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Bioaerosol Effect on Safe Use of Bathroom Appliances for Drinking Water Consumption

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Abstract

Purpose: The purpose of this study was to assess the bioaerosol effects on the use of bathroom appliances (a fountain faucet and a reusable cup) for drinking water consumption.

Methods: A mechanically pressurized hydraulic spray nozzle was used to generate bioaerosols containing non-pathogenic *E. coli*. These bioaerosols became airborne and came in contact with a fountain faucet (NASONI, Inc.) and a reusable cup. 10 mL and 100 mL of water samples from the cup and the faucet stream, respectively, were collected at intervals of 10 secs, 30 secs, 1 min, 2 mins, and 5 mins. A Tryptic Soy Broth (TSB) liquid solution was used to determine whether *E. coli* was present in the water, while the *Colilert* test was conducted to quantify *E. coli* concentrations.

Results: 88 MPN/100 mL – 866 MPN/100 mL of *E. coli* from the aerosol effect was removed from the fountain stream after the faucet was kept open for 10 secs. However, *E. coli* continued to be present in the reusable cup over the sampling period.

Conclusion: The fountain feature of the faucet had a significantly lower risk of microbial contamination from the aerosol effect as compared with the reusable cup.

Introduction

Household bathrooms are one of the most vulnerable locations for bacterial contamination. Regular or ordinary human activities, e.g. toilet flushing, coughing, washing, sneezing, and sweeping floors, can cause microbial contamination in household bathrooms (Kummer and Thielb, 2008). Among these human activities, flushing a toilet has been considered as one of the main contributors to microbial contamination (Aithinne et al., 2018). Toilets in general are designed to dispose human waste by flushing the waste mixed with water, which then turns into sewage. However, flushing the toilet can produce droplet and droplet nuclei bioaerosols that can contaminate surfaces and expose persons by contact or air currents. Studies showed that these bioaerosols contain pathogenic organisms, such as *Escherichia coli (E. coli)*, MS2 bacteriophase bacteria, *S marcescens* and enterobacteria, are present in a toilet plume (Johnson et al., 2013; Best et al., 2012). Consequently, the prevalence of bioaerosols can be associated with certain human diseases, such as gastrointestinal illness and infectious disease (Kim et al., 2017; Aithinne et al., 2018).

Studies showed that each flush of the toilet can produce up to 145,000 aerosol particles. Greater than 99% of these aerosol particles are less than 5μm and can remain suspended for minutes to hours (Prussian, 2015). After multiple flushes, *E. coli* and MS2 bacteriophage could persist in the toilet bowl (Prussian, 2015) thus implicating that a toilet may continue to generate bioaerosols and the resulting droplet nuclei could contaminate the environment when settling on surrounding surfaces, such as sink tops, hygiene accessories, faucet openings, showerheads, and cups used on a daily basis. Some of these appliances, such as faucets and cups, are used for drinking water consumption. From a public health standpoint view, it is important to understand whether the aerosol effect impacts the safe use of faucets and cups in the bathroom setting. Such results are useful for public health education and control measures to minimize microbial contamination in the bathroom setting.

Based on the Safety Drinking Water Act, the United States Environmental Protection Agency (US EPA, 2019) has set standards to guard against microbial contamination in drinking water (US EPA, 2019). Indicator organisms, including *E. coli* and fecal coliform, were selected to monitor the safety of drinking water (US EPA, 2019). The presence of indicator organisms

indicates a greater risk that pathogens are present. States are required to test these indicator organisms in drinking water from public water supplies on a regular basis. The objectives of this study were to 1) Determine the presence of *E. coli* in the tap water from the fountain stream of the faucet and the reusable cup created by the aerosol effect, 2) Quantify *E. coli* concentrations in the tap water from the fountain faucet and the reusable cup created by the aerosol effect in a time series, and 3) Determine the rate of decay of *E. coli* in the water samples from the fountain faucet and the reusable cup.

Methods

Two kinds of bathroom appliances, a fountain faucet and a reusable cup for drinking water use, were tested for the aerosol effect. The fountain faucet (NASONI, Inc), which has just been introduced to the market this year, has innovative features. There is a fountain feature at the top of the arch of the faucet's downspout to the water with a lever on the right side to control the fountain stream (Figure 1C). This feature makes easy access to the water. Also, the moderate flow of the faucet can reduce the amount of water consumption. The reusable cup represents a common, traditional method for water use in the bathroom setting.

The fountain faucet was installed in a portable vanity (Figure 1A). The faucet was connected to a drinking water source via the main pipe of the sink fixture in the Environmental Health laboratory on the campus of Old Dominion University (Figure 1B). A confinement area was created for bioaerosol dispersion. As shown in Figure 2, a cardboard box was set on the top of the sink counter. Both the fountain faucet and the reusable cup were located on the countertop inside the confinement area. Also, a reusable cup was located outside the cardboard boundary to serve as a control.

