Increasing pneumococcal vaccination among adults 65 and older: the development and implementation of a pneumococcal vaccine administration and documentation protocol for a small primary care practice.

Marina M. Ecklund

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INCREASING PNEUMOCOCCAL VACCINATION AMONG ADULTS 65 AND OLDER: THE DEVELOPMENT AND IMPLEMENTATION OF A PNEUMOCOCCAL VACCINE ADMINISTRATION AND DOCUMENTATION PROTOCOL FOR A SMALL PRIMARY CARE PRACTICE.

A Project Presented

by

Marina Margaret Ecklund, RN

to

The Faculty of the Graduate College of
The University of Vermont

In Partial Fulfillment of the Requirements
for the Degree of Master of Science Specializing in Nursing

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Abstract:
This project focuses on the development of a protocol to increase administration and
documentation of pneumococcal vaccination among patient 65 years and older in a primary care
practice setting. The project entails reviewing immunization records of all patients age ≥ 65
years at Appletree Bay Primary Care (ABPC) practice to determine current pneumococcal
vaccination rates among the specified age group within the practice. A single trial vaccination
clinic was established in collaboration with the Vermont Family Pharmacy wherein patients
were contacted by phone by the primary investigator, informed that they may be due for one or
more pneumococcal vaccination and asked if they would like to schedule an appointment for that
vaccination. The pharmacy was responsible for ordering administering and billing for
vaccinations, while the practice was responsible for calling patients 65 and older in need of one
or more pneumococcal vaccinations. The pharmacy then reported all administered vaccines back
to ABPC. Data obtained will be analyzed to determine the effectiveness of this protocol in
increasing the rate of administration and documentation of pneumococcal vaccines in ABPC
patients 65 and older.

Keywords: Pneumococcal vaccination
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Chapter I: Introduction

A. Project purpose

The purpose of this project is to increase pneumococcal vaccination rates among patients 65 and older in a small, semi-independent Nurse Practitioner led patient focused medical home. There is a large body of research on the causes of poor adherence to adult vaccination recommendations in the U.S. and on strategies to improve adherence, in the form of practice based vaccination campaigns or toolkits, but little research has focused on the problem in the context of small practices for whom offering adult vaccinations is cost prohibitive. For such small practices, changes to Medicare billing and reimbursement have created a system whereby providing vaccination services to patients may result in a financial loss for the practice.

Pneumococcal disease is a common cause of illness and death in older adults, accounting for greater morbidity than any other vaccine-preventable bacterial disease (CDC, 1997). A 2016 representative cross-sectional study by Klett-Tammen, et al. found that invasive pneumococcal disease (IPD) outcomes are strongly associated with greater severity and fatality in older age (Klett-Tammen, et al., 2016). Pneumococcal pneumonia is the most common clinical presentation of pneumococcal disease in adults, with the CDC estimating approximately 900,000 cases and 400,000 hospitalizations in the United States annually (CDC, 2015). Further, mortality rates for community-acquired pneumonia among older adults are estimated as high as 30%, with certain subpopulations, such as nursing home residents, with rates as high as 57% (Janssen and Krause, 2004). The severity and burden of pneumonia among older adults is largely explained the increased occurrence of several risk factors, such as the increased incidence of comorbidities, especially those affecting the lung parenchyma or immune system, and the high rate of polypharmacy among this population (Jansssens and Krause, 2004).
While the morbidity and economic burden of pneumococcal illness among adults $\geq 65$ is well established, pneumococcal vaccination coverage among older adults was estimated at 61.3% in 2014 (Williams, et al, 2015). This figure is well below the HealthyPeople 2020 goal of 90% vaccination rate among this population. Further, despite the recommendation since 1997 that all adults $\geq 65$ years receive vaccination against pneumococcal disease and that pneumococcal vaccination is fully covered by Medicare Part B, more than a third of U.S. adults 65 years and older remain unvaccinated.

**Estimated proportion of U.S. adults $\geq 65$ who received pneumococcal vaccines 2010-2014, National Health Interview Survey, United States.**

<table>
<thead>
<tr>
<th>Pneumococcal vaccination rate among U.S. adults $\geq 65$</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
<th>2014</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>59.7</td>
<td>62.3</td>
<td>59.9</td>
<td>59.7</td>
<td>61.3</td>
</tr>
</tbody>
</table>

Un-weighted sample size (2010-2014): 34,640; Linear trend test p-value: 0.77 (Williams, et al., 2016).

In 2014, the Advisory Committee on Immunization Practices (ACIP) revised a previous 2012 routine adult vaccination recommendation to include the sequential administration of two pneumococcal vaccines: pneumococcal conjugate, Prevnar13® (PCV13) and polysaccharide vaccine Pneumonvax® (PPSV23), for all adults $\geq 65$ years (Chen, et al., 2014). The rationale behind the 2014 recommendation grew out of a preponderance of evidence both on the heavy disease burden of non-bacteremic pneumonia among older adults and recent evidence confirming the efficacy of PCV13 in the prevention of pneumococcal pneumonia among older adults (Pilishvili & Bennett, 2015). In response to these guidelines, Medicare Part B reimbursement began to allow for an initial pneumococcal vaccine for beneficiaries, then a second, and different, pneumococcal vaccine 12 months after administration of the first (CMS, 2014).

Despite these guideline changes, many small, independent/semi-independent primary care practices, have found that they are unable to offer vaccines to their patients due to the existence of financial barriers. Because of the financial commitment required in the purchase
and storage of vaccines, combined with the complicated billing structure and insufficient reimbursement, each vaccine administration represents a potential financial loss for these practices.

Implicit in this project are several concepts both at the core of Advance Practice Nursing and relevant to the current healthcare policy and finance reform debate: the reduction of overall healthcare costs by investing in preventative services and the impact of public policy on healthcare delivery. There is a plethora of evidence indicating that certain preventative services decrease morbidity and mortality, and thus act to decrease overall healthcare costs, and vaccination is one such instance. The role of vaccination in insuring population health and reducing overall healthcare costs is well known and accepted, yet despite this knowledge adult vaccination efforts lag far behind similar efforts aimed at pediatric vaccination and Healthy People 2020/ Healthy Vermonters 2020 goals (HHS, 2010).

**TABLE 1. HEALTHY PEOPLE OBJECTIVES SPECIFIC TO ADULT VACCINATION, 2013 COVERAGE AND 2020 TARGETS**

<table>
<thead>
<tr>
<th>Objective ID-12: Increase the percentage of children and adults who are vaccinated annually against seasonal influenza.</th>
<th>2013 Percentage</th>
<th>2020 Target Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adults age &gt; 18 years</td>
<td>30 (^1)</td>
<td>70</td>
</tr>
<tr>
<td>Health care personnel</td>
<td>62 (^2)</td>
<td>90</td>
</tr>
<tr>
<td>Pregnant women</td>
<td>52 (^3)</td>
<td>No target, in development</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Objective ID-13: Increase the percentage of adults who are vaccinated against pneumococcal disease.</th>
<th>2013 Percentage</th>
<th>2020 Target Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Noninstitutionalized adults age &gt; 65 years</td>
<td>60 (^4)</td>
<td>90</td>
</tr>
<tr>
<td>Noninstitutionalized high-risk adults age 18–64 years</td>
<td>21 (^5)</td>
<td>60</td>
</tr>
</tbody>
</table>

\(^1\) National Health Interview Survey, as reported by Healthy People 2020. \(^2\) National Health Interview Survey, as reported by Healthy People 2020. \(^3\) Ding (2014). \(^4\) The most recent published statistics are for the 2013–2014 influenza season; the estimate is from an internet panel survey. The study sample did not include women without internet access; results might not be generalizable to all pregnant women in the United States. Also, the estimate might be biased if the selection processes for entry into the internet panel and a woman’s decision to participate in this survey were related to receipt of vaccination. \(^5\) Healthy People 2020. \(^6\) National Health Interview Survey (2013). \(^7\) National Health Interview Survey (2013).
B. Rationale/support for importance of project

The overarching rationale for this project is the financial and quality of life benefits offered by increasing the rate of immunization against pneumococcal disease in adults ≥65, a population who remains at the highest risk for severe illness due to pneumococcal disease. There is an accumulation of evidence over the last decade on the cost effectiveness of vaccination against pneumococcal illness, this is largely due to the estimated 7 billion dollars annually associated with treatment of invasive pneumococcal disease (IPD) among patients ≥65 in the U.S. (Thomas, et al., 2012).

