IDENTIFYING THE EFFECT OF PATIENTS’ INSURANCE STATUS ON NURSE PRACTITIONERS’ DECISION TO EDUCATE PATIENTS ON PREVENTIVE DENTAL CARE

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By

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ABSTRACT

This paper analyzes the effect of patient insurance status on nurse practitioners’ behavior towards patients by examining a survey of licensed nurse practitioners in the state of Maryland. By observing such effects, their efforts in educating their patients on preventive dental care can be examined empirically. I use a logistic regression model while controlling for nurse practitioners’ previous education, practice setting, fluoride prescription, dental sealant application, and nurse practitioner’s desire to receive further preventive dental care education. From the regression results, I find that patient insurance status (stratified as Medicaid or private) has a statistically significant effect on the likelihood of patients receiving preventive dental care education from nurse practitioners. The results suggest health insurance status gives nurse practitioners the incentive to provide preventive dental treatment and education to their patients.

Key Words

Preventive dental care, dental sealant, preventive dental care education, nurse practitioners, Medicaid
Many thanks to my professors at the Georgetown Public Policy Institute, especially my thesis advisor, Professor Kern.

Thank you Wyatt, Ashley, Alice, Emily and many other friends for your strength and support.
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I. Introduction

Every year, thousands of Americans file for bankruptcy due to insurmountable debts from health care. Approximately 60% of bankruptcies in the United States (U.S.) per year are a result of health care costs.¹ More recently, as an effort to decrease the public burden of medical care costs, the U.S. health communities have been making efforts by advocating health conscious habits such as hand washing/sanitizers, flu shots, routine visits to physicians, mammograms, exercise and healthy diet as preventive measures.² However, the American public is becoming less aware of the dangers associated with high expenditures in dental care and treatment despite the Surgeon General’s warning in the first national health report in 2000, where he characterized oral health diseases as a “silent epidemic.”³ In 2004, research by Sommers and the U.S. Department of Health and Human Services determined that 7.4% of total health care expenditures in the U.S. were used on dental care.⁴ Furthermore, according to the Centers for Medicare and Medicaid Services, “spending for dental services increased 3 percent in

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2011 to $108.5 billion dollars, increasing slightly faster than in 2010 and out-of-pocket spending has increased by about 4 percent from 2010 to 2011.

As indicated above, dental care, though a necessity to a person’s well-being, is often seen as a financial burden to the U.S. government and even to individuals with insurance. Incidentally, the high cost of dental care affects those who need it the most: people who are unable to afford insurance and do not have sufficient income to pay the high expenses out-of-pocket. It is evident from previous research that out-of-pocket expenses are increasing despite government interventions such as Medicaid, Children’s Health Insurance Program (CHIP), and Medicare.

Due to eligibility, low insurance coverage rate and lack of dental care facility accessibility, the issue of dental care and costs still remain a problem for the low-income population. Against this background, a large part of the public health literature argues that significant reductions can be made in both individual and government level spending on dental health care if health care professionals increased their efforts in educating themselves as well as their patients on preventive dental health care methods.

Many studies conducted in the past have successfully observed a health care professionals’ shortage in understanding preventive education in addition to educating their patients in preventive dental health care. However, aside from health

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6 Ibid
7 Ibid
10 Gretchen Caspary, David Krol, Suzanne Boulter, Martha Ann Keels, and Giusy Romano-Clarke,
professionals’ less than adequate knowledge on preventive dental care education, it is still unclear what other barriers must be identified and which methods need to be considered in order to decrease overall dental health care spending and to better supply less-expensive preventive dental care to those who need it the most.

To clarify this issue, this paper focuses on investigating whether a patient’s insurance status plays a significant role in the nurse practitioners’ decision to educate their patients about preventive dental care. I discuss the effect of patient’s insurance status on nurse practitioners’ decision to educate their patients by using a logistic regression model. In addition, through previous research studies, I highlight the benefits in utilizing nurse practitioners to increase accessibility and provision of preventive dental care to a wider range of population.

I use the data from the Maryland Survey of Dental Caries Prevention-Nurse Practitioners conducted in summer 2012 to test the importance of a patient’s insurance status on nurse practitioners’ decision. The empirical results confirm that a patient’s insurance status plays a statistically significant role, which suggests that nurse practitioners are more likely to spend time educating patients with certain types of insurance than patients with other types of insurance or without insurance. While the results highlight the importance of health insurance, it also implies that a patient’s health insurance acts as a barrier to access in preventive dental care and education to those without it. Through analyzing the benefits of using nurse practitioners and the importance of patient’s insurance status on receiving simple care such as preventive dental care and preventive dental care education, health insurance reforms such as the Affordable Care Act could be used to increase access to preventive dental care and education as well as
decrease costs for everyone regardless of their differences in income or health insurance status.