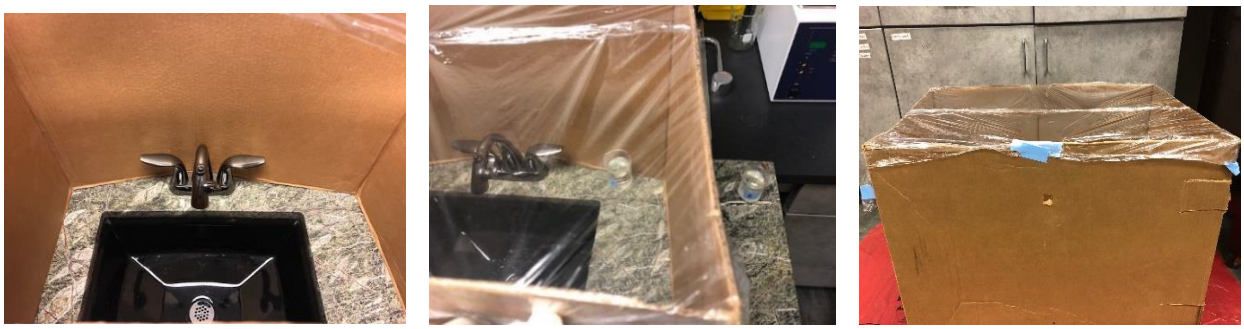
Figure 1.

Setup of NASONI fauce

A. NASONI faucet B. Pipe fixture C. Fountain & lever

Figure 2.

Setup of confined space for bioaerosol dispersion



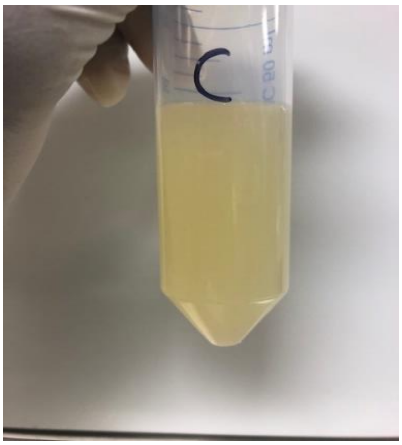
Non-pathogenic *E coli* stock (ATCC Strain 25922) was used to prepare an *E. coli* mixture used to generate bioaerosols. The *E. coli* stock with a concentration range of 1.5 – 2.0 x10^8 CFU/mL was prepared within one hour of the same day of any experiments conducted to ensure the bacterial concentrations fall within the range. A series of dilutions were conducted to determine a desirable range of *E. coli* concentrations for generating bioaerosols. After conducting the dilution series, an *E. coli* mixture was determined for generating bioaerosols, which included 1-2 mL of *E. coli* stock solution and 20 mL of sterilized tap water. A pressurized hydraulic spray nozzle was used to generate bioaerosols. Manual pumping was used to draw the liquid and force it through the spray nozzle. The technique yielded heterogeneous liquid aerosols with respect to particle size. The 20 mL *E. coli* mixture was pressurized by the manually hydraulic spray nozzle. The bioaerosols then became airborne into the confinement area and were allowed to come into contact with the faucet and the reusable cup.

Prior to the dispersion of bioaerosols, a 100 mL tap sample was collected from the fountain stream of the faucet to ensure no presence of *E. coli*. Immediately after the dispersion of bioaerosols, 100 mL of water was collected from the fountain stream of the faucet to serve as the initial sample to establish the baseline concentration. Simultaneously, 10 mL of water was collected from the reusable cup. The fountain faucet was kept open; 100 mL of water samples were then collected at intervals of 10 secs, 30 secs, 1 min, 2 mins, and 5 mins, respectively. In addition, 10 mL of water samples were collected from the reusable cup at these time points.

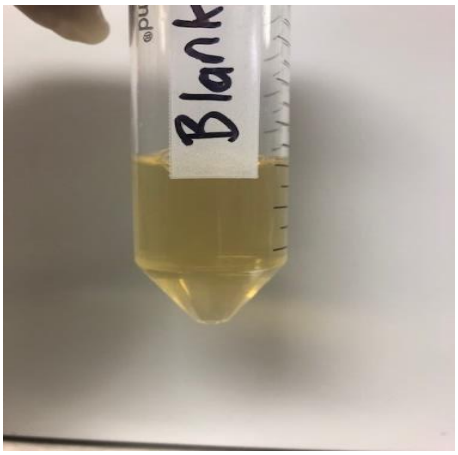
A Tryptic Soy Broth (TSB) solution was used to test the presence of *E. coli*. 10 mL of each water sample was added into 20 mL of TSB solution. The mixture was then incubated at 37ºC for 24 hrs. Turbidity was used to determine whether *E. coli* is present in the water sample (Figure 3). To quantify *E. coli* concentration, the *Colilert* test was used. This method is approved by the US EPA and is included in the Standard Methods for Examination of Water and Wastewater (APHA, 2012). 100 mL of each water sample was added into a sterilized bottle with the *Colilert* reagent (IDEXX, Inc.) Once the reagent was completely resolved, the mixture was poured into a Quanti-Tray, and sealed using a sealer. The tray was incubated at 37ºC for 24hrs and was observed for any presence of fluorescence under an ultraviolet (UV) light. The number of wells with fluorescence were counted (Figure 4) and were used to determine *E. coli* concentrations reported as MPN/100 mL (MPN, most probable number).