Rozenbaum, et al., in a 2015 study, found that the per capita incidence of severe pneumococcal illness among those ≥65 years was 881 per 100,000 individuals, while the overall average prevalence was 295 per 100,000 individuals (Rozenbaum, et al., 2015).

A further consideration is the role of pneumococcal vaccination in the reduction of antibiotic resistant S. pneumoniae strains. The CDC estimates that as many as 30% of cases of severe pneumococcal disease involve antimicrobial drug resistant bacteria, a fact which makes them both more difficult and more costly to treat (CDC, 2015). This is reflected in the data on
relative length of hospitalization for antibiotic resistant versus sensitive bacteremia strains, with the average length of stay for patients with penicillin-resistant bacteremia at 15.8 days compared to 12 days for those with penicillin-sensitive strains, representing a 32% longer stay for those with antimicrobial drug resistant strains (CDC, 2015).

The CDC’s Emerging Infections Programs (EIPs), the entity charged with the task of tracking pneumococcal disease epidemiology in the United States, has reported a dramatic decline in pneumococcal disease since surveillance began in the 1990s. This decline is largely due to the introduction of conjugate vaccines, PCV7 and PCV13, to U.S. childhood and adult vaccine schedules (Moore & Whitney, 2015). Additional and more troubling findings of EIPs include the continued rise of antimicrobial drug resistant disease strains in response to inappropriate antibiotic use and alterations in the prevalence of disease serotypes in response to widespread vaccination, with the observed increased prevalence of serotypes not included in current vaccine formulations (Moore & Whitney, 2015). These findings act to remind us that disease prevention and treatment is a dynamic rather than static process, and one that requires constant observation and response.

Though difficult to accurately quantify, conservative estimates suggest more than a million cases of pneumococcal pneumonia annually in the U.S., with mortality occurring in 5-7% of cases, the highest mortality rates being among adults ≥65. Invasive pneumococcal disease (IPD) which includes meningitis and bacteremia, or sepsis, is far less prevalent than pneumococcal pneumonia but carries a mortality rate over 20-25% in those ≥65 years. Further, pneumococcal meningitis results in death in one third of infected individuals, with those who survive often suffering serious, chronic manifestations of the disease. While mortality rates for pneumococcal bacteremia are lower, in the range of 20% of those affected, treatment of
pneumococcal bacteraemia often requires an extended period of hospitalization and ongoing treatment following acute hospitalization.

Ozawa, et al. estimate the economic burden associated with the treatment of the sequelae related to pneumococcal meningitis over a lifetime to be approximately $57.3 million (Ozawa, et al., 2016). Further, Ozawa et al. estimated that the total economic burden from all vaccine-preventable diseases was approximately $9 billion in 2015, with a plausibility range of $4.7–$15.2 billion. They further estimate that unvaccinated individuals are responsible for nearly 80%, or $7.1 billion, of those costs (Ozawa, et al., 2016).

A 2010 study by Weycker, et al. estimated the overall direct economic burden of pneumococcal disease among US adults aged ≥50 years to be $3.7 billion with an additional cost
of $1.8 billion in indirect costs related to wage and productivity losses attributed to the large proportion of those $\geq 50$ years active in the workforce (Weycker, et al, 2010). A 2012 study by Thomas, Ryan, et al. conservatively estimated the annual cost of pneumococcal pneumonia requiring hospitalization at $> 7$ billion among Medicare beneficiaries age $\geq 65$ (Thomas, Ryan, et al., 2012). They calculated the age-adjusted annual cumulative incidence to be 47.4 per 1,000 among Medicare beneficiaries, with those requiring hospitalization costing an additional $15,682 in treatment costs in the year following hospitalization (Thomas, Ryan, et al., 2012).

**Efficacy of Vaccines in the Prevention of IPD**

The above graph illustrates the impact of the introduction of pneumococcal vaccine on the incidence of invasive pneumococcal disease (IPD) among U.S. adults $\geq 65$ years from 1998-2015. The overall IPD incidence declined from 59 cases per 100,000 in 1998 to 23 cases per
100,000 in 2015. IPD caused by serotypes included in the PPSV23 vaccine declined from 51 cases per 100,000 in 1998 to 13 cases per 100,000 in 2015, while IPD serotypes covered by the PCV13 vaccine declined from 44 cases per 100,000 in 1998 to 5 cases per 100,000 in 2015 (CDC, 2017).

Stoecker, et al. reported that the addition of one dose of PCV13 to the vaccine schedule for a cohort of adults ≥65 years amounted to $62,065 per quality-adjusted life year gained. A figure which rose to $272,621 per year after 6 years due to projected herd protection offered by adding a dose of PCV13 to the adult vaccine schedule (Stoecker, et al, 2016).

C. Relationship to advanced nursing practice

The purpose and execution of this project encompasses many of the Advance Practice Nursing core competencies including those of Scientific Foundation, Quality Improvement, Practice Inquiry, Technology and Information Literacy, Policy and Health Delivery System Competencies.

This project employed Scientific Foundation and Quality and Practice Inquiry Competencies by developing new practice protocols directly rooted in the integration of theory, research and practice. While time consuming, the process of developing this project resulted from a critical assessment of overall practice and patient population needs, the analysis of practice specific data and research into current evidence based strategies, developed to improve clinical practice and patient outcomes. Research on the larger financial and public health implications of the problem of low vaccination rates, current evidence based tools and strategies aimed at improving vaccination rates, the specific barriers faced by small, independent practices all with the goal of improving the efficacy and cost effectiveness of clinical practice and
increasing the delivery of services to a high risk patient population thereby improving patient outcomes.

Implicit in this project is the examination of the direct impact of public policy and finance decisions on the delivery of services and quality of patient care, as such, an understanding of the complex interdependence of policy decisions and clinical practice demonstrates achievement of Policy Competencies. Similarly, Health Delivery System Competencies are demonstrated in the exploration of the larger context and existing resources to improve the delivery of care to patients of the practice.

D. Contribution the project will have on intended recipient and anticipated benefits which may result from project completion.

The most significant contribution this project will accomplish is increasing the number of ABPC patients ≥ 65 who receive the recommended pneumococcal vaccines, thereby increasing the relative health and quality of life of those patients and decreasing overall mortality and healthcare costs. The additional benefit in achieving this end, is to offer ABPC a practical and cost neutral solution to achieving more widespread vaccination among this patient population. By achieving this end, this project would add to current the body of research on practical methods of increasing vaccination rates among older adults and, more specifically, doing so in a way that is cost effective for small, independent practices.
Chapter II: Review of Literature

A. Context for proposed project

As outlined above, the evidence supporting the efficacy of vaccines, as well as the cost effectiveness of vaccination against pneumococcal illness is undeniable, yet current pneumococcal vaccination rates among adults ≥65 years are well below the goal set in Healthy People 2020. Much research has focused on increasing vaccination rates through the development of immunization campaigns or “toolkits”, many of them with great success. While there is discussion of the financial burden on practices associated with offering vaccination services, there is little in the existing literature as far as solutions for increasing vaccination rates in small, independent primary care practices who cannot afford to offer vaccination. For such practices, the potential financial losses associated with stocking and administering vaccines are prohibitive and, as such, patients of these practice often go without recommended vaccines.

