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Impact of Financial and Demographic Factors on Severity of Treatment Procedure

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Impact of Financial and Demographic Factors on Severity of Treatment Procedure

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ABSTRACT:

Indirect pulp caps (IPCs) and pulpotomies are forms of vital pulp therapy. These procedures are performed on young patients who have deep cavities due to bacterial biofilm damage; however, the two are performed and utilized differently. The less severe of the two procedures is an IPC. This is when decayed dentin is covered with biocompatible material to avoid pulp exposure. The more severe procedure, the pulpotomy, is when the inflamed coronal pulp tissue is removed either partially or fully to save any remaining pulp tissue. In this study, all IPCs and pulpotomies performed by Dr. Ben Reimer throughout ~4.5-years of his dental career and the patient insurance coverage for each procedure was investigated to determine if socioeconomic class impacted procedure severity and age of treatment. The less severe procedure (IPC) was performed more frequently in higher income patients over 6 years old; pulpotomies, the more severe procedure, were performed more frequently in low-income patients under the age of 6. These results indicate that higher-income patients are more likely to prevent deep cavities to a later age, and lower-income patients are more likely to develop more severe cavities at an earlier age. This points to higher-income families having more access to proper dental hygiene, hygiene products, education, and care; further, it indicates the need for more accessible dental care and products for low-income families.

Keywords: Indirect pulp cap, pulpotomy, low-income, cavities, pediatric dentistry, socioeconomic factors

Table of Contents:

INTRODUCTION:

Vital pulp therapy procedures are performed on young, pediatric patients who have deep cavities (cavities) due to bacterial biofilm damage. Typically, dentists approach this kind of decay with two different vital pulp therapy procedures: indirect pulp caps (IPC) and pulpotomies. Dentists will decide which form of vital pulp therapy to utilize on a case-by-case basis because there are differences between the two in when they are utilized and how they are approached (Ward, 2002). An IPC is when the dentist removes any decayed or carious dentin and then covers the area with a biocompatible material. The purpose of an IPC is to protect odontoblasts or cells that produce dentin to prevent any further decay and to ultimately avoid potential pulp exposure. The other approach, the pulpotomy, is used when the decay is more severe and the pulp tissue is exposed. In this procedure, the dentist either fully or partially removes the inflamed pulp tissue depending on the severity of decay. The purpose of the pulpotomy is to save any remaining pulp tissue and potentially save the tooth as a whole (Ghoddusi, Forghani, & Parisay, 2014).

These two forms of vital pulp therapy are utilized much more frequently in pediatric patients than in adults because younger individuals have a higher healing capacity when undergoing procedures involving the highly reactive pulp tissue (Aguilar & Linsuwanont, 2011). However, there are some cases when they can be utilized in adults depending on the patient's tooth root apex status and other etiological factors; due to this, adult patients must be evaluated more in-depth to undergo vital pulp therapies. Further, these procedures are more important for the health of young patients versus adults due to their lack of complete apical root development in their teeth (Demarco et al., 2005). When comparing tooth survival rates of endodontically treated teeth versus that of vital pulp therapy, teeth treated through vital pulp therapy procedures have a much higher survival rate (Ghoddusi, Forghani, & Parisay, 2014). These factors all must

be taken into consideration when forming a treatment plan trying to save a young patient's tooth from severe decay and potential tooth loss. Overall, vital pulp therapy procedures are a crucial treatment in pediatric patients with severe cavities.

In addition to vital pulp therapy procedures being crucial for the oral health of young patients with severe cavities, a gap in the development of severe cavities exists between socioeconomic classes. According to the Centers for Disease Control (CDC), low-income individuals are two times more likely to have anywhere from one to three untreated cavities (Centers for Disease Control [CDC], 2021). A study done by the CDC looked at the poverty status in contrast with cavities prevalence in primary (baby) teeth, and they found an increased prevalence of primary teeth cavities in individuals the closer they were to the federal poverty line (CDC, 2019). This is indicative of these lower-income families being more susceptible to the risk factors of developing cavities in both children and adults. These risk factors for cavities, commonly known as cavities, include plaque and tartar buildup, tooth anatomy defects, sugary or acidic foods, lack of fluoride on teeth, dry mouth, and genetic factors (Hennessy, 2023). Since low-income individuals typically have less access to healthy food, proper hygiene products, and healthcare services (Pechey & Monsivais, 2016), this population is automatically at a higher risk of developing cavities.