Figure 3.

Presence and absence of *E. coli* in TSB



Presence



Absence

Figure 4.

Quantification of *E. coli* using the *Colilert* test

Presence Absence

Quality assurance and control (QA/QC) procedures were included throughout the study. The QA/QC for the *Colilert* test was conducted, according to the manufacturer instructions. Each test included a control to ensure no *E. coli* contamination was outside the cardboard boundary. The countertop and faucet were cleaned with soapy water thoroughly after each experiment. A drinking water sample was taken from the fountain stream before each test to ensure no presence of *E. coli*. Also, a duplicate sample was collected for each water sample.

Results and Discussion

Table 1 summarizes the presence or absence of *E. coli* in water samples after bioaerosols were dispersed. Results show that the water in the reusable cup on the countertop had *E. coli*. In addition, the turbidity of these samples in the TSB solution in the reusable cup increased from Day 1 to Day 3. This suggests the possible growth of *E. coli*, as the water in the reusable cup was retained providing an ideal condition for *E. coli* to incubate. After dispersing bioaerosols, an initial water sample from the fountain stream of the faucet was collected. Turbidity in the water sample was observed and illustrated that *E. coli* was present in the water. The results show the

dispersion of bioaerosols worked properly to introduce *E. coli* to the fountain faucet. After running the fountain stream for one minute, *E. coli* continued to be present in these water samples. However, no *E. coli* was present in those samples after the fountain stream of the fountain faucet was kept running for two minutes.

These results from the presence and absence test show that the use of the fountain feature of the faucet is safer than the reusable cup. First, the opening of the reusable cup (5 cm in diameter) is significantly wider than the fountain faucet's fountain nozzle (3 mm in diameter). The reusable cup had a significantly higher chance to contract bioaerosols than the fountain nozzle of the fountain faucet does. For example, the water in the reusable cup was contaminated with *E. coli* after only one spray of <25 μL *E. coli* mixture. However, >5 mL of *E. coli* mixture was required to generate bioaerosols accumulated in the fountain nozzle of the fountain faucet to reach the detection level of *E. coli* in the fountain stream of the faucet. Second, once bioaerosols came in contact with both the reusable cup and the fountain faucet, the faucet's fountain feature could remove all bacteria in the tap water from aerosol contamination, while a reusable cup had bacteria propagating in any retained drinking water over time.

Table 1.

Presence and absence of *E. coli* in water samples after bioaerosol dispersion*

	B	C1	C2	F0	F1	F2	F3	F4	F5
Day 1	--	+	+	+	+	--	--	--	--
Day 2	--	+	+	+	+	+	--	--	--
Day 3	--	+	+	+	+	+	--	--	--

*B = blank | C= cup | C1: left on the counter | C2: right on the counter

F0 = 0 min | F1 = 30 seconds | F2 = 1 minute | F3 = 2 minutes | F4 = 3 min | F5 = 5 minutes

+ = *E. coli* presence | -- = *E. coli* absence

Day 1 = Samples incubated for 24 hours; Day 2: Samples incubated for 48 hours; Day 3: Samples incubated for 72 hours

Table 2 shows quantification of *E. coli* concentrations in the water collected from the fountain faucet. *E. coli* concentrations in the non-disposable cup were consistently greater than >1x 10^8 MPM in all the samples. Thus, the *E. coli* concentrations in the water in the reusable up were not tabulated in these tables. F0 samples indicate the initial concentrations of *E. coli* immediately after the dispersion of bioaerosols. As shown in Table 2, after running the fountain stream for 30 seconds, the fountain feature of the fountain faucet completely removed 88 MPN/100 mL of *E. coli* from the fountain stream (F1).

Table 2.

E. coli concentrations in the tap water from the stream of the faucet**

	B	F0	F1	F2	F3
Day 1	--	88	--	--	--
Day 2	--	88	--	--	--
Day 3	--	88	--	--	--

*B = blank | F0 = 0 minute | F1 = 30 seconds | F2 = 1 minute | F3 = 2 minutes

***E. coli* concentration in MPN/100 mL

In another set of the experiment, the fountain feature of the fountain faucet completely removed 866 MPN/100 mL of *E. coli*, after just running the water for 10 seconds (Table 3). To determine a decay rate, three points of measurements are required. Since the fountain feature of the fountain faucet removed *E. coli* within 10 seconds, only one point of *E. coli* concentration was detected. Thus, a decay rate was not determined.

Table 3.

E. coli concentrations in the tap water from the fountain stream of the faucet*,*

	B	F0	F1	F2	F3

Day 1	--	866	--	--	--
Day 2	--	866	--	--	--
Day 3	--	866	--	--	--

*F0 = 0 min | F1 = 10 seconds | F2 = 30 seconds | F3 = one minute

***E. coli* concentration in MPN/100 mL

The NASONI faucet is very efficient at removing *E. coli*. During testing, about 150 ml of water was collected in beakers for each sample. The time to collect each sample took roughly 10 seconds. After 10 seconds passed, there were no *E. coli* after the initial samples were taken. There were a lot of steps made to standardize experimental procedures in order to improve our consistency, concluding that after 10 secs of running water, the fountain can effectively wash away any bacteria trapped in its spout. The results gathered can aid in providing information that could further the understanding of water quality safety in household settings.