<table>
<thead>
<tr>
<th>Vaccine/ Tradename/ HCPCS Code</th>
<th>Dose/ Pack</th>
<th>CDC Contract** cost/ dose</th>
<th>Private sector cost/ dose</th>
<th>Medicare B 2017 reimbursement***</th>
<th>Manufacturer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prevnar 13™ Pneumococcal 13-valent 0.5mL/ IM 90670*</td>
<td>10 pk single dose syringes</td>
<td>$96.56</td>
<td>$169.11</td>
<td>$192.64</td>
<td>Pfizer</td>
</tr>
<tr>
<td>Pneumovax®23 (Polysaccharide-23 Valent) 0.5mL/ SQ/ IM 90670*</td>
<td>10 pk single dose syringes or vials</td>
<td>$26.15</td>
<td>$86.71</td>
<td>$98.85</td>
<td>Merck</td>
</tr>
</tbody>
</table>

*Practices are also reimbursed separately for administration of the vaccine: Administration Code: G0009, Diagnosis Code: Z23

**Contract prices are available to programs that receive CDC immunization grant funds (eg. state health departments, some urban immunization projects, etc.) and private providers cannot directly purchase vaccines through CDC contracts.

*** Medicare Part B payment allowance limits for covered vaccines are 95% of the Average Wholesale Price (AWP) as established by the compendia, from prices reported to the CDC by vaccine manufacturers annually.
As is evident from the above table, practices are in a position of an initial cash outlay of $1691.10 for 10 vaccines, assuming vaccines are purchased at the stated CDC cost. If the practice were able to administer and bill for all those doses prior to the expiration date they would receive $1926.40 in reimbursements, plus reimbursement for the administration. However, in the event that they did not administer those vaccines before expiration, or if some or all doses perished due to power outage or equipment failure, then the practice would simply lose that portion of their investment and for many small, independent practices operating on very tight margins, this is a substantial loss.

Furthermore, calculating the total cost of administering vaccines must include provider/staff time required for counselling, administration, inventory management and documentation, equipment costs associated with vaccine storage and opportunity costs of purchasing and storing vaccines. These costs considered against the reimbursement received for administered vaccines often amounts to a net loss for many small, independent adult practices.

<table>
<thead>
<tr>
<th>Costs associated with vaccine administration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vaccine purchase</td>
</tr>
<tr>
<td>Ordering, tracking inventory and establishing payment terms</td>
</tr>
<tr>
<td>Capital required for purchase</td>
</tr>
<tr>
<td>Supplies: sharps, syringes, gloves, alcohol pads, VIS handouts, etc.</td>
</tr>
<tr>
<td>Opportunity cost in having resources tied up in vaccine inventory</td>
</tr>
<tr>
<td>Vaccine storage</td>
</tr>
<tr>
<td>Refrigerator/freezer</td>
</tr>
<tr>
<td>Temperature monitoring devices</td>
</tr>
<tr>
<td>Time/ labor required for temperature monitoring and recording</td>
</tr>
<tr>
<td>Backup power or storage plan in case of power failure</td>
</tr>
<tr>
<td>Insurance costs for coverage of vaccine inventory</td>
</tr>
<tr>
<td>Vaccine administration</td>
</tr>
<tr>
<td>Time/ labor required for: verification of vaccine status, patient education, time involved in vaccine administration and documentation</td>
</tr>
<tr>
<td>Labor costs to order, track, and maintain supply</td>
</tr>
<tr>
<td>Training required for ordering, storing, assessing, administering, billing and coding of vaccines.</td>
</tr>
<tr>
<td>Billing and coding across various public and private payors</td>
</tr>
</tbody>
</table>
Patients of practices that do not offer vaccines must exercise initiative by seeking vaccination services from external vaccinators such as retail pharmacies, or other institutions, and, not surprisingly, patients of these practices are vaccinated at significantly lower rates than those of practices offering in house vaccination. Changes to state laws allowing for pharmacist administered immunization offers a viable solution for small primary care practices struggling to provide vaccination services, yet there are certain obstacles inherent in this model of vaccine delivery. Chief among these obstacles is the issue of documentation: these immunizations are very often not reported back to the patient’s Primary Care office and subsequently are never entered into that patient’s Electronic Medical Record (EHR). The frequent occurrence of pharmacies’ failure to document vaccinations, combined with other factors, like that of healthcare received outside the state, due to the maintenance of dual residences, providers often lack an accurate record of patients’ immunization history.

The problem of undocumented vaccinations makes it difficult for practices to determine which patients have had what vaccines and when, a problem that is especially troubling when approaching pneumococcal vaccines, given the complicated nature of the pneumococcal vaccine schedule and the specificity of payor reimbursement rules. While a second dose of the same vaccine is not harmful to the patient, it’s likely that this re-vaccination will not be reimbursed by Medicare or other payors, so in such cases, the medical practice would absorb the cost of this

<table>
<thead>
<tr>
<th>Challenges in purchasing adult vaccines</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Newer vaccines, like PCV13 are substantially more expensive than older vaccines</td>
</tr>
<tr>
<td>• Pricing variation: small practices can pay over 3 times the price of other, larger organizations due to lower negotiated, often confidential, prices</td>
</tr>
<tr>
<td>• No federal vaccine purchase program exists for adults ≥ 65.</td>
</tr>
<tr>
<td>• Adult vaccine providers have smaller economies of scale than pediatric providers</td>
</tr>
</tbody>
</table>
second vaccination.

**B. Current research: major themes, discussion and critique of the literature:**

**Vaccine efficacy and Cost effectiveness of vaccination:**

While multiple studies have demonstrated PPV23’s efficacy in protecting patients against invasive pneumococcal disease, with studies showing PPSV23 to be 50–85% effective in preventing IPD in healthy adults, conflicting data exists as far as its efficacy in preventing pneumococcal pneumonia (CDC, 2015). Recent studies have found that the influence of PPV23 on community acquired pneumonia (CAP) could be contingent on the amount of time since the vaccination and could be more protective in subsets of older patients who are moderately ill or >65 years (Aliberti, et al., 2014). Rodriguez, et al., in a 2016 study, found that 74% of the serotypes associated with bacteremic disease were included in PVC13, and 83% of the serotypes were included in PPV23 (Rodriguez, et al., 2016).

Polysaccharide vaccines (PPVs) contain purified and slightly modified capsular polysaccharide antigens, because of this they are only able to elicit a T-cell independent immune response. Alternately, the capsular polysaccharides in conjugate vaccines (PCVs) are conjugated with a carrier protein, for example, PCV13 serotypes are conjugated to a nontoxic mutant of diphtheria toxin (Principi & Esposito, 2016). By introducing more complex antigens, PCVs produce a T-cell dependent immune response, which also produces mucosal immunity and suppresses colonization (Aliberti, et al., 2014). A conjugate vaccine is generally expected to have benefits over a polysaccharide vaccine due to its ability to elicit a T-cell-dependent response in terms of affinity, maturation of antibodies with repeated exposure, induction of immunological memory and long-lasting immunity (Aliberti, et al., 2014). Thus, the bulk of research comparing the immunogenicity of the two vaccines has shown that PCVs have higher humoral
immunogenicity and induce a stronger cell-mediated immunity (Principi & Esposito, 2016).

A 2016 study demonstrates the efficacy of the pneumococcal conjugate vaccines, like PCV13, by examining the impact of PCV7 uptake in the pediatric population on the prevalence of the pneumococcal serotypes targeted by that vaccine in the local adult population (Pingali, et al., 2016). Pingali, et al. found an inverse correlation between the prevalence of pneumococcal serotypes included in PCV7 in adults and vaccination with PCV7 among the pediatric population (Pingali, et al., 2016).

Since the FDA licensed PCV13 for use among adults ≥50 in 2011, the incidence of invasive pneumococcal disease (IPD) has declined by 12-32%, with IPD caused by strains included in PCV13 declined by 58-72% among adults (Moore et al., 2015). Further, it is estimated that over 30,000 cases of IPD and more than 3,000 deaths were prevented in the three years following the introduction of PCV13 into the adult vaccination schedule (Moore et al., 2015).

