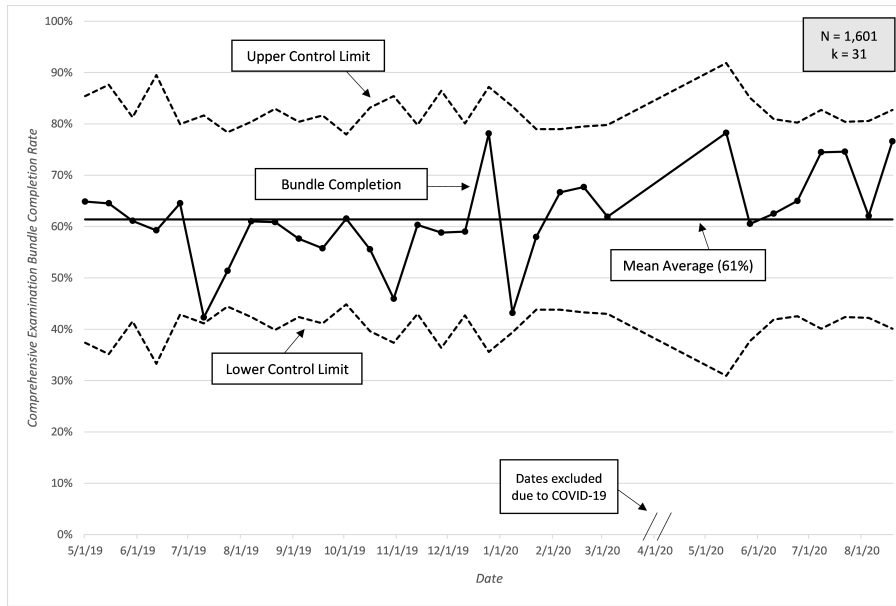
Following IRB approval, data were obtained from a pediatric dental group consisting of board-certified pediatric dentists with four clinics in urban settings in Arizona. Claims data included all patients ages 3-18 years at the time of visit over a 16-month period (May 1, 2019 – September 1, 2020). The clinic was closed in spring 2020 due to the COVID-19 pandemic and we excluded eight weeks (March 18, 2020 – May 12, 2020) from the analysis.

We conducted two sets of analysis to establish baseline performance for VBP and explore longitudinal trends. First, we identified all patients receiving comprehensive and periodic examinations and then used descriptive statistics to determine the total compliance for the Comprehensive Examination Bundle and Periodic Examination Bundle. Second, we used control chart analysis (P-Chart) with observations categorized in two-week intervals. Statistical process control uses a time-ordered sequence to determine the type of variation present in the process. Each P-Chart contains an upper control limit and lower control limit that defines the variation limits for the clinical bundles. Statistical process control techniques are commonly used to monitor and evaluate care processes, and are ideal for application in oral health settings, especially to establish process stability (accurate prediction of outcomes) and process capability (the outcome level that can be predicted when the process is in control).