Conclusion

The safety of drinking water has been a field of interest that scientists are constantly striving to improve. This investigation enhances our knowledge on how bioaerosols affect the safety of drinking water in household bathrooms and how to possibly prevent their spread or improve hygiene. Simple things such as closing the toilet lid when flushing the toilet and cleaning the bathroom regularly using hygiene products such as soap holders, mouth rinse cups, toothbrush holders, etc. will help prevent the possibility of contracting various harmful bioaerosols.

References

Aithinne, K. A. N., Cooper, C. W., Lynch, R. A., & Johnson, D. L. (2019). Toilet plume aerosol generation rate and environmental contamination following bowl water inoculation with Clostridium difficile spores. *American Journal of Infection Control, 47*(5):515-20

American Public Health Association (APHA). *Standard Methods for the Examination of Water and Wastewater (22nd ed.)*, American Public Health Association (APHA), American Water Works Association (AWWA) and Water Pollution Control Federation (WPCF), Washington, D.C.

Best, E.L., Sandoe, J.A.T., & Wilcox, M.H. (2012). Potential for aerosolization of *Clostridium difficile* after flushing toilets: The role of toilet lids in reducing environmental contamination risk. *Journal of Hospital Infection, 80*:1–5

Dufour, A.P. (1984) *Health effects criteria for fresh recreational waters*: U.S. Environmental Protection Agency, Office of Research and Development, EPA-600/1-84-004, 33 p.

Environmental Protection Agency (1976). *Quality criteria for water*: U.S. Environmental Protection Agency, Office of Water Planning and Standards, EPA 440/9-76/023, 501 p.

Environmental Protection Agency (2019*). Quality criteria for water*: U.S. Environmental Protection Agency, Office of Water Planning and Standards, EPA 440/9-76/023, 501 p.

Johnson, D. L., Mead, K. R., Lynch, R. A., & Hirst, D. V. (2013). Lifting the lid on toilet plume aerosol: a literature review with suggestions for future research. *American Journal of Infection Control, 41*(3): 254–258. doi:10.1016/j.ajic.2012.04.330

Johnson, D.L., Mead, K.R., Lynch, R.A., & Hirst, D.V.L. (2011). *Toilet plume aerosol occupational hazards to healthcare facility workers: A review of the literature with suggestions for future research*. Retrieved from https://www.cdc.gov/niosh/nioshtic-2/20042357.html

Kim, K. H., Kabir, E., & Jahan, S. A. (2017). Airborne bioaerosols and their impact on human health. *Journal of Environmental Sciences, 67*:23-35

Kummer V, Thielb WR. (2008) Bioaerosols – Sources and control measures. *Internal Journal of Environmental Health*, 211: 299–307

Prussin, A. J., & Marr, L. C. (2015). Sources of airborne microorganisms in the built environment. *Microbiome, 3*:78. doi:10.1186/s40168-015-0144-z

Foot Care Clinics Within A Mobile Suitcase Clinic- Providing Healthcare for the Homeless

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Abstract

Homeless individuals have significantly higher rates of mortality, morbidity, and hospitalization compared to the general population. Foot problems have been described as a common concern among homeless individuals, but these are often overlooked and inadequately treated. The purpose of this article is to describe the development, implementation, and evaluation activities of footcare clinics for homeless clients as an extension of a "Suitcase Clinic" that functions within homeless shelter sites. The Suitcase Clinic provides a unique healthcare delivery model that addresses the unconventional and complex health concerns of both sheltered and unsheltered homeless individuals. This service provides clinical learning activities for public health nursing and physician assistant students within an academic-community partnership while addressing the complex needs of vulnerable homeless populations. Evaluation activities are based on the Donabedian model of structure, process, and outcome. Community-based programs with targeted screening and referrals for foot care problems can result in improved health outcomes for homeless individuals.

Purpose

The purpose of this article is to describe the development, implementation, and evaluation activities of footcare clinics for homeless clients. This project is an extension of services provided through a unique mobile clinic that operates out of a suitcase within homeless shelters in a rural community in Central Virginia. This service provides clinical learning activities for public health nursing and physician assistant students within an academic-community partnership while addressing the complex needs of vulnerable homeless populations.

Introduction

Homelessness is a major public health concern in North America. Recent reports suggest that on any given night, over 553,000 individuals across the United States are homeless (U.S. Department of Health & Human Services, 2018). Homeless individuals have significantly higher rates of mortality, morbidity, and hospitalization compared to the general population. They face a wide range of health problems such as dental problems, mental illnesses, respiratory diseases, and seizures, but frequently report unmet needs for health care (Baggett, O'Connell, Singer, & Rigotti, 2010). While homeless individuals experience healthcare disparities for many reasons, these disparities not only affect the homeless individuals, but also pose a public health risk while increasing the economic burden of the health in the community (Chen, Mitchell, & Tran, 2014).