II. Background and Previous Research

The U.S. government along with assistance from the Centers for Disease Control and Prevention (CDC) and the National Institutes of Health (NIH) has increased its efforts to spread the knowledge of preventive health care to the public.\textsuperscript{11} Also, to account for health care disparities as a result of income disparities, the US government has implemented additional programs within Medicaid, CHIP and more recently introduced the Affordable Care Act. However, despite the increasing amount of resources dedicated to preventive health during the past couple decades, current research and advocacy for preventive care is still not enough, especially for those with low income and therefore current preventive care measures require more research and public effort.\textsuperscript{12}

To confirm the issue of high cost health care among low-income populations, Yu and Bellamy’s research highlights the inequalities in child’s access to health care depending on his/her race, ethnicity, and family income.\textsuperscript{13} Although government efforts have been increasing, preventive care, specifically oral health preventive care, is still deficient due to not only the lack of concern from the public, but also because of disinterest from dental health care providers.\textsuperscript{14}

\textsuperscript{12} Georgia dela Cruz, Gary Rozier, and Gary Slade, "Dental Screening and Referral of Young Children by Pediatric Primary Care," \textit{Pediatrics}, 114, no. 5 (2004): 642,
\textsuperscript{13} Stella Yu, Hilary Bellamy, Michael Kogan, Jennifer Dunbar, Renee Schwalberg, and Mark Schuster, "Factors that Influence Receipt of Recommended Preventive Health and Dental Care," \textit{Pediatrics}, 110, no. 6 (2002): 3,
\textsuperscript{14} Dolores Malvitz, Laurie Barker, and Kathy Phipps, "Development and Status of the National Oral Health Surveillance System." \textit{Centers for Disease Control and Prevention}, Centers for Disease Control and
oral health care of the U.S. public, the Surgeon General’s report confirms tooth decay to be one of the more important health issues that have been majorly neglected, more so within low-income families. According to the CDC, 500 million Americans visit the dentist annually, and costs spent on dental care in 2010 were estimated to be around 108 billion dollars. With tooth decay as one of the most common childhood chronic diseases in the U.S., it is important for the dental health care community to look deeper into the issue of oral health and preventive dental care across the general population as an effort to decrease dental care expenditures.

Recently, nurse practitioners have been assigned the task of assessing dental caries as well as providing preventive dental care such as fluoride prescription and dental sealant application to address the problem of access difficulties and high cost of dental treatment. In an article by Hakim et al., the state of Maryland is noted as one of the few states in the U.S. that has taken the initiative to reimburse nurse practitioners to offer fluoride treatment to children in preventive dental care to increase accessibility to care to the community, especially patients with low income. Yu et al.’s study suggests higher reimbursement rates may motivate health care professionals to treat more patients, which

20 Ibid p.7
could play as a factor in increasing access to health care professionals.\textsuperscript{21} It is also noted that because receiving dental service from dentists is difficult for some families due to high costs and accessibility, nurse practitioners are now given more responsibility than in the past to provide low cost preventive dental care.\textsuperscript{22} According to recent findings in the literature, nurse practitioners are more likely than dentists to receive visitations from children belonging to the lower-middle income class who are uninsured, insured through Medicaid and/or underinsured due to lower costs and accessibility.\textsuperscript{23} Nurse practitioners are considered the ideal agents to provide care for those without adequate dental insurance due to their prominence in the health care setting.\textsuperscript{24} By utilizing nurse practitioners, number of preventive dental care visits among patients including adult patients may increase.

In addition to the importance and the benefits from utilizing nurse practitioners, previous research studies also focused on factors that contribute to poor dental hygiene among children as well as issues in children receiving preventive dental care. A study by Edelstein and Chinn suggests that children in low-income families are more likely to experience tooth decay,\textsuperscript{25} and factors such as malnutrition, low accessibility to nutritional foods and high consumption of sugary foods that may accelerate dental caries.

\textsuperscript{21} Stella Yu, Hilary Bellamy, Michael Kogan, Jennifer Dunbar, Renee Schwalberg, and Mark Schuster, "Factors that Influence Receipt of Recommended Preventive Health and Dental Care," \textit{Pediatrics}, 110, no. 6 (2002): 6,


\textsuperscript{25} Burton Edelstein, and Courtney Chinn, "Update on Disparities in Oral Health and Access to Dental Care for America's Children," \textit{Academic Pediatrics}, 9, no. 6 (2009): 415,
Edelstein and Chinn’s research on oral health also highlights an increasing dental caries rate among younger children, and this trend of increased caries rates among younger children is predicted to continue in the future. Furthermore, according to a study by Bramlett et al. from 2010, children that live with unconcerned parents in an unsafe neighborhood had worse dental conditions than other in safer and less poor areas. Bramlett and Edelstein’s studies confirm the assertion that dental care is a greater issue for those with low income.

Most of the research studies on preventive dental care as mentioned above, are studies on how to increase access to care through increasing Medicaid reimbursement and utilization of nurse practitioners to decrease cost of care. The research concludes that increased utilization of nurse practitioners could increase access and patient education in preventive dental care may decrease oral health disparities in the U.S. Such findings emphasize the rising importance of nurse practitioners and their role in educating and treating preventable dental diseases, especially among low-income families and uninsured and underinsured children.