<table>
<thead>
<tr>
<th>VACCINE</th>
<th>SEROTYPES</th>
<th>YEAR INTRODUCED</th>
<th>RECOMMENDATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>23-valent pneumococcal polysaccharide* vaccine Pneumovax23® (PPSV23)</td>
<td>1, 2, 3, 4, 5, 6B, 7F, 8, 9N, 9V, 10A, 11A, 12F, 14, 15B, 17F, 18C, 19A, 19F, 20, 22F, 23F, and 33F</td>
<td>1984</td>
<td>• Adults ≥65 years  • Individuals ≥2 years w/ chronic illnesses</td>
</tr>
<tr>
<td>Pneumococcal 13-valent conjugate** vaccine Prevnar13® (PCV13)</td>
<td>1, 3, 4, 5, 6A, 6B, 7F, 9V, 14, 18C, 19A, 19F, and 23F</td>
<td>2010</td>
<td>• Children &lt;5 years old</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2012</td>
<td>• Immunocompromised Adults ≥19 years</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2014</td>
<td>• Adults ≥65 years</td>
</tr>
<tr>
<td>Pneumococcal 7-valent conjugate vaccine (PCV7)</td>
<td>4, 6B, 9V, 14, 18C, 19F, and 23F</td>
<td>2000</td>
<td>• Children &lt;5 years old</td>
</tr>
</tbody>
</table>

* Polysaccharide vaccines are made up of sub-units of polysaccharides from the cell wall of targeted bacteria.
** Conjugate vaccines contain cell walls polysaccharides from targeted bacteria, chemically linked to protein sub-units. This changes the immune response from T-cell independent to T-cell dependent, resulting in increased immunogenicity and making them more potent vaccines.

**Provider Barriers to Vaccination:**
Among the most prominent themes in current research surrounding adult vaccination is the topic of “barriers” to widespread immunization of adults, especially in comparison to the undeniable successes of childhood immunization campaigns. Factors considered barriers by providers include complexities of billing and inadequate reimbursement for vaccination by public and private insurers, limited funding for vaccination of uninsured adults, costs associated with purchasing and maintaining vaccine stock, time constraints presented by the number of preventative services and health screening recommendations for adults at healthcare visits and limited awareness among the public about adult vaccinations (Bridges, et al, 2015).

In a 2016 study, researchers Hurley, et al. found that, while 80% of providers surveyed considered pneumococcal vaccine as “very important” for a hypothetical patient 67-year-old, they report the existence of barriers to vaccinating adults that limit their ability to provide vaccines to their patients (Hurley, et al., 2016). Hurley, et al. identified a number of problems and barriers relating to the delivery of adult vaccines in the primary care setting: inconsistent assessment of vaccination status, failure to stock recommended vaccines, inadequate insurance reimbursement of vaccine administration, the financial burden of presented by up-front purchasing of vaccines, and the inconsistent nature of communication and documentation of immunizations administered by outside vaccinators (Hurley, et al., 2014). Another study by Bridges, et al. noted that providers consistently cited the prohibitive cost of providing vaccination services, inadequate or inconsistent payment for vaccine services and acute medical care taking precedence over preventive services as the greatest barriers to vaccination (Bridges, et al, 2015).

A 2012 survey of primary care providers reported the most cited barriers to vaccination were financial in nature, including lack of adequate reimbursement, difficulty determining
insurance coverage for vaccination and the upfront costs associated with purchasing vaccines (Bridges, et al, 2015). Hurley, et al. also cite the financial risk associated with the outlay of resources required to stock vaccines in the primary care setting and the potential loss due to the perishable nature of vaccines (Hurley, et al, 2014). Reimbursement issues are a consistently noted barrier for providers with the complexities in billing and insurance coverage for vaccines (Bridges, et al, 2015).

Hurley, et al. found that providers in small, private practices were particularly affected by financial barriers and were shown to assume greater financial risk in stocking expensive vaccines (Hurley, et al., 2014). Practices reporting greater financial barriers shared several common characteristics: a private practice status, having fewer than 5 providers and having a high proportion of patients with Medicare Part D. Further, they found regional differences with providers in the South, Midwest and family practitioners in the Western U.S. reporting increased financial barriers to providing immunization services (Hurley, et al., 2014).

A substantial barrier reported by providers was time constraints due to the time burden posed by acute patient care and the existence of other preventative care they perceive as taking precedence over vaccination services, with providers noting the time consuming nature of vaccination services not the least of which is the time required for regular assessment of patient immunization status (Hurley, et al, 2014). However, despite stated scarcity of time, the majority of providers included in the study still believed it was the primary care provider’s responsibility to ensure their patients receive recommended vaccinations (Hurley, et al., 2014). Further, Hurley, et al. found that Medicare preventive visits, which provide an ideal opportunity for the delivery of vaccination and other preventive services, remained largely underutilized (Hurley, et al., 2016).
Patient Barriers to Vaccination:

Patients consistently report not receiving vaccine recommendations at provider visits, and this is despite the well established evidence showing receipt of a provider recommendation is a key predictor of vaccination. A 2008 study Johnson, et al. found that 79-85% of adult patients stated they were likely to receive a vaccination if their healthcare provider recommended it (Johnson, et al., 2008). A 2010 survey of consumers and providers conducted by the National Foundation for Infectious Diseases found that 88% of consumers reported that a strong recommendation from their physician would increase the likelihood of receiving a vaccination (Bridges, et al, 2015). A Canadian study examining the fact that fewer adults ≥65 years received pneumococcal vaccines than receive annual influenza vaccines found that being offered the vaccine by a health care provider had the strongest correlation with a patient receiving a vaccine (Schneeberg, et al., 2014). Similarly, an international meta-analysis by Kohlhammer, et al. found that provider recommendation played a central role in predicting pneumococcal vaccination, noting that the primary reason for not being vaccinated was “lack of information” (Kohlhammer, et al., 2007). While 87% of providers surveyed reported discussing vaccines with their patients, only 47% of patients recalled discussing vaccines, other than seasonal influenza vaccine with their provider (Bridges, et al, 2015).

Lack of patient knowledge or awareness of adult vaccination recommendations is another consistently cited factor impacting adult vaccination. A 2006 consumer survey found that 82% of consumers believed it was important to keep up with immunizations but among the most often cited reasons patients did not seek vaccination was the belief that vaccination was unnecessary or not indicated for healthy adults (Bridges, et al, 2015).

A 2014 study by Sabapathy, et al. found that 44% of the 53,249 unvaccinated older
adults studied had at least one acute care visit over a one year period (Sabapathy, et al., 2014). This number is significant in that it represents opportunities for immunization for patients that may not engage in regular health maintenance.

**Immunization Toolkits**

Despite these challenges, a number of systems level interventions have been demonstrated to substantially improve adult vaccine rates in the primary care setting. Critical to the success of such programs is routine assessment of patients’ vaccination status during all clinical encounters and ensuring patients either receive the recommend vaccines on site, or are referred for to outside sources for vaccine administration (Bridges, et al, 2015).

A 2014 study by Turner, et al. developed a multifaceted, nurse led intervention program to address knowledge deficits and increase vaccination rates. These interventions consisted of incorporating standing protocol vaccine orders, educating nurses on current ACIP guidelines with weekly in-service trainings, creation of a script for nurses to aid them in discussing the importance and benefits of immunizations, displayed of educational posters within the practice and created a vaccine reminder system (Turner, et al, 2014). In identifying barriers within individual practices and formulating strategies to address those barriers, this study recognized the critical role of nurses in increasing vaccination rates through patient education and incorporating vaccine tracking and administration into the flow of routine clinical care (Turner, et al, 2014).