Discussion

Foot problems have been described as a common concern among homeless individuals, but these are often overlooked and inadequately treated (To, Brothers, & Van Zoost, 2016). Lower-extremity health allows the homeless individual to seek needed resources with adequate mobility (Chen, Mitchell, & Tran, 2014). Walking is a common mode of transportation among homeless individuals and increased risks of physical injury, poor hygiene, and inadequate footwear have been cited as contributing factors to the development of foot problems (Schoon, Champlin, & Hunt, 2012). Frequently, homeless individuals self-report conditions such as fungal nails, calluses, and athlete's foot (tinea pedis) which may seem trivial. However, when coupled with the risk factors such as diabetes, smoking, substance abuse, and poor hygiene, these symptoms can lead to ulcerations, cellulitis, and serious infections (Chen, Mitchell, & Tran, 2014). Homeless individuals are also at a high risk of physical injuries and repetitive trauma which can cause limb-threatening and potentially life-threatening conditions (To, Brothers, & Zoost, 2016). In addition, the lack of access to health services and financial resources also prevent homeless individuals from receiving appropriate treatment for footcare concerns (Hwang, 2001). There is clearly a need for evidence-based interventions to improve foot health in this vulnerable population and lower the social economic burden to communities.

History of the Suitcase Clinic

The unmet social, economic, and health needs of the homeless population are of growing concern to both public and private sectors as steep costs are incurred when severely debilitated homeless individuals cycle repeatedly through hospitals, emergency departments, treatment centers, and jails. The communities of Harrisonburg and Rockingham County in Virginia have recognized homelessness as a growing problem requiring compassion, care, and understanding. In recent years, these communities have seen a growth in homelessness due to low wages, a lack of affordable housing, and unemployment. The annual Homeless *Point-in-Time* (PIT) count is a prevalence survey that counts the number of persons who are homeless on a given day each year. Table 1 shows that the reported number of homeless adults and children in this community has increased substantially since 2013 (Harrisonburg HUD and Community of Caring PIT, 2018). These numbers are likely an underestimation due to the nature of homelessness.

Table 1.

Number of Reported Persons Homeless in Harrisonburg, VA

	2013	2014	2015	2016	2017	2018
Sheltered Adults	106	98	101	109	99	111
Sheltered Children	36	26	30	37	27	33
Unsheltered Adults	10	5	3	2	1	5

In recent years, community members, homeless individuals, representatives from homeless shelters, and the academic community mobilized efforts to address these issues using tenets from Community-based Participatory Research (CBPR), a model that emphasizes local relevance of public health problems and ecological perspectives that acknowledge multiple determinants of health and disease (Minkler & Wallerstein, 2008; Kiser & Hulton, 2018). Community-wide efforts were organized to address these issues and in 2009, the *Healthcare for the Homeless Coalition* of Harrisonburg/Rockingham was formed. After conducting an in-depth community assessment, as well as numerous planning meetings and funding initiatives, the launch of the

"Suitcase Clinic" began in June 2011 and emerged in response to the inherent needs of the local homeless community.

The mission of the *Healthcare for the Homeless* Suitcase clinic is to prevent and end homelessness for vulnerable individuals and families by providing quality and integrated healthcare and promoting access to affordable housing and sustainable incomes through direct service, advocacy, and community engagement. The Suitcase Clinic provides a unique healthcare delivery model that addresses the unconventional and complex health concerns of both sheltered and unsheltered homeless individuals. Uniquely, rather than the program functioning within a permanent clinic setting, the supplies are transported in a suitcase on wheels and the clinic functions in private spaces within the six local shelter sites. This program has provided the most vulnerable individuals with access to healthcare and has become the provider of last resort when the mainstream system has not been able to offer an environment that engenders trust or when there is no healthcare service at all.

The Suitcase Clinic addresses both acute and chronic medical conditions using non-judgmental and client-centered services, which can empower clients to overcome stigmas against the traditional healthcare organizations in order to receive treatment. The Suitcase Clinic has also functioned as an intermediary portal for patients to access more mainstream services through the Harrisonburg Community Health Center. The Suitcase Clinic provides 18-20 clinic hours/week and is staffed by volunteer providers to include a full-time nursing case manager, and numerous volunteers. To qualify for services, the clients must currently be sheltered or street homeless, or have transitioned into housing within the past 90 days. In the past year, the Suitcase Clinic has provided care to over 300 unduplicated homeless clients with over 1500 care encounters, including providing over $18,000 in free medications.

Development and Implementation of Foot Clinics

A piloted footcare clinic began in January 2015 after numerous shelter managers and Suitcase Clinic volunteers reported footcare care as an unmet need. Homeless individuals have extended exposure to moisture, poor footwear, prolonged standing and walking, poor foot hygiene, and repetitive trauma (Muirhead, Roberson, & Secrest, 2011). In addition to being exposed to environmental living conditions that increase their risks for multiple foot and skin conditions, peripheral neuropathy associated with alcoholism and diabetes often complicates these problems.