Even with their comprehensive approach, these studies do not adequately provide if the implementation of nurse practitioners and the increase in reimbursement rates has been effective as anticipated. Despite the health policy implementations, factors such as

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29 Donna Hallas, and Donna Shelley, "Role of Pediatric Nurse Practitioners in Oral Health Care," Academic Pediatrics, 9, no. 6 (2009): 462,
patient insurance status may still be creating a negative effect on the deliverance of preventive health care education from nurse practitioners to his/her patients. Therefore, further research is needed to determine possible factors such as patient insurance status, which can act as a deterrent to the progression of preventive dental care education, treatment and awareness.

III. Theoretical Considerations and Hypothesis

Currently, under the Medicaid and CHIP program, children and adults who are eligible for participation in those programs are entitled to preventive and remedial dental treatment. Previous studies applaud Maryland for increasing reimburse rates for its health care professionals because it addressed the issue of low re-imbursement rates received by health care facilities by Medicaid and CHIP, but it does not examine the effects after the implementation of higher reimbursement rates and utilization of nurse practitioners. To better analyze the current relationship between patients’ insurance status and the nurse practitioners’ decision, I hypothesize that the likelihood of a patient receiving education depends on the patient’s insurance status/type in the state of Maryland. The state of Maryland was chosen because it was one of the few states that have implemented both higher reimbursement rates as well as utilization of nurse practitioners. The results will determine whether or not government insurance such as Medicaid and/or CHIP are as effective or any different from private insurance and/or out of pocket payments with regards to motivating nurse practitioners to educate their child.

30 Medicaid.gov ("Early and Periodic Screening, Diagnostic, and Treatment")
and adult patients on preventive dental care since the recent changes have taken place. By examining the effects of patient insurance status after the implementation of nurse practitioners and higher reimbursement rates, the success of recent changes in Maryland could be determined.

IV. Data and Methodology

By using information and data provided by the Maryland Survey of Dental Caries Prevention-Nurse Practitioners, I was able to create a data set to determine how the patient insurance status affects nurse practitioners’ decision to educate preventive dental care to their patients. The Maryland Survey of Dental Caries Prevention-Nurse Practitioners was mailed out to 1410 registered nurse practitioners in Maryland between May and July of 2011. The response rate was low at 38.65%, and some survey responses had too many unanswered questions to be deemed complete. As a result, 22.34% of survey responses were usable. Unfortunately, such low response rate becomes highly problematic when interpreting results because working with low response survey data with missing variables and non-sampling errors may lead to biased parameters that may not be an accurate representation of the surveyed population.33 To address these issues, detailed limitations of this survey study will be discussed towards the end of this research paper.

With the data set extracted from the survey, I used a binomial logit model to observe whether patients’ insurance status play a significant role in determining nurse practitioners’ decision to educate or not educate their patients. In other words, the

binomial logit model below in equation (1) can tell us the difference in the likelihood of receiving preventive dental care education between Medicaid vs. non-Medicaid patients, Private insurance vs. non-private insurance patients, Out-of-pocket vs. insured (Medicaid or Private) patients.

\[
\text{Preventive Education}^2 (\text{NP’s decision to educate patients}) = \beta_0 + \beta_1\text{medicaid} + \beta_2\text{private} + \beta_3 \text{fluoride prescription} + \beta_4 \text{dental sealants} + \beta_5 \text{prior education} + \beta_6 \text{practice setting} + \beta_7 \text{continued education} + \mu \tag{1}
\]

In the above equation, the key dependent variable is Preventive Education\(^2\), which is one (1), if the nurse practitioner provides preventive dental care education, and zero (0) otherwise. To better understand the effects of patient insurance status, I identified the different types of insurance that are majorly present in each nurse practitioner’s practice. To accurately assess the impact of a patient’s insurance status on nurse practitioner’s decision to educate his/her patient, three dummy variables were created for each insurance category. Dummy variables medicaid, private, and outofpocket represent patients with Medicaid or Medicare insurance, private insurance and without insurance respectively, and were created to indicate the most prevalent patients’ insurance status per nurse practitioner.

\[\text{Eventually, STATA drops the dummy variable outofpocket for the issue of multicollinearity with the dependent variable; the dummy variable outofpocket was removed by STATA from the logistic regression equation.}\]
Since the dependent variable is a binomial, the use of a binary response model such logit or probit model is appropriate to test the relationship between the dependent variable and the key independent variable,\(^{35}\) which in this case are nurse practitioners’ decision to educate their patients and the patient’s insurance status, respectively. Aside from the main dependent variable (education of patients by nurse practitioners) and the key independent variable (patient insurance status), preventive dental treatment methods (prescribing fluoride, and application of dental sealants), nurse practitioner’s practice setting, and nurse practitioner’s prior education are used as control variables.

