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Cover Page Footnote

The authors thank Dr Audrey Klopp, Dr Diana Hackbarth and Dr Arun Ohri for the support throughout the study as the committee members; Dr Diana Hackbarth for reviewing and correcting the needs assessment tool, Dr James Sinacore for statistical analysis and Holly O'Connor for the graphic designs and CE module development process. A special thanks to Dr Audrey Klopp for guidance, support and critical review of the manuscript. The first author, Simi Jesto Joseph, was a DNP student of Loyola University Chicago during the project development, implementation and evaluation

Use of an electronic educational module to educate advanced practice nurses on preventive care protocol for immunocompromised patients

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Abstract

Introduction: Immunocompromised patients are at increased risk of infections and certain cancers due to the immunosuppressed body as well as the immunosuppressive agents. Despite American national organizations' specific guidelines for immunocompromised patients, reported vaccination rates and provider compliance on preventive services is low. The aim of this study was to assess knowledge, attitude and clinical practice among Advanced Practice Nurses (APN) in preventive care for immunocompromised patients and educating APNs to improve their knowledge and practice skills using an evidence-based preventive care protocol. **Methods:** APN members of Illinois Society of Advanced Practice Nurses (ISAPN) organization were surveyed by a needs assessment questionnaire and descriptive analysis was done. Based on the results, an evidence-based Preventive Care Protocol was created and implemented through a web-based Continuing Education (CE) module. A post-test was used to evaluate the project objectives. **Results:** Of the 811 surveys that were sent to ISAPN members, 164 members responded, yielding an overall response rate of 17%. The barriers identified were lack of knowledge and confidence among practicing APNs. Forty-four out of forty-seven APN's took the CE module with a response rate of 94%. The post-test showed an improvement in confidence level (98%) and knowledge of APNs ($p < .005$) in preventive care for immunocompromised patients. **Conclusion:** The web-based CE module implementing the Preventive Care Protocol was an effective method and improved APN's knowledge, current practice and confidence level in preventive care for immunocompromised patients.

Keywords: Inflammatory bowel disease, immunocompromised, outpatient, infection prevention, opportunistic infections, cancer, vaccinations, interventions

INTRODUCTION

In chronic immune mediated diseases, chronic inflammatory process compromises the patient's overall quality of life, despite all the advanced therapeutic options available. Immunosuppressive therapy is an effective therapy for the immune mediated disease conditions to keep patients in disease remission. Common medical treatments now available for immune mediated diseases include corticosteroids, immune modulators and biologic drugs. The inflammatory cascade that causes chronic inflammation is due to the pivotal role of pro-inflammatory cytokine TNF-alpha. Biologics, otherwise known as Tumour Necrosis Factor (TNF) inhibitors, have been shown to induce apoptosis of the immune cells and reduce the pro-inflammatory

cytokines (Nielsen and Ainsworth, 2013). While the efficacy is proven for immunosuppressive therapy, the adverse effects are a concern for these patients. Immunocompromised patients are at increased risk of lymphomas, serious infections and tuberculosis (Singh et al., 2013). Many healthcare providers are aware that because of the increased incidence of infections, ACIP (Advisory Committee on Immunization Practices) and many American national organizations have published clear guidelines and recommendations for vaccinating adults, as well as those who are immunocompromised (CDC, 2011; Lichtenstein, Abreu, Cohen, & Tremaine, 2006; AGA, 2006). However, healthcare providers are non-compliant in recommending vaccinations and appropriate cancer screenings to these group of

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patients (Gupta, Macrae and Gibson, 2011; Yeung, Goodman and Fedorak, 2012). The major goal of management of chronic diseases is to improve and maintain patient's general wellbeing or quality of life. The important questions are: are these goals being achieved through the national guidelines? Although treatment guidelines for the providers are available, how many step forward to decrease infections and improve preventive services to immunocompromised patients? Do providers feel that infection prevention is important in immunocompromised patients?