The aim of the footcare clinic is screening and prevention of common systemic diseases affecting the feet.

Initial assessment of the clients for the onsite footcare clinics includes a health assessment and diabetic screening. An inspection of the feet follows and includes soaking, cleaning, nail clipping, pumice stone exfoliation, foot massage, and lotion and essential oils application. Throughout the visit, the provider intersperses health education in the conversation. Clean socks, free shoes, and appropriate referrals are also a part of the services offered in the foot clinics. Any noted foot issues are addressed on site immediately with referral to the Suitcase Clinic Nurse Practitioner (N.P.) or Physican Assistant (P.A.) and P.A. students working at that clinic site. Referrals to specialists are facilitated when the diagnosis requires.

The foot care clinics are planned, coordinated, and implemented by nursing students from a local University, in collaboration with P.A. students from the same University. Faculty from both the School of Nursing and the P.A. program also work closely with the Suitcase Clinic and provide oversite for the foot clinics. Students from the Nursing and P.A. programs work with the Suitcase Clinic as one aspect of their clinical course work. For the nursing students, the clinical hours involved in conducting the foot clinics are a part of their "Population Centered Care in the Community Clinical". Students spend a semester working with the Suitcase Clinic and are provided initially with an orientation to the Suitcase clinic and each homeless shelter served by the clinic. Each week, the students are present for the clinic and are responsible for planning and organizing the foot clinic as well as assigning roles and responsibilities to each person on the student team. Students collaborate with the Nursing faculty to prepare in advance educational materials on foot care and the relationship between care of the feet and overall health outcomes. This information is provided by the students to the clients as a part of their foot clinic visit. Throughout the clinic, students are also responsible for evaluating client outcomes and documenting the encounters in the client's medical record

Evaluation Activities

Evaluation of the Suitcase Clinic services follows a well-known model by Donabedian (1982) that highlights structure, process, and outcomes. Table 2 outlines the evaluation activities of the Footcare Clinics and highlights the aspects and data sources for ongoing evaluation and feedback.

Table 2.

Structure, Process, Outcomes of Footcare Clinics for Homeless

Structure	**Process**	**Outcome of Services/Measurement**	
Physical properties of the provided space	Cultural competence Privacy and Confidentiality	User/client satisfaction	Patient Satisfaction Tool
Access to services	Intake Foot Assessment Screening practices Client involvement in planning and evaluation	User/client satisfaction Number of referrals, visits, phone calls	Patient tracking documentation/flowsheets Client Health Records
Quality and Safety	Staffing/Qualifications Student education/ training of foot care practices for homeless	Student experiences, attitudes and behaviors	Student course evaluations/post clinical conferences Interprofessional Socialization and Valuing scale/Attitudes towards the homeless inventory

Implications

Lower extremity health in homeless individuals has important public health implications including interventions to prevent the spread of infection and subsequently lowering the community health burden and social costs (Chen, Mitchell, & Tran, 2014). Recommendations can be adapted and individualized for each community based on available resources, as these challenges are complex and require a holistic approach (Muirhead, Roberson, & Secrest, 2011). First, when designing healthcare programs for the homeless, predisposing, enabling, and need factors specific to homelessness need to be taken into consideration. Note that these individuals may not have material or financial resources that are necessary to maintain good foot hygiene. These include lack of transportation, patterns of living, co-morbid conditions, lack of resources

to adhere to regimens, lack of family support, competing needs for human survival, and a lack of judgmental care (Muirhead, Roberson, & Secrest, 2011).

Second, offer privacy and confidentiality during the footcare clinic. Embarrassment and sensitivity related to the condition of their feet, shoes, and socks have been identified as a barrier to care by homeless individuals (To, Brothers, & Zoost, 2016: Muirhead, Roberson, & Secrest, 2011). These concerns can help to guide interventions by providing materials such as clean water, soap, towels, nail clippers, clean socks, and properly fitting shoes while providing a quiet place for each client to participate in the foot care interventions (To, Brothers & Zoost, 2016).

Third, in developing academic-community partnerships assess the levels of interest and commitment of the stakeholders, as the level of commitment should be high for all involved (Schoon, Champlin, & Hunt, 2012). A comprehensive and targeted needs assessment followed by a community resource analysis is key for any community planning projects (Kiser & Hulton, 2018). Components of successful academic-community partnerships include trust and respect, competence, collaboration, commitment, and sharing of efforts (Broussard, 2011; McKinnon & Fealy, 2011). The students in this project hold fundraisers to support the purchasing of socks and shoes for the footcare clinic clients, thus demonstrating their enthusiasm and commitment to the projects. All of these components are integral in the implementation and sustainability of the foot care clinics. Finally, more research is needed on podiatric conditions and care among the homeless to create evidence-based interventions that are successful and sustainable. There is a limited body of literature on this topic despite the prevalence of foot problems in this population, thus leading to significant gaps that assess long-term health outcomes or better epidemiological data (To, Brothers, & Zoost, 2016; Chen, Mitchell, & Tran, 2012).