Norwalk, et al. developed the 4 Pillar Toolkit, a system designed to encourage vaccination uptake in the primary care setting. Like Turner’s and several other vaccination strategies, the 4 Pillar Toolkit employs a standing order program (SOP), which is a blanket document empowering non-provider staff to assess immunization status and administer vaccines without an individual order from a provider. A number of other elements are commonly featured
in primary care immunization toolkits, including a systems level intervention which incorporates vaccination into the standard workflow, staff education around current ACIP guidelines and the importance of vaccination in disease prevention, creation of a patient education/ awareness campaign and the creation of provider/ staff and patients reminder systems (HHS, 2016).

A 2015 Lebanese study conducted by Ghadieh, et al., compared the impact of several reminder methods, both with and without patient education, on pneumococcal immunization rates in the primary care setting. Authors compared a short phone call, a short text message or an email, each with and without patient education and analyzed the relative efficacy of each system. Ghadieh, et al. found that the short phone call method yielded a 16.5% response rate, while a short sms-text produced a 7.2% increase in vaccination and the e-mail method was associated with a 5.7% increase. Researchers also found that there was no statistically significant difference between those who received patient education and those who did not. Given the time and staff resources required to execute reminder phone calls, researchers concluded the both sms-text and e-mail reminders provided a feasible and sustainable model to increase pneumococcal vaccination rates in a primary care setting (Ghadieh, et al., 2015).

A 2015 article in AAFP addresses the financial considerations for primary care practices around providing recommended vaccinations and offers suggestions to improve the financial viability of providing these vaccines. The author’s small practice, including three physicians and two nurse practitioners, has achieved steady revenue from immunizations (Loehr, 2015). This was achieved by systematically comparing prices and purchasing vaccines at the lowest available cost, often directly from pharmaceuticals is essential for increasing profitability. Additionally, thorough and appropriate coding for vaccination services results in maximum reimbursement, this includes billing for the vaccine itself, each immunization administration, and includes a
Vaccine Documentation:

A 2011 study conducted by Hurley, et al. found that 79% of providers had concerns about the time and effort required in referring patients to outside vaccinators and expressed concern over what they deemed inadequate documentation by external vaccinators (Hurley, et al., 2011). Further, many providers included the Hurley, et al. study described communication between the primary care office and alternate vaccinators as “suboptimal”, with 48% of family medicine physicians reporting that it was “moderately/very difficult” to determine an adult patient’s vaccination status other than that of seasonal influenza vaccinations (Hurley, et al., 2014).

Rolnick, et al. sought to perform a comprehensive assessment of the validity of self-reported adult vaccination status for the eight most common adult vaccines by comparing vaccines patients recalled having received and compared that information to the patients electronic health record (EHR) (Rolnick, et al., 2013). Variation was found across vaccines and Nowhere is poor patient recall and inadequate immunization record keeping more pertinent than when considering pneumococcal vaccines given the complex, multi-variant guidelines around the timing, sequence and interval between vaccine administrations (Rolnick, et al., 2013).

State Immunization Registries:

State immunization registries, which, in theory collect and consolidate vaccination data from multiple health care providers, external and community vaccinators in a central database are another critical tool for increasing adult vaccination. State immunization registries are potentially a valuable resource to overcoming communication barriers between primary care and external or community vaccinators. The ability to access collective vaccination information via state registries acts to prevent unnecessary vaccination, billing and reimbursement problems and
helps to avoid missed opportunities for vaccination (CDC, 2011).

Created to overcome the problem of lack of documentation, state registries, including the Vermont Immunization Registry, attempt to capture undocumented vaccinations by mandating the reporting of all vaccinations administered in the state to a central Department of Health managed registry. However, despite the presence of a state law requiring pharmacies to report all vaccinations administered to the Vermont Immunization Registry, as of August 2016 only 34% of pharmacies in Vermont were sending immunization data to the IMR, though it is important to note that not all pharmacies in Vermont administer vaccines (VDH, 2016). Further, pharmacies that report to the IMR do so in monthly batch files, as a result, this data may take as long as 30 days to propagate in the IMR (VDH, 2016).

Recent research by Stockwell, et al. focused on the implementation of bidirectional information sharing between EHRs and immunization registries and its impact on immunization coverage (Stockwell, et al., 2016). Researchers found the implementation of bidirectional information sharing lead to significant improvements in pediatric immunization coverage, a reduction in over-immunization for adolescents, a decrease from 8.8% to 4.7% and increased accurate documentation of immunizations from 75% to 81.6% (Stockwell, et al., 2016).

Wilson, et al., point out the limitations of state registries in the context of an increasingly itinerant population, suggesting that mobile technologies may help to mitigate some of the challenges multiple state registries present, though they do so with a set of problems of their own including privacy of data, access, and equity (Wilson, et al., 2017).

**Role of Pharmacies in Vaccine Administration:**

A 2016 Vermont Department of Health brief acknowledges that changes to state law and Medicare reimbursements have made pharmacies key players in increasing access to adult
vaccines in Vermont with 14,305 pharmacist administered immunizations reported to the IMR between July 2015 and June 2016 (VDH, 2016). However, likely due several factors, only 7% of all Pneumococcal vaccines reported to the registry are given in the pharmacy setting, compared to 12% of Herpes Zoster vaccines (VDH, 2016).

A recent study by McConeghdy and Wing found that while changes to state laws allowing pharmacists to administer vaccines resulted in a six-fold increase in the number of pharmacist administered influenza vaccinations, this increase did not correspond to a significant increase in the overall number of adult vaccinations administered (McConeghdy & Wing, 2016). This research suggests that those who seek vaccination services from pharmacists would likely have been vaccinated anyway, thus the value of pharmacy based vaccination rests in providing a convenient and flexible method of obtaining these services but not in expanding vaccination to those previously not inclined to seek them (McConeghdy & Wing, 2016).

Singhal, et al sought to determine whether the direct medical costs paid for adult
vaccination differ depending on the setting, focusing on costs paid in an inpatient/outpatient medical setting versus those paid in the pharmacy setting (Singhal, et al., 2014). Costs included in this analysis by Singhal, et al. considered the cost of the vaccine itself, vaccine administration and, if applicable, a dispensing fee or charge for the office visit. Singhal, et al. found the average direct costs paid per adult vaccination were 16%-26% higher in the primary care setting and 11%-20% higher in alternate inpatient or outpatient medical settings compared to vaccines administered in the pharmacy setting (Singhal, et al., 2014).

There is little or no available research on the feasibility of small, understaffed primary care practices offering adult vaccination services or on the problem of low vaccination rates in practices who do not offer vaccination services. The value in this project is that it requires no cash outlay for a practice, very little time for office staff, no cost to patients and makes use of an existing resource by utilizing pharmacies offering vaccination services. If this protocol proves effective it will allow more patients to be vaccinated, those vaccinations will be documented and little or no capital will be required for it’s launch.
Chapter III: Method

A. Procedures and/or process involved in project completion

In 2014 the National Vaccine Advisory Committee released updated guidelines for Adult Immunization Practice, which was based on the accumulation of evidence on common barriers to adult vaccination and strategies proven effective for increasing adult vaccination rates (National Vaccine Advisory Committee, 2014). The NCIP’s “Standards for Immunization Practices” recommends that all healthcare providers routinely assess patients vaccination status during every clinical encounter, strongly recommend indicated vaccines, offer vaccinations at the same visit or, if the vaccine is not offered by the provider, refer the patient to outside vaccinator, and finally, that vaccinations are documented in state registry systems when available (National Vaccine Advisory Committee, 2014).

Based on these guidelines, first a protocol was developed for use at ABPC and later a vaccination clinic was established with the goal of increasing vaccination among patients ≥65.

This project involves assessing the pneumococcal vaccination status of each ABPC patient ≥65, those patients ≥65 with an appointment scheduled on days designated for this intervention will be approached by the primary investigator and asked to verify their vaccination history.