The variables in the regression equation (1) were chosen from the Maryland Survey of Dental Caries Prevention (nurse practitioners) by their relevance in insurance status and preventive dental care treatment such as fluoride prescription and dental sealants. Although there were many variables in the survey, the variables were chosen in congruent with previous literatures that I have encountered during the research. Other variables, prior education, continued education, and practice setting used in my regression were chosen based on the independent variables used in the research study by Yu et al. Variables used in the study by Yu et al. were chosen to best determine the factors that relate to preventive dental care and therefore had variables relating to patient’s income and race. Due to the difference in survey method and questions between the survey by Yu et al. and the Maryland Survey of Dental Caries Prevention (nurse practitioners), I chose variables relating to parent’s income such as nurse practitioner’s practice setting. This is under the assumption patients with low income are more likely to seek public or non-profit clinics due to lower costs. The other control variables regarding

nurse practitioners’ prior education in preventive dental care and their willingness to continue education in preventive dental care were added to control the difference in quality and preventive dental care education care among observed nurse practitioners.

V. Descriptive Statistics

Table 1. Variables Summary

<table>
<thead>
<tr>
<th>Variables</th>
<th>Mean</th>
<th>Std Dev</th>
<th>Min</th>
<th>Max</th>
<th>Responses</th>
<th>Missing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preventive Education2</td>
<td>0.2924</td>
<td>0.4559</td>
<td>0</td>
<td>1</td>
<td>212</td>
<td>18</td>
</tr>
<tr>
<td>Medicaid</td>
<td>0.2086</td>
<td>0.4072</td>
<td>0</td>
<td>1</td>
<td>230</td>
<td>0</td>
</tr>
<tr>
<td>Private</td>
<td>0.326</td>
<td>0.4698</td>
<td>0</td>
<td>1</td>
<td>230</td>
<td>0</td>
</tr>
<tr>
<td>Outofpocket</td>
<td>0.0391</td>
<td>0.1943</td>
<td>0</td>
<td>1</td>
<td>230</td>
<td>0</td>
</tr>
<tr>
<td>Presflu</td>
<td>0.2904</td>
<td>0.455</td>
<td>0</td>
<td>1</td>
<td>230</td>
<td>0</td>
</tr>
<tr>
<td>Dentals</td>
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<td>0.4521</td>
<td>0</td>
<td>1</td>
<td>210</td>
<td>20</td>
</tr>
<tr>
<td>Prioreduc</td>
<td>0.1652</td>
<td>0.3721</td>
<td>0</td>
<td>1</td>
<td>230</td>
<td>0</td>
</tr>
<tr>
<td>Contineduc</td>
<td>0.6434</td>
<td>0.48</td>
<td>0</td>
<td>1</td>
<td>230</td>
<td>0</td>
</tr>
<tr>
<td>Practset</td>
<td>0.6315</td>
<td>0.4834</td>
<td>0</td>
<td>1</td>
<td>228</td>
<td>2</td>
</tr>
</tbody>
</table>

Source: Author's calculations by using survey data from Maryland Survey of Dental Caries Prevention (Nurse Practitioners)

Table 1 presents the means, standard deviations, minimum and maximum values, number of responses and missing values of both dependent and independent variables that will be used for the regression model. The total of seven independent variables, which are used in the regression, include patient insurance status (Medicaid and private), preventive dental treatment methods (prescribing fluoride and application of dental sealants), nurse practitioner’s practice setting, and nurse practitioner’s prior education are used as control variables. Approximately 86% of the survey respondents self-identified their race as white, and 94% of the respondents self-identified their gender as female.

*Medicaid* and *Private* are the main binary independent variables created to capture the effects of patients enrolled in Medicaid or Private insurance on nurse practitioners deciding to educate their patients with preventive dental care. A value of 1 is
given in each variable if over 70% of a nurse practitioner’s patients have Medicaid or Private insurance. *Outofpocket* is a dummy variable created to indicate the effects of patients that are neither enrolled in Medicaid or private insurance, on nurse practitioners deciding to educate their patients with preventive dental care. However, this variable is ultimately dropped in the logistic regression model because the variable is considered as a perfect predictor of the dependent variable, which could be due to a large number of missing observations.\(^{36}\) *Presflu* is a binary variable whereby a value of 1 is given when the nurse practitioner prescribes fluoride to his/her patients. *Prioreduc* and *contineduc* are binary dummy variables, where value of 1 is given to each variable respectively if nurse practitioner has had additional preventive education aside from his/her professional school, and if the nurse practitioner has the desire to continue learning more about preventive dental care. Variable *practset* indicates a nurse practitioner’s practice setting. Value of 1 is given if the nurse practitioner’s practice is in a private setting, and 0 is given if it is in a non-profit/government/public setting. To understand the between each independent dummy variables, provided below is a table that examines the pairwise correlation.