Providers and Immunocompromised Patients

The Centre for Disease Control and Prevention (CDC) recommends adult immunizations to prevent most of the opportunistic infections. However, CDC (2012) reported in their vaccination reports that most adults are not vaccinated as recommended (NFID, 2012). To explore the low rate of vaccinations and reasons, multiple studies were reviewed. It was discovered that most physicians never took an immunization history and 39% agreed that they were either concerned about the side-effects of vaccines or did not know which vaccines to advice during immunocompromised state (Gupta et al., 2011; Yeung et al., 2012). It is evident that gastroenterologists and primary care physicians are failing to routinely monitor their patients for vaccination and recommending vaccinations to their immunocompromised patients (Gupta et al., 2009; Wasan, et al. 2010). This is not a surprise in gastroenterology practice due to the high rate of hospitalizations with infections among Inflammatory Bowel Disease (IBD) patients. A 30 year Danish Cohort study (1982-2010) found a 50% increased mortality among patients with Crohn's disease due to infections over a period of three decades (Jess, Frisch and Simonsen, 2013). While this is a concern in gastroenterology practice, other specialties that use immunosuppressive therapy in their practice were also found to have similar issues. McCarthy et al., (2012) surveyed rheumatologists, who use immune modulators and found that a significant percentage (34%) of rheumatologists did not perform screening prior to initiating anti-TNF therapy and 57% considered the patients' primary care physicians to be responsible for vaccination.

Cancers and Immunosuppressed Patients

There is an increased incidence of cervical cancer and colon cancer among patients with IBD and immunosuppression. Women with IBD on immune modulators are at increased risk of cervical dysplasia and Human Papilloma Virus (HPV) infection has shown high association with cervical cancer (Kane et al., 2008). A study among 134 women with a diagnosis of IBD showed abnormal cervical histology ($p=0.04$) and all were given immune modulators. However, fewer women with IBD are undergoing cervical testing compared to women without IBD (Gutierrez, 2009). This indicates that most practitioners' screening methodologies significantly vary due to their lack of awareness, attitude and surveillance interval has shown to be inconsistent worldwide (AGA, 2010). The American College of Gastroenterology recommends colonoscopy surveillance to be started after 8 years from initial IBD diagnosis. The risk of colon cancer increases with extensive disease. The surveillance for Crohn's disease and Ulcerative colitis are at similar interval and a small bowel evaluation is recommended along with colonoscopy for Crohn's disease patients (AGA, 2010; ASGE, 2006; Kornbluth and Sachar, 2010). Another type of cancer incidence seen among immunocompromised patients was cutaneous malignancies (Kubica and Brewer, 2012). This includes patients who have had solid organ transplant, Human Immunodeficiency Virus (HIV) positive patients, bone marrow transplant patients, or anyone who is taking chronic immunosuppressive medications for their underlying pathology. Controversy exists as to whether cutaneous tumors develop due to certain immunosuppressive medications rather than solely due to immunosuppressed body. According to Kubica and Brewer (2012), medications associated with an increased risk for cutaneous cancers are azathioprine and prednisolone.

Barriers to Immunization

It is time to ponder why preventive care for immunocompromised is underutilized and what are the barriers in recommending those services to this group of patients. The reasons identified for underutilization of vaccinations include inadequate knowledge among healthcare providers in selecting vaccinations, timing of vaccinations, lack of awareness among patients regarding adult immunizations while on IBD treatment, fear of vaccinations, lack of

providers available to uninsured populations and lack of discussion on infection prevention during a visit (Yeung et al., 2012). Among the reasons, cited by patients include unaware of the need for immunization, disliked needles and afraid of adverse effects. Another important and interesting finding is Nurse Practitioners (NP), Physician Assistants (PA) and Registered Nurses (RN) were, more likely, informing patients regarding the consequences of missing vaccination than the patient's MD providers (Lu et al., 2009; Johnson, Nichol and Lipczynski, 2008).