This project is intended to assess vaccination status of ABPC patient ≥65 and, if vaccination is indicated, provide them with a written recommendation to seek vaccination from an external vaccinator or pharmacy. Those patients ≥65 with an appointment scheduled on days designated for this intervention will be asked to verify their vaccination history. Patients will be educated about current pneumococcal vaccination recommendations and asked if, where and when they may have received a pneumococcal vaccination outside the practice/ UVM Medical
Center. If patient reports an unrecorded vaccination, the investigator will then call the pharmacy or institution to verify vaccine type and administration date, and his/her EHR will be updated to reflect an accurate vaccine history. For those patients who need additional vaccinations, the investigator will determine the proper PNU vaccine schedule for that patient and a verified “vaccination order” will be furnished to the provider to dispense to the patient. This form will direct patients to present this form to any pharmacy offering Prevnar13®/Pneumovax23® for vaccination.

As a necessary component of the project a list of all ABPC patients ≥ 65, their vaccination history and the recommended vaccine schedule based information currently recorded in PRISM was compiled. This data was recorded in an excel spreadsheet.
The rationale for these methods is to catch vaccinations that patients have had which are not recorded in PRISM. So, while not always an accurate representation of the patient’s vaccination history, the information reflects what is recorded the patient’s EHR, and allows a method to catch and correct inaccuracies in documentation and insure that each patient has both the recommended PNU vaccines. Similarly, while external vaccinations do not require an order/or provider signature, this form was developed to serve the dual purpose of acting as a formal “provider recommendation” of the specified vaccination and to serve as documentation of vaccination by outside vaccinators, given the problem of insufficient documentation of pharmacy administered vaccines which are rarely documented in a patient’s medical record.

Outcomes were evaluated by collecting all responses received, including vaccine documentation forms submitted by external vaccinators, forms reporting previous pneumococcal vaccine administration. The number of completed and returned vaccination forms, number of forms documenting previous vaccinations and number of incomplete/unreturned forms will be assessed in relation to the number of patients ≥ 65 seen over the 10 days of the intervention. The
reasons for incomplete forms will be examined for common themes and provider/staff feedback will be used to explore ways in which the process might be streamlined or the efficiency of the system.

Vaccination clinic outcomes were measured and analyzed based on the number of patients contacted, the type of contact and the response to contact. Overall response rates will be calculated for each subcategory of patient contact type.
Chapter IV: Evaluation and Discussion

A. Achievement of project objectives reflect results of evaluation

In the final phases of this project, an alliance was developed between the practice and a local independent pharmacy with the goal of vaccinating ABPC patients 65 and older. A single trial vaccination clinic was established in collaboration with the Vermont Family Pharmacy wherein patients were contacted by phone by the primary investigator, informed that they may be due for one or more pneumococcal vaccination and asked if they would like to schedule an appointment for that vaccination. The pharmacy was responsible for ordering administering and billing for vaccinations, while the practice was responsible for calling patients 65 and older in need of a pneumococcal vaccination. The pharmacy then reported all administered vaccines back to ABPC. There was no release of protected health information and the Vermont Family Pharmacy only had access to the names and phone numbers of those who consented to scheduling an appointment at the vaccination clinic.

Patients targeted for the initial pneumococcal vaccine clinic were unvaccinated patients at highest risk for pneumococcal disease, including those with a diagnosis of chronic obstructive pulmonary disease (COPD), asthma or those documented as current cigarette smokers.

Patients were called by the primary investigator and given a brief summary of pneumococcal vaccination recommendations and asked if they would like to schedule an appointment to receive the needed vaccination. Those patients wishing to receive vaccination were scheduled on a single afternoon in July in 10 minute increments. Patients were asked what type of insurance they had and their mailing address was verified so that a brief vaccination screening questionnaire and consent form could be mailed to their home, which was to be returned at the time of vaccination.
A non-specific message was left for those patients who did not answer the call from the primary investigator. The message was as follows:

“This is Marina Ecklund calling from Appletree Bay Primary Care for ________. I am calling because our records show you may be due for one or more pneumococcal vaccinations. ABPC, in conjunction with Vermont Family Pharmacy, is offering a pneumococcal vaccination clinic on July 13 from 1:30-5 PM. This vaccination is fully covered by Medicare and most private insurance, with no out of pocket cost to patients. If you would like to schedule an appointment for a vaccine, or already received a vaccine that we do not have record of, please call her office back at 863 1313. Thank you.”

Those patients reached by phone were asked for by first name, I then identified myself and stated I was calling on behalf of Appletree Bay Primary Care, patients were then asked to verify their name and date of birth. After the patient identity was verified, the patient was told that according to ABPC’s records, he or she was due for one or more pneumococcal vaccines. There was a brief educational intervention whereby patients were informed current guidelines around pneumococcal vaccination for patients 65 and older, as well as, the risks associated with pneumococcal illness in older adults with certain respiratory conditions. Patients were then informed of the past pneumococcal vaccinations Appletree Bay Primary Care had on file for them and asked if they had any pneumococcal vaccine administrations that remained unrecorded. If patient had no previous unrecorded vaccinations they were asked if they would like to schedule an appointment on the specified day to receive the recommended vaccine. If patients agreed, an appointment was scheduled to receive specified vaccine at Vermont Family Pharmacy, their insurance was verified as was the mailing address where they wished to receive
the screening and consent form used by Vermont Family Pharmacy.

Along with the consent form the patient was also sent a form letter with appointment details, directions for appointment cancellation and contact information for Appletree Bay Primary Care. Letters were then mailed to scheduled patients at the expense of the primary investigator. All calls were logged as “Immunization Outreach” in the patient’s EHR and notes detailing the contact were recorded by the primary investigator.

Of those patients contacted the majority had a positive response to the call and were willing to schedule an appointment at the vaccination clinic. Of all the patients contacted, only one reported he was opposed to immunization and did not wish to be contacted in future vaccination outreach endeavors. It was discovered that those reached by phone at the time of initial contact were much more likely to schedule an appointment than those patients who failed to answer and instead received a message with vaccination clinic information. These patients were much less likely to call back and schedule an appointment. This may represent a confounding factor in that those who answer the phone, rather than letting the call go to voicemail may also be more likely to be proactive about their healthcare.

<table>
<thead>
<tr>
<th>Nature of telephone contact</th>
<th>Patient Response</th>
<th>Proportion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spoke to patient</td>
<td>Patient stated they preferred to seek recommended vaccination at a more convenient time or pharmacy</td>
<td>36% (5/14)</td>
</tr>
<tr>
<td>Spoke to patient</td>
<td>Patient scheduled an appointment for recommended vaccination at VFP/ ABPC clinic</td>
<td>57% (8/14)</td>
</tr>
<tr>
<td>Spoke to patient</td>
<td>Patient agreed to receive recommended vaccination at VFP/ ABPC clinic or another time or pharmacy</td>
<td>78% (11/14)</td>
</tr>
<tr>
<td>Left message for patient</td>
<td>Patient called back to schedule vaccination</td>
<td>21% (3/14)</td>
</tr>
<tr>
<td>Left message for patient</td>
<td>Patient did not call back or schedule vaccination</td>
<td>79% (11/14)</td>
</tr>
<tr>
<td>Spoke to patient or left message for patient</td>
<td>Patients contacted who scheduled an appointment for recommended vaccination at VFP/ ABPC Clinic</td>
<td>40% (10/28)</td>
</tr>
</tbody>
</table>
Among patients who were reached and spoke directly to the primary investigator by telephone, 78% agreed to either schedule an appointment or stated they would seek vaccination services at another time or pharmacy. Overall, 40% of those contacted received the recommended vaccination either at the vaccination clinic or at another time or pharmacy. Of those patients reached by phone and spoke directly to the primary investigator 57% agreed to schedule an appointment for the clinic, while only 21% among those who failed to answer but instead, received a message stating that they may be due for a recommended vaccination, informing them of the clinic and asking them to call ABPC to schedule an appointment responded and scheduled an appointment. Two patients reported previous unrecorded vaccinations and 7 patients stated they wished to be vaccinated at another, more convenient, time or pharmacy. Of those reached by phone who did not schedule appointments at the vaccination clinic due to lack of transportation to and from the clinic, asked if it was possible to schedule a vaccination at the time of their upcoming appointment. Data pertaining to the receipt of these vaccines was not captured, due to lack of access to the Vermont IMR.