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Table 2. Independent Variable Pairwise Correlation

<table>
<thead>
<tr>
<th>Variables</th>
<th>Medicaid</th>
<th>Private</th>
<th>Outofpocket</th>
<th>Presflu</th>
<th>Dentials</th>
<th>Prioreduc</th>
<th>Continueduc</th>
<th>Practset</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Medicaid</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(p-value)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Obs)</td>
<td>230</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 Private</td>
<td>-0.3572*</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(p-value)</td>
<td>0.0000</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>(Obs)</td>
<td>230</td>
<td>230</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 Outofpocket</td>
<td>-0.1036</td>
<td>-0.0925</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td>(p-value)</td>
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<td>0.1619</td>
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</tr>
<tr>
<td>(Obs)</td>
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<td>230</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 Presflu</td>
<td>-0.0345</td>
<td>0.3039*</td>
<td>-0.0604</td>
<td>1</td>
<td></td>
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<tr>
<td>(p-value)</td>
<td>0.6186</td>
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<td>0.384</td>
<td>0.0000</td>
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<tr>
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<td>210</td>
<td>210</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5 Dentials</td>
<td>0.0316</td>
<td>0.1485*</td>
<td>-0.1188</td>
<td>0.4450*</td>
<td>1</td>
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<td>(p-value)</td>
<td>0.6536</td>
<td>0.0341</td>
<td>0.0905</td>
<td>0.0000</td>
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<td></td>
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<td></td>
</tr>
<tr>
<td>(Obs)</td>
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<td>204</td>
<td>204</td>
<td>203</td>
<td>204</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6 Prioreduc</td>
<td>0.1460*</td>
<td>-0.0098</td>
<td>0.031</td>
<td>0.1997*</td>
<td>0.1928*</td>
<td>1</td>
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<td>(p-value)</td>
<td>0.0268</td>
<td>0.8828</td>
<td>0.6403</td>
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<td>0.0057</td>
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<tr>
<td>(Obs)</td>
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<td>230</td>
<td>230</td>
<td>210</td>
<td>204</td>
<td>230</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7 Continueduc</td>
<td>0.0472</td>
<td>-0.0825</td>
<td>0.0566</td>
<td>0.1086</td>
<td>-0.0022</td>
<td>-0.0599</td>
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<td>(p-value)</td>
<td>0.4763</td>
<td>0.2125</td>
<td>0.393</td>
<td>0.1167</td>
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<tr>
<td>(Obs)</td>
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<td>210</td>
<td>204</td>
<td>230</td>
<td>230</td>
<td></td>
</tr>
<tr>
<td>8 Practset</td>
<td>-0.2851*</td>
<td>0.1864*</td>
<td>-0.0786</td>
<td>0.1571*</td>
<td>-0.026</td>
<td>-0.1077</td>
<td>0.0339</td>
<td>1</td>
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<tr>
<td>(p-value)</td>
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<td>0.0231</td>
<td>0.713</td>
<td>0.1047</td>
<td>0.6106</td>
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</tr>
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<td>(Obs)</td>
<td>228</td>
<td>228</td>
<td>228</td>
<td>209</td>
<td>203</td>
<td>228</td>
<td>228</td>
<td>228</td>
</tr>
</tbody>
</table>

Source: Author's calculations by using survey data from Maryland Survey of Dental Caries Prevention (Nurse Practitioners)

* indicates that pairwise correlation is statistically significant at the 0.05 level

Table 2 presents a list of pairwise correlations between the independent variables. Since this paper deals with missing survey data observations, using pairwise correlation to interpret independent variables can decrease bias and increase the working sample size.37

For example, the correlation coefficient r= 0.30 between private insurance patient and fluoride prescription means that private insurance patients receive more fluoride prescription than those who have Medicaid insurance or pay out-of-pocket for their treatments/services. In other words, the magnitude of correlation coefficient “r” determines how much impact a variable has on the outcome variable.38 The variables examined above have low enough “r”s to avoid multicollinearity and were used in the logistic regression model.

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37 Alan Acock, A Gentle Introduction to Stata, (College Station: StataCorp, 2010), 189.
38 Ibid
VI. Estimation Results

In this section of the paper, I present the estimated odds ratios from the logistic regression results. Then, interpretations of the findings will be discussed as well as its relevance to policy relevance and implications.

Table 3. Estimated odds ratio from logistic regression of preventive dental care education offered by nurse practitioners in the state of Maryland

<table>
<thead>
<tr>
<th>Predictor</th>
<th>Model 1</th>
<th>Model 2 includes Private insurance</th>
<th>Model 3 includes fluoride prescription</th>
<th>Model 4 includes dental sealants</th>
<th>Model 5 includes other control variables</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medicaid Patients</td>
<td>2.8875***</td>
<td>4.0980***</td>
<td>4.1751***</td>
<td>4.7785***</td>
<td>4.3325***</td>
</tr>
<tr>
<td>Private Insurance Patients</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fluoride Prescription</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dental Sealants</td>
<td>7.4388***</td>
<td>3.7369***</td>
<td>3.3099**</td>
<td>4.7428***</td>
<td>4.3029***</td>
</tr>
<tr>
<td>Nurse Practitioner's Prior Education in Preventive Dental Care</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2.2383*</td>
</tr>
<tr>
<td>Nurse Practitioner's desire to continue their education in preventive dental care</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(1.1029)</td>
</tr>
<tr>
<td>Nurse Practitioner's Practice Setting</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1.2023</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(.5023)</td>
</tr>
</tbody>
</table>

\[ N = 212 \]
\[ Missing = 18 \]
\[ Wald Chi-Square = 9.32, 12.51, 32.33, 37.59, 37.15 \]
\[ (p=.0023), (p=.0019), (p=.0000), (p=.0000), (p=.0000) \]
\[ Pseudo R^2 = 0.036, 0.0512, 0.1741, 0.2338, 0.239 \]