Need for Practice Change

These issues indicate that co-coordinating preventive care for patients, who are immunocompromised, is a dilemma in clinical practice and that improvement is imperative. To improve vaccination rates and cancer screening strategies an evidence-based standardized protocol, based on current guidelines, is an effective way to improve vaccination adherence for the persons who are immunocompromised. Primary and secondary prevention methods are essential for immunocompromised patients to reduce disability and lower health care cost. These preventive services should be provided by every practitioner to their immunocompromised patients. According to the American Academy of Nurse Practitioner database 2011-2012, there are over 171,000 nurse practitioners practicing in the U.S. Eighty-eight percent of NPs are prepared to practice in primary care and at least 68% of NPs practice in at least one primary care setting (AANP, 2012). While the debate between specialists and primary care providers continue, there is a great opportunity for increasing the number of APNs currently working in preventive care settings to address the problem of poor adherence to vaccinations for patients who are immunocompromised. Thus, the overall objectives of this evidence-based study were: 1) To identify and overcome barriers in recommending preventive care for immunocompromised patients, 2) To improve APNs knowledge, skills and clinical practice in preventive care among immunocompromised patients, 3) To create and improve usage of evidence-based preventive care protocol and 4) To provide confidence to APNs in practicing preventive care for immunocompromised patients through an electronic educational module.

MATERIALS AND METHODS

ISAPN is a professional organization in Illinois State, United States, dedicated to promotion and advocacy of APNs. The study sample was a convenience sample from the existing membership list of ISAPN, which comprises about 811 APNs [Certified Nurse Mid-wife (33), Certified Nurse Anaesthetists (15), Certified Nurse Practitioners (645) and Certified Nurse Specialists (118)]. The student members were excluded from the study. A 32 item electronic questionnaire was developed and used as the needs assessment tool to assess APNs' knowledge, attitude and clinical practice patterns in preventive care for immunocompromised patients. Two professors in nursing contributed to the development of the survey tool. To improve the content validity of the survey tool, a pilot testing was done among five APNs, who work in different clinical settings. The feedback provided by them were used to evaluate the validity of the questionnaire, length of the survey, quality and the clarity of the content, inter-rater reliability and the feasibility of using the tool among APNs. The study was approved by the Institutional Review Board at Loyola University, Chicago. A cover letter describing the purpose and confidentiality of the responses to the questionnaire were sent to ISAPN members via e-mail as a recruitment strategy for the Needs Assessment Survey; participation was voluntary. The survey was released on February 24, 2014 and closed on March 10, 2014. In addition, a reminder e-mail was sent out after 7 days of the release to remind APNs that the survey was open and responses would be appreciated.

The participants recommended and encouraged a standardized protocol and to include current guidelines as an effective way to solve the current issue on under-vaccination for immunocompromised patient population. Attention turned to develop an evidence-based preventive care protocol for immune compromised patients and towards the education, infection and cancer prevention. The protocol was created from the concise recommendations on preventive care by CDC (CDC, 2014; CDC, 2011), American Gastroenterology Association (Allen and Dassopoulos, 2011), American Society of Gastroenterology Endoscopy (ASGE, 2006), American College of Gastroenterology (Kornbluth and Sachar, 2010), American College of Rheumatology (Singh et al., 2012), American Congress of Obstetrics and Gynecology (ACOG, 2010) and experts from the field

of IBD treatment (Melmed, 2009; Lu et al., 2009; Viget, et al., 2008; Wasan et al., 2010; Yeung, Goodman and Fedorack, 2012). The protocol delineates appropriate clinical and laboratory work-up during the patients' disease treatment course or before initiating immunosuppressive therapy. The clinical work-up focuses on the past medical history, vaccination history, travelling history and previous infections. The protocol includes routine blood sample analysis, including titers of Hepatitis B Surface Antigen, Varicella Zoster IgG, MMR titers and TB skin test.

The implementation of the evidence-based protocol was accomplished through a Continuing Education (CE) module based on evidence as well as input from a Needs Assessment Survey. A one hour CE module was created and accredited by American Association of Nurse Practitioners (AANP) CE Department. The web-based teaching module, released through ISAPN, provided information on type and timing of vaccinations, specific education to patients and their families and cancer prevention strategies for patients who are immunocompromised. At the end of the module, a post-test was used to assess the knowledge of APNs gained through the module and questions were asked to evaluate the impact of CE module as well as the preventive care protocol. All participants were given one hour CE certificate accredited by AANP after completing the module, post-test and evaluation.