Although it is known that low-income families are at a higher risk for developing cavities, it is unknown how this affects vital pulp therapy treatment procedure. Further, it is unknown how this impacts different age groups of pediatric patients. Prior studies show that children of low-income families experience more cavities overall the closer they are to the poverty line (CDC, 2019), but how this factor may affect what course of treatment a dentist may take is unknown. Moreover, it is unknown if the age of a child in a lower-income versus higher-

income family experiences different degrees of decay and therefore different vital pulp therapy treatment procedures. This study aims to corroborate the higher risk of cavities that low-income families face as well as investigate its impact on the prevalence of various vital pulp therapy treatment procedures in pediatric patients. To determine if these demographic factors affect decay and treatment procedure, various data reports that included insurance coverage status, procedure type, and age at treatment were pulled on pediatric patients who underwent either IPC or pulpotomy vital pulp therapies.

METHODS:

Subjects

Children from the ages ~1 year old to ~11 years old underwent either form of vital pulp therapy (IPC or pulpotomy) from Dr. Reimer over a ~4.5-year time period from August 8th, 2018, to February 19th, 2023. The only inclusionary criteria were the patient having either an indirect pulp cap or pulpotomy performed by Dr. Reimer. There were no exclusionary criteria for patient data collection.

Data Collection

Data was collected from Pediatric Dental Specialists of Omaha through a secure online patient database and charting program called Dentrix Ascend. Two reports of patient information were pulled from Dentrix using specific procedural codes consisting of a “D” followed by four numbers. One report of patients that underwent either a pulpotomy (D3220) or indirect pulp cap (D3120) on MCNA (Nebraska Medicaid) dental insurance coverage was pulled as well as one that included the same procedures of patients not on MCNA. Patient age at time of procedure was included on the report as well. For this study, to compare high-income and low-income

patient populations, individuals on MCNA insurance were considered low-income. Alternatively, individuals not on MCNA were considered high-income; this includes any form of private insurance as well as the non-insured. These categories were determined from the State of Nebraska Department of Health and Human Services (DHHS) Nebraska Medicaid (MCNA) requirement that coverage is available to families that have an income of only 138% above the poverty level (Division of Medicaid and Long-Term Care, 2021).

Data Analysis

From the Dentrix Ascend reports, patient numbers for four categories were summarized: indirect pulp cap and pulpotomy on higher-income patients, and indirect pulp cap and pulpotomy on lower-income patients. From these four categories, two age categories were created to investigate the impact of age on treatment procedure. Numbers for some patient categories were turned into percentages to compare and determine differences between conditions.

RESULTS:

Vital pulp therapy procedures are more prevalent in patients under six years old

To investigate age as a factor in vital pulp therapy, under six-year-old and over six-year-old categories of subjects were compared. The vital pulp therapy procedures including both indirect pulp caps (IPC) and pulpotomies were performed more in the under six-year-old patient population (see Figure 1). More specifically, Dr. Reimer performed 135 pulp therapy procedures in the under six-year-old population and only 109 in the over six-year-old population; this is a 19.26% difference in prevalence between the two age groups.

Low-income patients underwent more severe pulp therapy interventions

Within the low-income (MCNA-insured) patient population, more pulpotomies were performed in the under six-year-old patient population (see Table 1). Statistically, 63% of pulpotomies in the low-income population were in patients under six-years old versus only 37% in the over six-year-old population. There were higher rates of more severe decay that required a pulpotomy at a younger age in the low-income subject group.