Notes: *** p<0.01; ** p<0.05; * p<0.10. Calculations based upon calculations by using survey data from 2011 Maryland Survey of Dental Caries Prevention (Nurse Practitioners). Robust standard errors in parentheses.
Table 3 presents the logistic regression results where the dependent variable represents nurse practitioners’ decision to educate his/her patients in preventive dental care. Model 1 presents a logistic regression result where only the Medicaid dummy variable is used as the independent variable. The coefficient for the Medicaid dummy variable is statistically significant at the 0.01 level, and it suggests that odds of Medicaid insured patients receiving preventive dental care education provided by a nurse practitioner increases by a factor of 2.89. As it can be observed in Model 2, the odds of Medicaid insured patients receiving preventive dental care education from a nurse practitioner increases almost by twice its magnitude when the dummy variable for privately insured patients are included.

In Model 2, both coefficients for the private and the medicaid variables are statistically significant at conventional levels. The medicaid coefficient in Model 2 imply that the odds of a patient without Medicaid insurance decreases by about a factor of 4, or it can also mean that those with Medicaid have a higher likelihood (by a factor of 4) than those without Medicaid to be educated by nurse practitioners on preventive dental care. The patients without medicaid insurance in this case can either be those truly without any insurance coverage, or those with private insurance. The private coefficient in Model 2 suggest that those with private insurance have a higher likelihood than those who do not have private insurance to be educated in preventive dental care methods. Alternatively, it can be interpreted as that those without private insurance are less likely than their counterparts to be educated in preventive dental care by the nurse practitioners. The counterparts of those who are privately insured can either be without any insurance coverage or have Medicaid insurance. The empirical findings of the two insurance

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39 Since it is more difficult to interpret the coefficients from the logit regression model (Acock 2012), I have decided to use the logistic regression model instead of the logit regression model and interpreted the odds ratio.
variables confirm the test hypothesis. Insurance status is indeed a significant factor in determining nurse practitioners’ decision to educate their patients. It is interesting to see the continued statistically significant effect of the medicaid variable on the nurse practitioners’ decision to educate his/her patients from Model 1 through Model 5. However, the private variable no longer is statistically significant from Model 3 through Model 5, but still retains its positive coefficient. The overall results corroborate with the hypothesis in that insurance, especially Medicaid insurance, does have the intended effect of providing preventive dental care accessibility, treatment and education.

The empirical results regarding the control variables support previous research studies’ conclusions by confirming the importance and effects of nurse practitioners’ awareness in preventive dental care, and how that relates to their decision to provide their patients with preventive dental care education. The dummy variable presflu (fluoride prescription) is statistically significant at conventional levels in Models 3, 4, and 5. While controlling for other variables, nurse practitioners that prescribe fluoride to his/her patient are more likely to educate their patients in preventive dental care than those who do not. Such results imply that nurse practitioners that are aware of the importance of fluoride prescription are more likely to consider important preventive dental care education to their patients. This confirms the assertion that nurse practitioners that are well educated in preventive care are more likely to relay the information of preventive dental care to their patients.

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The *dentals* (dental sealant application) dummy variable coefficients in Models 4 and 5 are statistically significant at conventional levels, and indicate that while controlling for other variables, nurse practitioners who apply dental sealants to their patients are more likely to educate his/her patients in preventive dental care than those who do not apply dental sealants to their patients. Again, similar to the interpretation of *presflu*, nurse practitioners trained in preventive care are more likely to educate their patients.

Lastly, the coefficient from *prioreduc* (nurse practitioners’ prior preventive dental care education outside of professional school) indicates statistical significance at conventional levels. This indicates that nurse practitioners with additional education in preventive dental care are more likely to educate his/her patient in preventive dental care than a nurse practitioner who has not had any prior preventive dental care education aside from their degree, since their degrees may not demonstrate adequate training in preventive dental care. The results from the regression are parallel to that of previous research studies’ assertion that health professionals that lack the knowledge in preventive dental care are not able to adequately treat of educates patients, and patient insurance status plays a significant role in determining patient’s access to care and education.

To summarize the key points from the logistic regression results above, both Medicaid and private insurance have a positive effect on patients with regards to receiving

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43 Donna Hallas, and Donna Shelley, "Role of Pediatric Nurse Practitioners in Oral Health Care," *Academic Pediatrics*, 9, no. 6 (2009): 464,
preventive dental care education from their nurse practitioners. This implies that patient insurance status is important with regards to receiving preventive dental care education from nurse practitioners. In addition to highlighting the importance of patient insurance status, interpretation of control variables generally\textsuperscript{44} conform to the results of previous research studies.\textsuperscript{45} Nurse practitioners that received extra education/training in preventive dental care, prescribe fluoride, and/or apply sealants to their patients are more likely to educate their patients in preventive dental care than those who did not have extra prevention education, do not prescribe fluoride and/or apply dental sealants to their patients. Furthermore, the findings in the logistic regression model with regards to patient insurance status support my test hypothesis, especially with the continued statistical significance at the 0.01 level in all five models, while the private insurance dummy variable loses its statistical significance as control variables are added.