RESULTS

Of the 811 surveys sent, 164 APNs responded, yielding an overall response rate of 17%. Twenty five surveys were excluded due to incomplete response. Majority of the participants were Certified Nurse Practitioners (CNP), practicing in Adult and Family specialities (56%) and 66% of respondents had been practicing for over six years. Twenty-four percent of responding APNs reported taking care of immunocompromised patients weekly and 16% were seeing at least one immunocompromised patient daily. Only 54 APNs reported that they ask patients about their immunization history during each visit and update patients on vaccination status. APNs were not consistent in placing importance on documenting vaccination history. Forty-three percent report documenting the vaccination history 'always' and 16% said they 'never' document it. Among the survey participants, only 24 were prescribing vaccinations routinely. Even though

72% of APN had vaccinations in stock, 32% never administer and 15% said they rarely administer vaccines. If APNs were not administering vaccines in their practice, 37% reported that they refer them to patients' primary care provider, 36% refer them to local health department and 30% do not make any referrals. One hundred sixteen APNs indicated that CDC is the organization that they rely on for vaccination guidelines. However, those APN's responses indicated that only 50% are recommending influenza and 35% are recommending pneumococcal vaccines (Figures 1 and 2) and 23% were incorrectly recommending a live vaccine, varicella vaccine, to their immunocompromised patients.

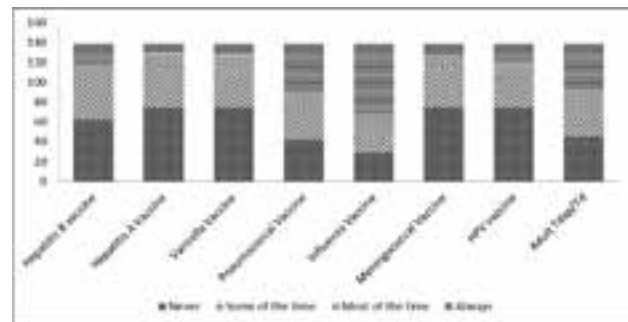


Fig. 1: Needs Assessment Survey: Result of APN's Current Practice on Vaccinating Adults

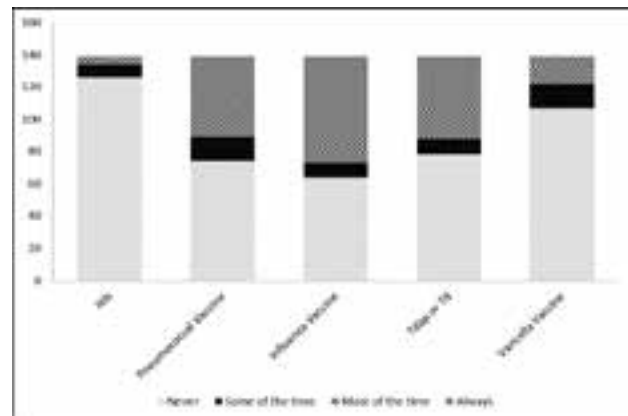


Fig. 2: Needs Assessment Survey: Result of APN's Current Practice on Vaccinating Immunocompromised patients

Regarding immunization recommendation to their immunocompromised patients, lack of confidence was identified among APNs (20%) through the Needs Assessment Survey. It was also found that APNs have poor knowledge on current recommendations on cervical cancer screening (61%), colon cancer screening (39%) and awareness of skin cancers among immunocompromised (41%). Majority of the APNs demonstrated appropriate

knowledge on infection prevention and educating their immunocompromised patients about infection prevention (89%). However, 35% APNs never educated patients on self-skin exams as a routine teaching. It is surprising that only 55% discussed smoking status and cessation with immunocompromised patients on a daily basis. The results regarding knowledge on vaccination recommendations for family members of immunocompromised were poor. APNs were not aware of vaccination recommendations for family members of immunocompromised patients. Ninety percent of APNs requested for a check list in preventive care and indicated willingness to take an educational module to improve their clinical practice.