B. Implication for practice, education, and/or research

Based on these findings, it was determined that direct patient outreach via telephone and simultaneous scheduling of vaccinations at an organized vaccine clinic resulted in a far greater number of vaccinations and proved to be the most effective method of increasing vaccination rates. While the initial intervention incorporated much in the way of current data on barriers to vaccination, it appears that facilitating the vaccine administration, rather than simply recommending that the patient be vaccinated was critical in achieving increased vaccination rates among this population. Based on these findings, it is recommended that future efforts targeting
vaccination in this population should focus on direct telephone contact with patients and should include scheduling a specific time and place for administration of the recommended vaccine.

C. Limitations of project

Chief among the limitations of this project was the issue of small sample size. It is difficult to draw conclusions based on the project’s findings due to the small number of patients involved in the interventions. Because of this, future research on a larger scale is necessary to validate the findings of this project.

Further, there were many steps that were necessary prior to the implementation of this project around determining initial vaccinations status of the patients in question. First, a single report detailing which pneumococcal vaccines each patient had and when/ at what age they were administered did not exist in the electronic health record (EHR). As a result, it was necessary for the primary investigator to create a report that included all patients in the Appletree Bay Primary Care practice age 65 and older, along with the vaccinations they had, and the outstanding recommended vaccines. To do this, it was necessary to compile a list of all practice patients age 65 and older and manually record the vaccinations they have received. This information was compiled into an Excel spreadsheet and made available to providers and staff of the practice. This information was then used to determine which vaccinations patients needed and outreach was based on this information. This portion of the project amounted to many of hours of work.

While it was likely possible to create a report in the EHR that included this information without manually gathering and compiling the data, the primary investigator made multiple calls to the EHR help desk requesting assistance with no response. This complication is mentioned because it is a problem commonly faced in the use of EHRs, those without understanding or training and with insufficient technical support are unable to fully utilize the technology. As a graduate
student, I had the 20-30 hours required to compile such data, but it is unrealistic for any primary care practitioner or staff to take that amount of time away from patient care for such work. Further, despite the importance of increasing vaccination among this vulnerable population, in the case of vaccination, it is work which results in financial loss rather than revenue for the practice.
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Appendices A: Adult Pneumococcal Vaccine Recommendations

The following is a four page guide to proper sequencing of the pneumococcal vaccines in adults, based on which pneumococcal vaccines were received when, prior to age 65 (Centers for Disease Control and Prevention, 2015).

(CDC, 2015)
Appendices B: Pneumococcal Disease Information and Recommendations

What is pneumococcal disease?
Pneumococcal disease refers to several serious infections caused by the Streptococcus pneumoniae bacteria. The most serious of these are pneumococcal pneumonia (infection of the lungs), meningitis (infection of the tissue surrounding the brain) and bacteremia (infection of the blood).

How serious is pneumococcal disease?
- Despite appropriate antibiotics and medical treatment, the cost associated with pneumococcal disease, in lives and healthcare dollars, is alarmingly high. This is due, in part, to growing bacterial resistance to antibiotics, making these infections increasing more difficult and costly to treat.
- In 2013 an estimated 13,500 cases of invasive pneumococcal disease occurred among adults age 65 years and older.
- An estimated 4,250 deaths from invasive pneumococcal diseases occurred in the United States in 2011.

Who is at the greatest risk of developing serious pneumococcal disease?
- Adults 65 & older have the highest risk of mortality from pneumococcal disease.
- Those who smoke, abuse alcohol, have certain chronic health conditions or a weakened immune system.
- Children younger than 5.

There are 2 vaccines that can prevent pneumococcal disease, PCV13 and PPSV23, which is recommended?
- Those age 65 years or older have never gotten a pneumococcal vaccine before should get both vaccines, PCV13, then 1 year later, PPSV23.
- If you smoke, have certain chronic health conditions, or a compromised immune system, you may have gotten one, or both, of these shots before age 65.
- If you received a PCV13 and/ or PPSV23 vaccine prior to age 65, you will still need additional doses after turning 65, consult your provider to determine the appropriate schedule.

Should patients for whom PPSV23 and PCV13 are recommended but are unsure if they have received the vaccines be (re)vaccinated?
Yes. If patients without a documented vaccination history, and whose records are not readily obtainable, the recommended doses should be administered. Extra doses will not harm the patient.
PNEUMOCOCCAL DISEASE: INFORMATION and RECOMMENDATIONS

Who should receive the PCV13 vaccine?
- All adults age 65 years and older should receive one dose of PCV13.
- Adults age 19 through 64 years who have not previously received PCV13 and fall into one of the following groups should receive a PCV13 dose:
  - Immunocompromised patients (e.g., patients with HIV, immunodeficiency, chronic renal failure, nephrotic syndrome, leukemia, lymphoma, Hodgkin’s disease, generalized malignancy, iatrogenic immunosuppression, solid organ transplant, and multiple myeloma)
  - Patients without a functional spleen (e.g., sickle cell disease or other blood disorders, congenital or acquired asplenia)
  - Patients with a cerebrospinal fluid (CSF) leak
  - Patients with cochlear implants

Who should receive the Pneumovax 23 (PPSV23) vaccine?
Pneumovax 23 (PPSV23) is recommended for patients meeting any of the following criteria:
- Age 65 years and older
- Age 2 through 64 years with any of the following conditions
  - cigarette smokers age 19 years and older
  - alcoholism
  - chronic liver disease, cirrhosis
  - chronic cardiovascular disease, excluding hypertension (e.g., congestive heart failure, cardiomyopathies)
  - chronic pulmonary disease (including COPD and emphysema, and for adults age 19 years and older, asthma)
  - diabetes mellitus
  - candidate for or recipient of cochlear implant
  - cerebrospinal fluid (CSF) leak
  - functional or anatomic asplenia (e.g., sickle cell disease, splenectomy)
  - immunocompromising conditions (e.g., HIV infection, leukemia, congenital immunodeficiency, Hodgkin’s disease, lymphoma, multiple myeloma, generalized malignancy, immunosuppressive therapy)
  - solid organ transplantation or bone marrow transplantation
  - chronic renal failure or nephrotic syndrome
PNEUMOCOCCAL DISEASE: INFORMATION AND RECOMMENDATIONS

What is the recommended dosing interval between PCV13 and PPSV23 for patients receiving both vaccines?

- PCV13 should be given before PPSV23 if possible.
- For persons age 65 years and older who have not previously received pneumococcal vaccine or whose pneumococcal vaccine history is unknown, give PCV13 followed by PPSV23 12 months later.
- For adults 19 through 64 years at high risk of pneumococcal disease give PCV13 followed by PPSV23 at least 8 weeks later.
- For children who have already received PPSV23, wait 8 weeks before giving PCV13.
- For adults who have already received PPSV23, wait 12 months before giving PCV13.

Summary of the revaccination recommendations for PPSV23:

- Patients younger than age 65 who are immunocompromised or have renal insufficiency should get 2 doses of PPSV23 5 years apart, and a third dose after turning 65 (with at least 5 years between each dose).
- Patients with no risk factors should get 1 dose at age 65.

*Thus, depending on risk & age at vaccination, patients age ≥65 will have received 1, 2, or 3 doses of PPSV23 in their lifetime.

Should patients 65 and older who are newly diagnosed with a “high risk” medical condition be given a second, additional dose of PPSV23 in 5 years?

No. People who are first vaccinated with PPSV23 at age 65 years or older should receive only 1 dose, regardless of their underlying medical condition.

If a patient has had a confirmed case of pneumococcal pneumonia, does he/she still need to be vaccinated with PCV13/PPSV23?