\section*{VII. Research Limitations}

While the empirical model and results presented above appear to be congruent with previous studies and research as well as with my hypothesis, these results must be taken into consideration with a number of shortcomings. The low survey response rate creates the issue of non-response bias on the empirical model,\textsuperscript{46} and unlike random error bias, non-response bias is extremely difficult to quantify.\textsuperscript{47} The issue of response bias also should be taken into account when interpreting the empirical results presented above.

\textsuperscript{44} Interpretation results of the control variables do conform with previous studies, however, the regression results in Table 3 do not take into account reimbursement regulation and rates in the state of Maryland.
\textsuperscript{47} Ibid p.2
The low response rate of the survey may be due to the disinterest and lack of knowledge in preventive dental care among nurse practitioners in Maryland, which may mean that those who responded to the survey are familiar with/or interested in preventive dental care, leading to bias in the results. The limitations as a result of non-response bias and response bias could not be addressed properly with the option of stratification or weighting due to very low numbers of observations and lack of weights in the survey.\textsuperscript{48} These problems cannot be effectively addressed and corrected due to the missing survey questions from the conducted survey. Without these survey instruments, it is not possible to determine the direction of causality. Also, due to the limited amount of information provided by the survey, finding a variable relating to indicating parent income was difficult. Ultimately, the variable \textit{practset} was chosen for the regression based on the assumption that patients with low income are more likely to seek public or non-profit clinics due to lower costs.

Moreover, unlike previous research and studies, race and gender could not be included in the logistic regression model due to the lack of variation in both race and gender since the survey data since more than 90\% of survey respondents were white females. Such lack of variation may indicate that this sample may not be the best representation of the Maryland nurse practitioner population. Therefore, the logistic regression model and results presented above must be interpreted with caution as they reflect only the behavior of the surveyed sample population. Nevertheless the results seem to be broadly in line with similar studies in the literature. However, existing limitations do not discount the importance of patient’s insurance status on nurse practitioner’s decision to educate them on preventive dental care, and further policy

\textsuperscript{48} Ibid p. 6
efforts must be made to give patients better access to dental care and preventive care education.

**VIII. Conclusion**

This paper raises the question of whether preventive health care, especially preventive education is driven by the insurance status of an individual. The results presented in the regression model confirm the importance of patient insurance status on receiving preventive dental education and care from nurse practitioners. Based on empirical results, one of the barriers to increasing preventive dental care education from nurse practitioners to patients have been identified: patient insurance status. The presented empirical results confirm that a patients’ insurance status plays an important role in a nurse practitioners’ decision to educate them in preventive dental care. The findings also relate to the results from previous research that describes the importance of health insurance status among children.\(^4^9\) The results imply that without either private or public insurance, the likelihood of an individual receiving preventive dental care and education would be very low. Moreover, as previously mentioned, attention towards further increasing accessibility in preventive dental care is required to decrease total national oral health care expenditures. As preventive dental care has been proven to be more cost effective than most other preventive treatments; therefore, by focusing additional resources on preventive dental care, it can be anticipated that less money could be spent on treatments for cavities, infections and preventable oral diseases. By utilizing nurse practitioners to perform simple preventive dental care services and educate their

patients nationwide as the state of Maryland has done, the aforementioned issues of cost and access may be remediated.

Health policy should address the issue of lack of access to dental care services that exists for those without insurance. Currently, the U.S. health care system is going through an extensive reform through the Affordable Care Act and will soon include preventive dental care as part of its coverage. In particular, the Affordable Care Act will allow individuals who have not been able to qualify for Medicaid, or those who did not have the financial capacity to purchase private insurance to acquire insurance through government subsidies and mandates.50 This regulatory and legislative reform is anticipated to decrease the overall US health care expenditures as well as lessening financial burdens, especially for citizens with low-income. For this reason increasing the access to insurance has a great potential to expand the use of preventive dental care service including education through nurse practitioners. Yet, from a policy standpoint, more research needs to be done such as observing the change in dental caries rate over time to detect the effectiveness of utilizing nurse practitioners. Another important component that also needs to be considered regarding preventive dental care education, would be to increase preventive dental care demand from the patients’ side, meaning, incentives or mandates be used in order to motivate low-income and less educated individuals to visit nurse practitioners and receive preventive dental care education. By observing the effects of nurse practitioner’s on preventive dental care education on individuals, especially those with low-income through surveys such as National Health and Nutrition Examination Survey (NHANES), it may be possible to determine whether

incentives or mandates are more appropriate to increase patient participation in receiving preventive dental care treatment and education. Through the continued efforts to identify the gaps and barriers between patients and dental health care professionals, the American public can benefit from enhanced education and awareness, more universal access and ideally, greater savings to the taxpayer.
IX. Appendices