Summary

Given the high burden of unmet and social needs of this population, mobile interventions such as those provided by the Suitcase Clinic may be effective in providing foot care to homeless populations (To, Brothers, & Zoost, 2016). Community-based programs with targeted screening and referrals for foot care problems could result in improved health outcomes for homeless individuals.

References

Baggett, T.B., O'Connell, J.J., Singer, D.E., & Rigotti, N.A. (2010). The unmet healthcare needs of homeless adults: A national study. *American Journal of Public Health, 100,* 1326-1333. doi:10.2105/AJPH.2009.180109

Broussard, B., (2011). The bucket list: A service-learning approach to community engagement to enhance community health nursing clinical learning. *Journal of Nursing Education, 50,* 40-43. doi: 10.3928/01484834-20100930-07

Chen, B., Mitchell, A. & Tran, D. (2014). "Step up for foot care": Addressing podiatric care needs in a sample homeless population. *Journal of the American Podiatric Medical Association, 104*(3), 269-276.

Donabedian, A. (1982). *The criteria and standards of quality*. Ann Arbor, MI: Health Administration Press.

Harrisonburg HUD and Community of Caring (2018). *Annual Homeless Point in Time Survey*.

Hwang, S. (2001). Homelessness and health. *Canadian Medical Association Journal, 164* (2), 229-233.

Kiser, T. & Hulton, L. (2018). Addressing health care needs in the homeless population: A new approach using participatory action research. *Sage Open Special Collection-CBPR.* July-Sept, 1-7. DOI: 10.1177/2158244018789750

Minkler M, Wallerstein N, editors. , *Community based participatory fesearch for health: Process to outcomes (2nd ed.)* San Francisco, CA: Jossey Bass; 2008

Muirhead, L., Roberson, A., & Secrest, J. (2011). Utilization of foot care services among homeless adults: Implications for advanced practice nurses. *Journal of the American Academy of Nurse Practitioners,* 23. 209-215.

Schoon, P., Champlin, B., & Hunt, R. (2012). Developing a sustainable foot care clinic in a homeless shelter within an academic-community partnership. *Journal of Nursing Education, 15*(12), 714-718. doi: 10.3928/01484834-20121112-02

U.S. Department of Housing and Urban Development (2018). The 2018 Point-in-Time Estimates of Homelessness. 2018. The Annual Homelessness Assessment Report to Congress. Retrieved from https://files.hudexchange.info/resources/documents/2018-AHAR-Part-1.pdf

To, M.J., Brothers, T.D., & Van Zoost, C. (2016) Foot conditions among homeless persons: A systematic review. *PLoS ONE 11*(12), 1-14. doi: 10.1371/journal.pone.0167463

Interprofessional Learning Readiness: Health Policy Summit

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Abstract

Purpose:

Interprofessional Education (IPE) and Health Policy are important components in health professional curricula. Students from business, communication sciences and disorders, dietetics, occupational therapy, nursing, and social work participated in an innovative IPE event working in an IPE group to apply discipline specific knowledge and propose solutions to the Medicaid Expansion gap in Virginia. Students presented their final proposals to legislators while advocating for issues important to their discipline.

Methodology/Results:

This study used the Readiness for Interprofessional Learning Scale (RIPLS) to examine student Teamwork and Collaboration, Professional Identity, and Roles and Responsibilities following participation in a Health Policy Summit. The results revealed a difference at baseline between health professions students and business students (N= 260) in their perception of teamwork and collaboration between groups. The themes of the question items found to be significant within the scale pre- and posttest were student perception of learning with other health-care/professional students, shared learning to help students understand their limitations, and welcoming opportunities to work with IPE students.

Conclusion:

This data indicates that there remains an opportunity to promote student perceptions of their abilities to participate in teamwork, collaborate significantly, and to understand the scope of their discipline specific knowledge and contributions to a team.

Key words: *interprofessional, health policy*

Introduction

Interprofessional education (IPE) is when two or more professions learn from and work with each other to enable effective collaborations, and to improve the wellbeing of the community (World Health Organization (WHO), 2010). Established by the Institute of Medicine in the 1970's, guidelines for IPE curricula stress the importance of IPE for both professionals and clients/patients, and propose the models and application that reflect the holistic approach. There are several different methods of IPE to include case simulations through online learning, simulations through pedagogy, combining classroom and clinical learning, pilot studies, utilizing small groups, health mentors in clinical settings, scenario modeling and role playing, and faculty training. Interprofessional practice and more advanced IPE interventions may be more effective if the students involved have optimistic outlooks on teamwork and knowledge about the professions that they would be working with (Jutte, Browne, & Reynolds, 2016).