## Results

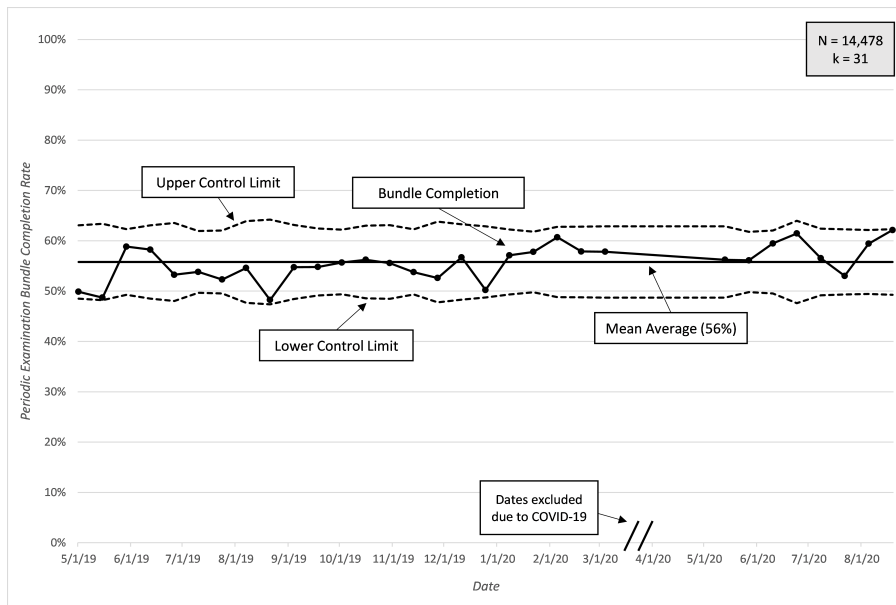
A total of 16,079 comprehensive and periodic examinations were performed during the study period and we analyzed the compliance for both the Comprehensive Examination Bundle and the Periodic Examination Bundle. For the Comprehensive Examination Bundle, there were 1,601 comprehensive care examinations, of which 61.4% (n=983) were completed with all five bundle components and 38.6% (n=618) were not completed with all bundle components during that same visit. With respect to the Periodic Examination Bundle, there were 14,478 periodic examinations, of which 55.8% (n=8,077) were completed and 44.2% (n=6,401) were not completed during that same visit.

Figure 1 shows the bundle completion rate for the Comprehensive Examination Bundle over the 16-month period (from May 1, 2019 – September 1, 2020). The P-Chart analysis indicates the average bundle completion rate at 61.4% over the 16-month time period with no special cause variation, indicating a stable process. The variation range between the upper and lower control limits is approximately 45%, with the lower control limit at approximately 40% bundle completion and the upper control limit at approximately 85% bundle completion.



**Figure 1:** Comprehensive Examination Bundle Completion Rate: P-Chart Analysis

Figure 2 shows a P-Chart analysis for the Periodic Examination Bundle completion rate over the same 16-month period. The overall bundle completion rate is 55.8% with no special cause variation, likewise indicating a stable process. The variation range between the upper and lower control limits is approximately 15%, with the lower control limit at approximately 50% bundle completion and the upper control limit at approximately 65% bundle completion.



**Figure 2:** Periodic Examination Bundle Completion Rate: P-Chart Analysis

Next, we conducted an analysis to determine which items were not completed in the care bundles. Table 2 shows the completion rates for each bundle component. For the Comprehensive Examination Bundle, almost one in four patients did not receive a radiograph, approximately one in five patients did not receive fluoride application, and nearly three in twenty did not receive prophylaxis treatment. With respect to the Periodic Examination Bundle, three items were completed virtually 100% of the time (examination, treatment plan, and prophylaxis treatment), while approximately two out of five patients did not receive a radiograph and one in twenty patients did not receive a fluoride application.

**Table 2:** Item Analysis for Comprehensive Examination and Periodic Examination Care Bundles

	Comprehensive Examination BundleN (%)	Periodic Examination BundleN (%)
Total Examinations	1,659 (100)	14,847 (100)
Treatment Plan*	1,659 (100)	14,847 (100)
Radiographs	1,216 (73.3)	8,718 (58.7)
Prophylaxis	1,422 (85.7)	14,818 (99.8)
Fluoride Application	1,347 (81.2)	14,055 (94.7)

\*There is no CDT code for a treatment plan. Treatment plans are documented in the dental record.

## Discussion

We designed two preventive care bundles for comprehensive and periodic examinations and analyzed 16,079 patient visits at an urban pediatric dental group. The findings indicate that 61% of the Comprehensive Examination Bundles and 56% of the Periodic Examination Bundles were completed within the same visit. A longitudinal investigation using a P-chart analysis indicates the processes for both episode of care bundles were stable, with no special cause variation present. The control limit distance was quite wide for the Comprehensive Examination Bundle at approximately 45%, but was much narrower for the Periodic Examination Bundle at 15%. A major emphasis of statistical process control is to reduce variation in a process, indicating a much tighter variation in the Periodic Examination Bundle compared with the Comprehensive Examination Bundle.