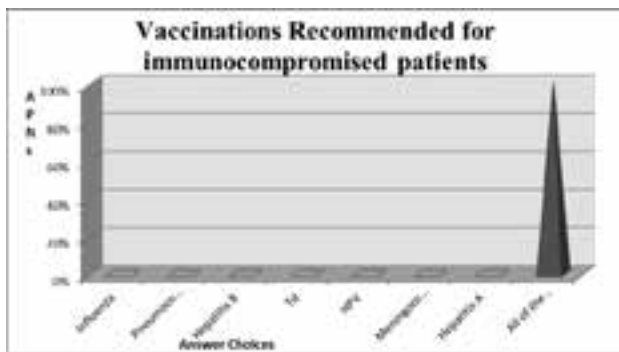


Fig. 3: Post-test showing percentage of participants correctly identifying vaccinations for immunocompromised patients

Forty-seven APNs took the CE module and forty four APNs completed the post-test evaluation, yielding a response rate of 94%. Cross tabulations and Pearson Chi-Square tests were performed for six relevant questions on the post-test to understand significance (Table 1). Even though the sample size vary between the Needs Assessment Survey (164) and the post-test (44), ninety-six percent ($P < 0.005$)

APNs who took the post-test correctly identified the immunocompromised patient through past medical history, medication list and previous documentation in comparison to 68% on Needs Assessment Survey. APNs correctly identified the screening tests that need to be ordered for immunocompromised patients (98%, $P < 0.005$), up from 2% on the Needs Assessment Survey (pre-education).

A great improvement was seen for the question on identifying type of vaccinations to the immunocompromised patients. The entire post-test participants answered it correctly in comparison to only 13% correctly identifying on Needs Assessment Survey (Figure 3). Eighty-seven percent ($P < 0.005$) correctly answered cervical cancer recommendations, colon cancer recommendation (91%, $P < 0.005$) and skin cancer recommendation (98%, $P < 0.005$) in the post-test. APNs showed confidence in recommending preventive care after completing the module (98%). Ninety-three percent agreed that the web-based module achieved the objective of improving APNs' knowledge, attitude and practice skills in preventive care for immunocompromised patients.

DISCUSSION

To the best of the authors' knowledge, this is the first project done among APNs to assess and improve their knowledge, attitude and clinical practice on preventive care for immunocompromised patients. The needs assessment targeted APNs of Illinois state, through ISAPN and it appears to be an interesting topic to Certified Nurse Practitioners than other specialty of APNs. Out of 164 responses to needs assessment, 132 were Certified Nurse Practitioners and 12 were Certified Nurse Specialists.

Table 1: Statistical significance of six questions in comparison to the Needs Assessment Survey

Questions Compared	Needs Assessment	Post-test	Chi-square	P Value
1. Identified patients that are immunocompromised	68%	96%	14. 7	<0.005
2. Identified screening tests for immunocompromised patients	2. 2%	98%	164. 6	<0.005
3. Identified appropriate vaccinations for immunocompromised patients	9. 4%	100%	130. 7	<0.005
4. Identified current cervical cancer recommendations for immunocompromised patients	40%	87%	30. 3	<0.005
5. Identified current colon cancer recommendations for IBD	27%	91%	56. 9	<0.005
6. Identified current skin cancer recommendations for immunocompromised patients	52%	98%	130. 7	<0.005