Higher income patients had more indirect pulp caps in the over six age category

In the high-income patient population, 71% of IPCs were done in the over six-year-old category as compared to the only 29% that were under six-years-old (see Table 2). We found more of the less severe vital pulp therapy procedure was done in the higher income population in patients over six-years old.

Significantly more pulpotomies were performed than IPCs

Looking at the procedure totals overall of IPCs and pulpotomies, Dr. Reimer performed only 37 IPCs versus 207 pulpotomies during this time period (see Figure 2). This is over five times more pulpotomies than IPCs or five times more of the more severe/invasive procedure in total.

DISCUSSION:

In the current study, it was discovered that vital pulp therapy interventions, including both indirect pulp caps (IPCs) and pulpotomies, were performed 19.26% more frequently in the under six-year-old age patient population as opposed to those over the age of six. Adding the demographic factor of socioeconomic status when comparing forms of vital pulp therapy, the more severe vital pulp therapy (pulpotomy) was performed more frequently on low-income patients in the under six-year-old category. On the other hand, the less severe vital pulp therapy

(indirect pulp cap) was performed at higher rates on high-income individuals over the age of six-years-old. Lastly, the more severe pulpotomy was utilized a substantial 82.13% more than the less severe IPC.

Overall, vital pulp therapy interventions were utilized at higher rates in the under six-year-old patient population. One review proposed that these procedures are typically used more frequently as an approach to tooth decay in younger individuals due to their higher healing capacity and lack of complete apical root development (Ghoddusi, Forghani, & Parisay, 2014). However, this could be due to the younger patients' lack of permanent teeth in comparison to the older age groups; dentists might be more prone to perform vital pulp therapy instead of more drastic procedures like root canals on non-permanent teeth since they will fall out eventually anyway. An adequate next step would be to look at the effectiveness of vital pulp therapy in older individuals compared to younger individuals to discover specific reasons why this is the case.

When adding the demographic factor of socioeconomic status to determine how it affects treatment procedure, it was discovered that more pulpotomies were performed on low-income patients under the age of six. The pulpotomy is considered the more severe of the two vital pulp therapy procedures; with this in mind, seeing the more severe procedure performed at higher rates and at younger ages within the low-income population points out a relationship between financial status and treatment procedure. Not only do we know that lower income families tend to experience higher rates of decay (CDC, 2021; Williams, et al., 2021), but we also know that this group typically has less access to healthy foods, proper hygiene products, and sufficient healthcare services (Pechey & Monsivais, 2016). This relationship between financial status and treatment procedure points toward lower-income families needing higher access to these foods

and services in order to prevent them having to undergo these more severe vital pulp therapies. Further research could pursue how specific disadvantages such as access to healthcare, hygiene, and education impacts the degree of cavities and dental treatment procedure.

Conversely, we found that higher income patients underwent more IPCs in the over six-year-old age category. In the past, it has been found that low-income individuals are three-times more likely to have four or more untreated cavities as compared to adults with higher incomes (CDC, 2021). Our study confirmed this by showing that high-income subjects were more prone to preventing cavities to a later age as well as having the less severe procedure performed when they did have to undergo vital pulp therapy. This shows that higher income families are more likely to prevent severe cavities. The reason for this could be due to higher income families having more access to preventative dentistry, dental hygiene care and products, and healthier foods. Next steps to investigating this result could include looking into daily hygiene habits and diets specifically of this demographic category to see how this factor impacts frequency and severity of cavities.

Lastly, we found that significantly more pulpotomies were performed than indirect pulp caps (IPCs). From this, we can say that children are prone to more severe decay overall. Despite this, a past study compared IPCs to pulpotomies and found that dental practitioners are hesitant to perform IPCs due to lack of evidence and research on this procedure's long-term efficacy (Smaïl-Faugeron et al., 2016); however, this current study proposes that it could be due to socioeconomic status and its related coexisting factors. These factors that come along with lower socioeconomic status include a lack of educating caretakers on how to properly care for a child's teeth and teaching children how to brush by themselves as well. Further, lack of dental hygiene supplies as well as access to healthy foods that prevent cavities is seen in this lower-income

population and could be why more severe cavities are seen. The current study indicated that a relationship between socioeconomic factors and treatment procedures exists, but future research could look at how certain socioeconomic factors such as diet and hygiene care affects cavities severity or treatment procedure. Future research could also pursue comparing the long-term efficacy and durability of pulpotomies versus indirect pulp caps (IPCs).