Appendix 1. Independent Variable Correlation

<table>
<thead>
<tr>
<th>Independent Variable</th>
<th>Medicaid Private</th>
<th>Outofpocket</th>
<th>Presflu</th>
<th>Dentals</th>
<th>Prioreduc</th>
<th>Contineduc</th>
<th>Practset</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Medicaid</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 Private</td>
<td>-0.3927</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 Outofpocket</td>
<td>-0.1</td>
<td>-0.0845</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 Presflu</td>
<td>-0.0225</td>
<td>0.3176</td>
<td>-0.0622</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5 Dentals</td>
<td>0.0422</td>
<td>0.1535</td>
<td>-0.1188</td>
<td>0.4439</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6 Prioreduc</td>
<td>0.1617</td>
<td>-0.0225</td>
<td>0.0532</td>
<td>0.1845</td>
<td>0.1966</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>7 Contineduc</td>
<td>0.026</td>
<td>-0.0742</td>
<td>0.0223</td>
<td>0.1183</td>
<td>0.0109</td>
<td>-0.101</td>
<td>1</td>
</tr>
<tr>
<td>8 Practset</td>
<td>-0.3084</td>
<td>0.187</td>
<td>-0.1416</td>
<td>0.1598</td>
<td>-0.0157</td>
<td>-0.1396</td>
<td>-0.0129</td>
</tr>
</tbody>
</table>

Source: Author's calculations by using survey data from Maryland Survey of Dental Caries Prevention (Nurse Practitioners)
Appendix 2. Results of a logit regression model of preventive dental care education offered by nurse practitioners in the state of Maryland.

<table>
<thead>
<tr>
<th>Predictor</th>
<th>Model 1</th>
<th>Model 2 includes Private insurance</th>
<th>Model 3 includes fluoride prescription</th>
<th>Model 4 includes dental sealants</th>
<th>Model 5 includes other control variables</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medicaid Patients</td>
<td>1.0603***</td>
<td>1.4105***</td>
<td>1.4291***</td>
<td>1.5641***</td>
<td>1.5753***</td>
</tr>
<tr>
<td></td>
<td>(0.3473)</td>
<td>(0.3998)</td>
<td>(0.4613)</td>
<td>(0.4858)</td>
<td>(0.5160)</td>
</tr>
<tr>
<td>Private Insurance Patients</td>
<td>0.7209</td>
<td>0.0776</td>
<td>0.1742</td>
<td>0.2147</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.3689)</td>
<td>(0.4144)</td>
<td>(0.4470)</td>
<td>(0.4516)</td>
<td></td>
</tr>
<tr>
<td>Fluoride Prescription</td>
<td>2.006***</td>
<td>1.3315***</td>
<td>1.1825***</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(.3205)</td>
<td>(0.4346)</td>
<td>(0.4649)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dental Sealants</td>
<td>1.5566***</td>
<td></td>
<td>1.5174***</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.4197)</td>
<td></td>
<td>(0.4277)</td>
<td></td>
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</tr>
<tr>
<td>Nurse Practitioner's Prior Education in Preventive Dental Care</td>
<td>.7801*</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.4790)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nurse Practitioner's desire to continue their education in preventive dental care</td>
<td>0.1808</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.41101)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nurse Practitioner's Practice Setting</td>
<td>0.187</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.4392)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td>-1.1474***</td>
<td>-1.4975***</td>
<td>-1.9968***</td>
<td>-2.3868***</td>
<td>-2.7353***</td>
</tr>
<tr>
<td></td>
<td>(.1819)</td>
<td>(.2689)</td>
<td>(.3205)</td>
<td>(.3491)</td>
<td>(.5555)</td>
</tr>
<tr>
<td>N</td>
<td>212</td>
<td>212</td>
<td>207</td>
<td>203</td>
<td>202</td>
</tr>
<tr>
<td>Missing Obs</td>
<td>18</td>
<td>18</td>
<td>23</td>
<td>23</td>
<td>28</td>
</tr>
<tr>
<td>Wald Chi-Square</td>
<td>9.32</td>
<td>12.51</td>
<td>32.33</td>
<td>37.59</td>
<td>38.93</td>
</tr>
<tr>
<td></td>
<td>(p=0.0023)</td>
<td>(p=0.0019)</td>
<td>(p=0.0000)</td>
<td>(p=0.0000)</td>
<td>(p=0.0000)</td>
</tr>
<tr>
<td>Pseudo R²</td>
<td>0.036</td>
<td>0.0512</td>
<td>0.1741</td>
<td>0.2338</td>
<td>0.2469</td>
</tr>
</tbody>
</table>

Notes: *** p<0.01; ** p<0.05; * p<0.10. Calculations based upon calculations by using survey data from 2011 Maryland Survey of Dental Caries Prevention (Nurse Practitioners). Standard errors in parentheses.
X. References