We conducted an item analysis to better understand which components in the care bundle were not completed, with different compliance patterns found between the Comprehensive Examination and Periodic Examination Bundles. For the Comprehensive Examination Bundle, radiographs, fluoride applications, and prophylaxis were not completed approximately 27%, 19%, and 14% of the time, respectively. For the Periodic Examination Bundle, radiographs and fluoride applications were not completed approximately 41% and 5% of the time, respectively.

Radiographs were the most common missing procedure for both the Comprehensive and Periodic Examination Bundles. Several explanations account for radiographs not being done in the care bundle, including: 1) they are not clinically necessary for low-risk patients who completed radiographs at a prior appointment, 2) insurance plan payment restrictions for radiographs can depend on the patient history and risk, 3) families without insurance coverage may be less likely to pay out-of-pocket for radiographs, and 4) parental concern for radiation exposure. In addition, analysis (not shown) indicates there is a substantial decline in the use of radiographs for children ages 3-5. This may be related to clinical judgment regarding the necessity for radiographs for this age group; as well as child behavior.

The second most common incomplete bundle component is fluoride application. Despite being an evidence-based intervention, some insurance plans cover only one application per year or discontinue fluoride treatment coverage once a patient reaches a certain age. Financial barriers can also result in patients not receiving fluoride application. Additionally, some parents decline fluoride treatment based on the belief that it is harmful to their child. Finally, patient behavior can be a reason to omit fluoride treatment when children do not like the taste or feeling of treatment.

The last incomplete bundle component is prophylaxis treatment. While prophylaxis treatment was completed with nearly every periodic examination in the Periodic Examination Bundle, it was not completed in approximately 15% of the Comprehensive Examination Bundle visits. This can be due to the patient receiving recent prophylaxis treatment from another provider or patient behavior preventing the completion of prophylaxis treatment.

While there is not consensus regarding how to define value for oral health [23] oral health care bundles can be a method to do so. This study shows a method to design and analyze an oral health care bundle for application as a VBP approach. Value in oral health encompasses at least three quality dimensions: professional excellence, effective preventive efforts, and achieving population health metrics for enrolled patients.<sup>16</sup> Oral health bundles can be used to ensure that appropriate services are provided during a single visit, and equally important, to create benchmarks for preventive care utilization to achieve greater population health.

While oral health care continues to rely heavily on a FFS payment approach that centers treatment volume,[1, 24] VBP focuses on outcome-based measures aimed at preventing oral disease to reduce restorative measures [25]. The ideal VBP approach solves the problems of FFS, but preserves its strengths [26]. The current FFS payment mechanism for dentistry provides access to professional excellence for patients, however it often under-reimburses preventive services compared to restorative care [27]. Although payment approaches can influence the treatment behavior of dentists, [28, 29] most oral health payment approaches and care delivery models lack adequate incentives for improving long-term health outcomes [30].

Oral health value-based care models and payment mechanisms can lead to better alignment to benefit all stakeholders- patients, dentists, payers, and policy makers -when structured properly. This study indicates that oral health care bundles can be designed, implemented, and then used to establish quality targets for oral health VBP in an effort to improve oral health outcomes for the patient. The CMS LAN created a large number of episode of care bundles for implementation in health care [17]. This study indicates that similar episode of care bundles can be developed for oral health. The recommended next step is an actuarial analysis to determine a fair and full payment for dental groups to provide preventive episode of care bundles for patient populations to improve care and help reduce disparities. An actuarial analysis can establish the total amount of services delivered and the resources needed to provide the services to promote patient adherence. A VBP strategy can be designed with an upside incentive for the dental clinic to reach historically underserved patients.

## Acknowledgments

This study was supported by funding from the Robert Wood Johnson Foundation (Grant ID: 74880).

The authors declare no potential conflicts of interest with respect to the authorship and/or publication of this article.

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