This study points toward low-income children experiencing more severe decay at higher rates, but there were some limitations to its findings. First of all, the high-income category included both privately insured individuals as well as uninsured individuals. Although it is assumed that these non-insured individuals are higher class since they are paying for procedures out of pocket, further research could pursue comparing socioeconomic status directly by looking at income as opposed to insurance coverage. Secondly, this study looked at just two procedures throughout an approximately 4.5-year time-period, so the subject population was only 244. Studies in the future could pull data from a longer time period and therefore a larger subject population to determine the degree to which this effect on low-income families is seen.

CONCLUSION:

Ultimately, awareness needs to be brought to this disparity so families can better take care of themselves as can their communities. If more awareness was raised on these issues, children would learn to properly brush their teeth and eat better foods, therefore preventing the need for expensive, invasive procedures such as vital pulp therapy. Further, pushing children to learn these habits early would also eliminate the caretaker knowledge gap on proper oral healthcare because these children would grow up knowing proper oral healthcare from first-hand experience. All in all, these factors are crucial for improving the treatment gap between low and high-income families.

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TABLES:

LOW INCOME - Comparing MCNA Insured Age Categories		
	Under 6 yrs. old	Over 6 yrs. old
Pulpotomy	63%	37%
IPC	40%	60%

Table 1. Comparing age categories across both vital pulp therapies of low-income patients under Nebraska Medicaid (MCNA) insurance. More pulpotomies, the procedure pursued when more severe decay is present, were performed on these low-income patients in the under six-year-old category.

HIGH INCOME - Comparing non-MCNA Insured Age Categories		
	Under 6 yrs. old	Over 6 yrs. old
Pulpotomy	54%	46%
IPC	29%	71%

Table 2. Comparing age categories across both vital pulp therapies of high-income patients. Significantly more indirect pulp caps (IPCs), the procedure pursued with less severe decay, were performed in these high-income patients over six-years-old.

FIGURES:

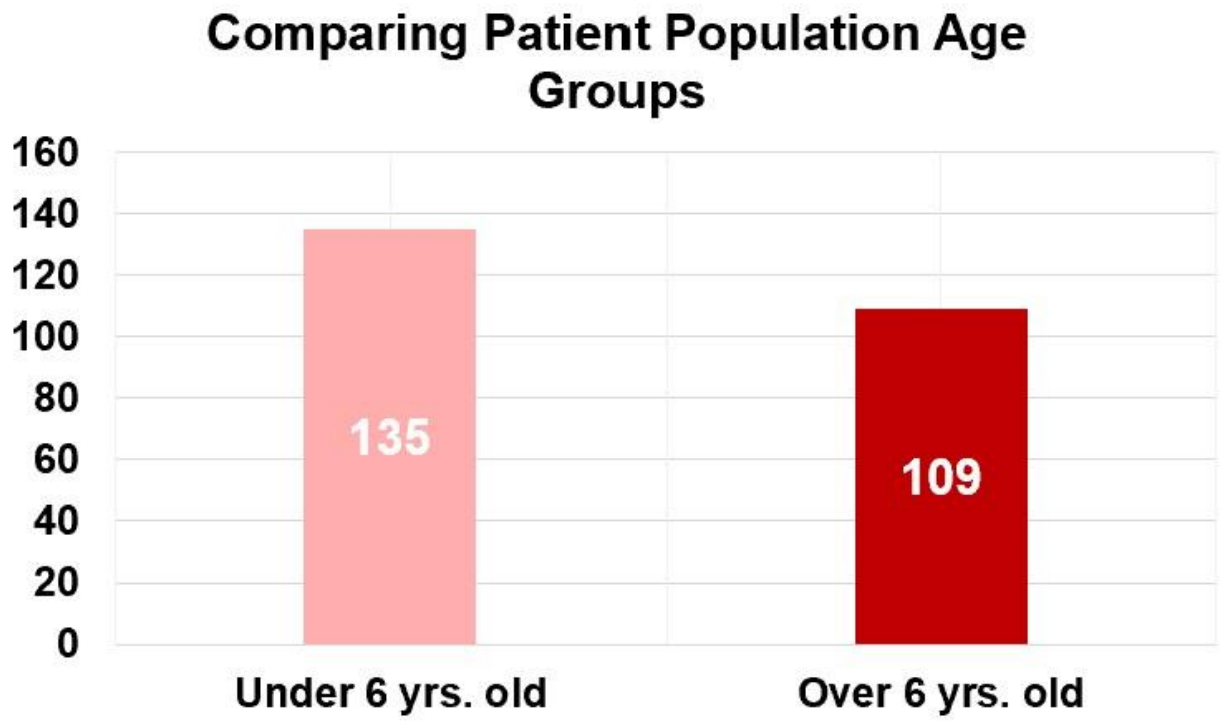

Figure 1. Comparing patient population age groups across both vital pulp therapies. The patient population for vital pulp therapies (indirect pulp cap and pulpotomy) overall was larger in the under six-year-old category.

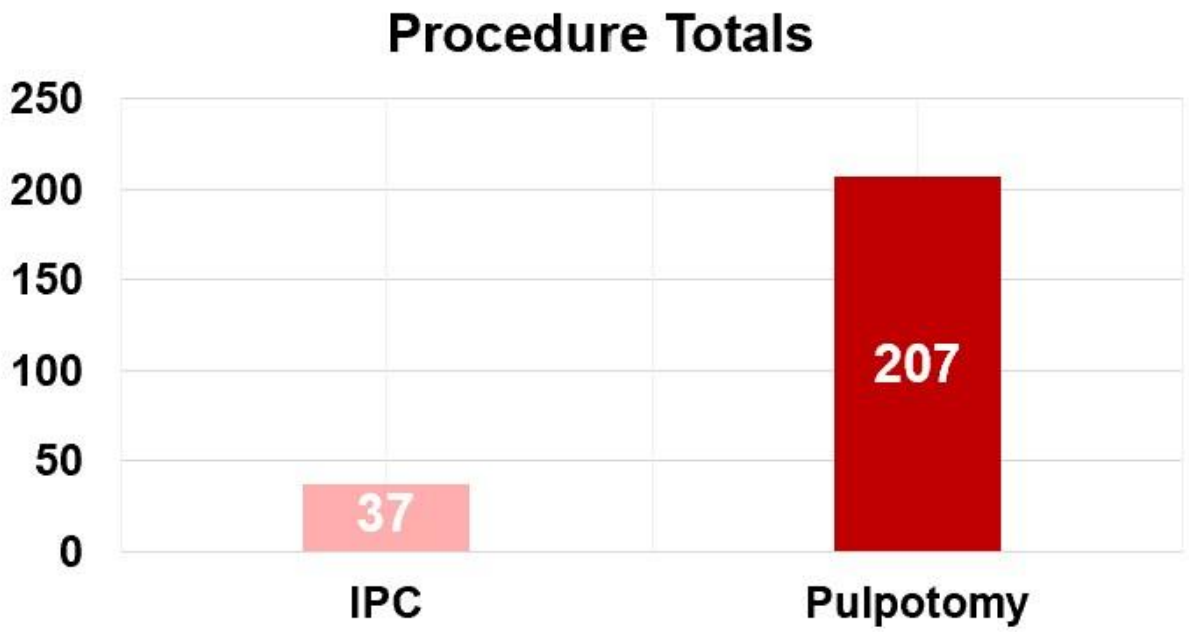

Figure 2. Total indirect pulp caps (IPCs) and pulpotomies performed across the whole patient population. Over five times more pulpotomies were performed than indirect pulp caps (IPCs).