Most of the APNs who participated in the study agreed that they are either in the role of prescribing therapy, educating patients and families and/or monitoring therapy for immunocompromised patients in their practice settings. A majority correctly identified immunocompromised patients through previous documentation, past medical history and medication list. There have been concerns in previous studies that patients were not being asked about their vaccination history and that vaccination history was poorly documented. The finding from the needs assessment is not better than those studies. Only 39% of APNs asked patients about their vaccination history during each visit and only 42% documented it. Thirty-five percent of APNs review patients' vaccination history annually. It is evident that poor documentation is still a concern among APNs. Most of the patients may not remember their vaccination dates and type of vaccine received. Hence, the appropriate history taking by practitioners may be limited by this variable. Although most of the study participants' clinical practices carry vaccines, very few APNs administer or prescribe vaccines to their patients. Thirty-seven percent of APNs are referring their patients to primary care providers and local health departments (36%) for adult immunization needs. This raises a question as to why APNs are not initiating preventive care in their own practice. Are they afraid of side effects? Do they lack knowledge on providing appropriate vaccinations to their adult patients? Or do they lack confidence in prescribing vaccines because they are unsure about the timing of vaccinations? However, 23% of the survey participants admitted that they were not confident in prescribing live or attenuated vaccinations to their adult and immunocompromised patients. Only 20% said that they are very confident in administering or prescribing the vaccinations to their patients.

It was important in this project to identify the barriers in APN practice. The Needs Assessment Survey was the method to discover the basic knowledge of APNs in identifying correct vaccinations for their adult and immunocompromised patients. Eighty-three percent respondents agreed that they are relying on CDC for up-to-date vaccination guidelines in order to prescribe it. However, knowledge on type of screening tests and vaccinations to immunocompromised patients were suboptimal. Sixty-two percent never knew that they need to screen patients who are on immunosuppressive

therapy for hepatitis B, 73% never knew about screening for varicella antibody and MMR titers and 60% never knew that they need to screen for TB, if patients are on biologic therapy like Remicade® or Humira®. APNs were not aware that any of these viruses can be fatal to their immunocompromised patient population on immunosuppressive therapy and that screenings should be initiated prior to starting any of the immunosuppressive drugs. If all providers are conscientious about carrying out preventive measures at the appropriate time, many hospitalizations and infections could be greatly reduced for immunocompromised patients. Even though some participants are proficient in identifying correct vaccinations for their immunocompromised patients, it is a matter of concern that still a significant number of APNs lack knowledge on vaccination recommendations to their immunocompromised patients; this is especially troubling with regard to live vaccines. It is dangerous and could be construed as malpractice if APNs prescribe live vaccinations to immunocompromised patients. This was a major concern after the Needs Assessment Survey was completed. Again, knowledge deficit may explain the reasons APNs avoid prescribing or recommending vaccinations to their patients and thus, miss an opportunity to prevent infections in their immunocompromised patients. To create strategies to improve practice, the preventive care protocol checklist may be a useful tool, which may be kept in patient examination rooms to remind APNs regarding discussion and documentation of vaccination history, schedule and recommendations.

Limitations

There are several limitations to this study. The project did not include all ISAPN members; of 811 members in this organization, only 164 were interested in participating in the needs assessment and 47 for CE module. To achieve the goal of improving knowledge of all APNs, other nursing organizations need to be contacted to implement the educational module and preventive care protocol. Another issue noticed after completing the project was regarding questions on the Needs Assessment Survey. There were no questions to identify reasons for not having confidence in recommending vaccinations. There may be many other barriers other than knowledge deficit. The operation of each practice and the opinions of collaborative practitioners can be an influencing factor in determining which protocol

needs to be followed in any given practice. The author believes that, to identify many other barriers in practicing evidence-based medicine in preventive care for immunocompromised patients, further study is needed.

CONCLUSION

A paradigm shift is needed in how APNs initiate preventive care for immunocompromised patients, in order to improve patients' overall quality of life. Improving the skills of APNs in preventive care, through the ISAPN organization, has benefited the organization in terms of the organization's ability to provide up-to-date information to its members. Once APNs build the confidence in providing preventive care and recommending appropriate adult vaccinations, the overall health of immunocompromised patients will improve. The preventive care protocol is provided to APNs in a check list format, which is easy to understand and follow while treating a patient for 15 to 20 minutes in any provider's office. This educational module will be disseminated to other organizations to include other APNs nationwide. The follow up in 3 months and 6 months will be done among APNs to better understand the usage of the protocol, sustainability of the confidence level and any other barriers that developed throughout the implementation of the preventive care protocol.

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