Yes. There are more than 90 known serotypes of pneumococcus, and infection with one serotype does not necessarily produce immunity to other serotypes. Patients at increased risk for pneumococcal disease, should be vaccinated against as many serotypes as possible to prevent future infection (PPSV23 covers 23 common serotypes and PCV13 covers an additional 13).
Appendices C: Vaccine clinic campaign posters

**Pneumonia Vaccine Clinic**

Appletree Bay Primary Care & Vermont Family Pharmacy are teaming up to offer pneumococcal vaccine clinics:

- **Tuesday June 27**
  - 1:30-5pm
- **Thursday July 13**
  - 1:30-5pm

**Ask your provider today if you need a vaccine.**

Call 863-1313 to schedule an appointment!

Adults ≥65 are at the greatest risk for hospitalization and death due to pneumococcal disease.

Medicare & most private insurers cover the cost of vaccination for patients ≥ 65.
Appendices D: VDH Statistics

Of note, women in the Burlington area are significantly more likely to have made a routine visit to their doctor in the last year as compared with men (70% vs. 60%), but similar to state averages, remain statistically similar across other demographic differences (Vermont Dept of Health, 2016a).

Data from (VDH, 2016a)

The State of Vermont reports modest progress in reaching the goal of 90% pneumococcal vaccination rate among adults age ≥65 from 74% in 2011 to 76% in 2015, while this average remains significantly higher than the 2015 U.S. average rate of 71% (VDH, 2017) (CDC, 2015). Further, the Vermont Department of Health Burlington District Office reports 79% of Burlington
area adult residents aged $\geq 65$ have gotten at least one pneumococcal vaccine, compared to the Vermont statewide average of 76% (VDH, 2016a, 2017). This likely is, at least due in part, to the relative accessibility and convenience of health care providers in the Burlington as compared to other, more rural areas of the state.

**Appendix A: Burlington District Office Trend Results (2011-2014)**

<table>
<thead>
<tr>
<th>Risk Behaviors</th>
<th>2011-2012</th>
<th>2012-2013</th>
<th>2013-2014</th>
<th>Significant Change Since 2011</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smoking</td>
<td>13%</td>
<td>14%</td>
<td>14%</td>
<td>No</td>
</tr>
<tr>
<td>Single Drinking</td>
<td>23%</td>
<td>21%</td>
<td>20%</td>
<td>No</td>
</tr>
<tr>
<td>No Exercise</td>
<td>13%</td>
<td>18%</td>
<td>17%</td>
<td>Yes</td>
</tr>
<tr>
<td>Recent Marijuana Use</td>
<td>10%</td>
<td>10%</td>
<td>N/A</td>
<td>No</td>
</tr>
<tr>
<td>Heavy Drinking</td>
<td>10%</td>
<td>9%</td>
<td>9%</td>
<td>No</td>
</tr>
<tr>
<td>Seldom or Never use Seatbelt</td>
<td>3%</td>
<td>3%</td>
<td>3%</td>
<td>No</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Preventative Behaviors</th>
<th>2011-2012</th>
<th>2012-2013</th>
<th>2013-2014</th>
<th>Significant Change Since 2011</th>
</tr>
</thead>
<tbody>
<tr>
<td>Routine Doctor Visit, in Last Year</td>
<td>63%</td>
<td>66%</td>
<td>66%</td>
<td>No</td>
</tr>
<tr>
<td>Pneumococcal Vaccine, Ever, Ages 65+</td>
<td>74%</td>
<td>73%</td>
<td>77%</td>
<td>No</td>
</tr>
<tr>
<td>Flu Shot in the Last Year, Ages 65+</td>
<td>66%</td>
<td>65%</td>
<td>69%</td>
<td>No</td>
</tr>
<tr>
<td>Ever Tested for HIV</td>
<td>33%</td>
<td>33%</td>
<td>32%</td>
<td>No</td>
</tr>
</tbody>
</table>

Data from (VDH, 2016b)

**Burlington Health District – 2014-2015 BRFSS Data**

### Health Status Indicators

<table>
<thead>
<tr>
<th>Estimated Adults**</th>
<th>Burlington</th>
<th>Vermont</th>
<th>%</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>General Health Status is Fair or Poor</td>
<td>8,000</td>
<td>7%</td>
<td>13%</td>
<td></td>
</tr>
<tr>
<td>Have Personal Health Care Provider</td>
<td>95,000</td>
<td>88%</td>
<td>88%</td>
<td></td>
</tr>
<tr>
<td>Have Health Insurance, Ages 18-64</td>
<td>83,000</td>
<td>96%</td>
<td>93%</td>
<td></td>
</tr>
<tr>
<td>Did Not Visit Doctor Due to Cost, in Last Year</td>
<td>8,000</td>
<td>7%</td>
<td>8%</td>
<td></td>
</tr>
<tr>
<td>Poor Physical Health</td>
<td>7,000</td>
<td>7%</td>
<td>11%</td>
<td></td>
</tr>
<tr>
<td>Poor Mental Health</td>
<td>9,000</td>
<td>8%</td>
<td>11%</td>
<td></td>
</tr>
<tr>
<td>Died</td>
<td>22,000</td>
<td>20%</td>
<td>23%</td>
<td></td>
</tr>
</tbody>
</table>

### Preventative Behaviors and Health Screening

<table>
<thead>
<tr>
<th>Estimated Adults**</th>
<th>Burlington</th>
<th>Vermont</th>
<th>%</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flu Shot in the Last Year, Ages 65+</td>
<td>13,000</td>
<td>67%</td>
<td>61%</td>
<td></td>
</tr>
<tr>
<td>Pneumococcal Vaccine, Ever, Ages 65+</td>
<td>15,000</td>
<td>78%</td>
<td>78%</td>
<td></td>
</tr>
<tr>
<td>Routine Doctor Visit, in Last Year</td>
<td>72,000</td>
<td>67%</td>
<td>70%</td>
<td></td>
</tr>
<tr>
<td>Dental Visit in Last Year</td>
<td>81,000</td>
<td>77%</td>
<td>72%</td>
<td></td>
</tr>
<tr>
<td>Any Teeth Extracted, Ages 45-64</td>
<td>14,000</td>
<td>36%</td>
<td>49%</td>
<td></td>
</tr>
<tr>
<td>Cholesterol Screened, in Last Five Years</td>
<td>79,000</td>
<td>77%</td>
<td>78%</td>
<td></td>
</tr>
<tr>
<td>Ever Tested for HIV</td>
<td>37,000</td>
<td>38%</td>
<td>34%</td>
<td></td>
</tr>
<tr>
<td>2+ Daily Fruit Servings*</td>
<td>35,000</td>
<td>34%</td>
<td>32%</td>
<td></td>
</tr>
<tr>
<td>3+ Daily Vegetable Servings*</td>
<td>21,000</td>
<td>23%</td>
<td>20%</td>
<td></td>
</tr>
<tr>
<td>2+ Daily Fruit &amp; Vegetable Servings*</td>
<td>23,000</td>
<td>23%</td>
<td>20%</td>
<td></td>
</tr>
<tr>
<td>Met Physical Activity Recommendations*</td>
<td>84,000</td>
<td>61%</td>
<td>59%</td>
<td></td>
</tr>
<tr>
<td>Met Strength Building Recommendations*</td>
<td>38,000</td>
<td>36%</td>
<td>30%</td>
<td></td>
</tr>
<tr>
<td>Use Community Resources for Physical Activity</td>
<td>72,000</td>
<td>71%</td>
<td>58%</td>
<td></td>
</tr>
<tr>
<td>Breast Cancer Screening, Women 50-74</td>
<td>17,000</td>
<td>82%</td>
<td>79%</td>
<td></td>
</tr>
<tr>
<td>Cervical Cancer Screening, Women 21-65</td>
<td>31,000</td>
<td>86%</td>
<td>86%</td>
<td></td>
</tr>
<tr>
<td>Colorectal Cancer Screening, Ages 50-74</td>
<td>25,000</td>
<td>77%</td>
<td>71%</td>
<td></td>
</tr>
</tbody>
</table>