There are benefits of IPE for both patients/clients and healthcare professionals. These include increased safety, improved patient care, reduction of health inequities, reasonable costs, better patient outcomes and collaborative care (Kolmer, Quinn, & Steele, 2010). When students are properly equipped and directed, they become better liaisons between their practice, patients, families, and the community (Earnest & Brandt, 2014). When learning from an IPE model or approach, students are taught not only the roles in which they will carry out their professions, but also can describe those of the other professionals within their team. This leads to a more comprehensive understanding of their profession as well as others (Charles et al, 2011). IPE training amongst health and social service professions includes the importance of understanding the social determinants of clients (Addy et al, 2015). Training professionals to work within a team and adapt to the needs of their community can reduce health inequities, and keep costs from rising by adjusting the services provided to match the complexity and acuity of the individual (Dow & Thibault, 2017). Interprofessional collaboration has been shown to improve team behavior and reduce the potential for medical error (Loversidge & Demb, 2015). Students begin to appreciate teamwork by authentic experiences, thus providing the ability to build relationships, both intra- and inter-professionally, while allowing them to test collective methods alongside faculty mentors (Loversidge & Demb, 2015).

Some common barriers to the implementation of IPE include the fear of professionals being territorial and fear of domain infringement, power differences among professions, different philosophies and values of the differing professions, deskilled or de-professionalized, closed role boundaries, loss of professional knowledge, role insecurity, and the perceived need for clinical autonomy (Charles et al, 2011; Kolomer, Quinn, and Steele, 2010). Other limitations to the implementation of IPE within programs is the lack of funding, and challenges of incorporating a curriculum that bridges education and practice which has created difficulty in evaluating the readiness of students in IPE programs (Chen, Delnat, & Gardner, 2015). Some of the most authentic and robust academic experiences come from students being paired in high-functioning collaborative teams and these processes could be limited by faculty commitment and time requirements, thus limited the availability of these placements (Loversidge & Demb, 2015).

An annual interprofessional health policy summit brings together students from several disciplines with the goal of leveraging diverse professional perspectives to develop potential solutions to real-world problems. Given that IPE is integral to professional practice, we sought to measure the attitudes of health and social services students and professionals regarding interprofessional learning using the Student Readiness for Interprofessional Learning Scale (RIPLS). RIPLS has been used across several settings, sometimes in its entirety and sometimes as a supplement to other assessments. IPE trainings that have implemented pre-and post-tests utilizing RIPLS have indicated results of student's readiness, perceptions, and attitudes towards interprofessional learning (Lipton et. at., 2010; Murphy & Nimmagadda; Thompson et al, 2016).

Methods

Students from the School of Nursing, College of Business, and Departments of Occupational Therapy, Dietetics, Social Work and Communication Sciences and Disorders at a medium-sized public university come together each year for a Health Policy Summit (HPS). The HPS engages students using Team Based Learning (TBL), which has been shown to improve learning and promote students' ability to solve difficult and complex problems (Michaelsen et al., 2002). The four key components of TBL include appropriate group formation where intellectual talent is equally distributed, student accountability for teamwork, assignments that promote learning and team development, and frequent and immediate feedback.

To ensure accountability, students reviewed discipline specific basics of legislation, health policy advocacy, and learned about a health care "hot topic", the Virginia Medicaid Gap, in advance of the HPS. On the day of the HPS, students' were grouped according to self-identified skills and experiences and then sub-divided by counting off and forming IPE groups of 5-6 students. This method composes groups of relatively equal skills and experiences. Within the IPE groups an Individual Readiness Test (IRAT) and a Group Readiness Assessment (GRAT) was given to assess baseline knowledge of health policy. The IRAT promotes individual accountability for readiness, while the GRAT promotes group socialization and sharing of discipline specific knowledge. Immediate review of the IRAT and GRAT with an expert faculty facilitator provided students an opportunity to ask questions for clarification while providing contextual application examples for students. Following this, students were given a case study that detailed the experience of a family living in the Virginia Medicaid Gap. Students worked in their IPE groups to develop possible feasible and sustainable solutions to Medicaid Expansion in Virginia to close the gap. The proposed solutions were outlined on a poster and placed around the conference room in a Gallery Walk where students, faculty, and local legislators reviewed each proposal. Students voted on the proposals and the top three were presented to local legislators in an 3-minute elevator speech. The local legislators asked clarifying questions and brought up historical references as a means to strengthen proposals.

Following the HPS, the legislators shared that they were impressed with the students' innovative and creative problem-solving approaches and indicated that the interprofessional approach was apparent in the proposals. They even requested copies of the proposals to take back with them to the General Assembly. The students gave positive feedback and reported appreciating the chance to learn how to work in an interprofessional group, advocate for their practice, gain perspective of other professions, and communicate with and build rapport with legislators.

Sample and Instrument

This interprofessional teaching and learning project was designed to examine student readiness for interprofessional learning. A convenience sample of students (N=260) from nursing (n=90), business (n=60), occupational therapy (n=20), dietetics (n=15), social work (n=48), and communication science and disorders (n=27) who attended the Health Policy Summit were recruited (Table 1). The Readiness for Interprofessional Learning Scale (RIPLS) was used to

examine students' knowledge, skills, and attitudes regarding working with other health care professionals. The questionnaire consists of 19 items, with a three-factor subscale: teamwork and collaboration, professional identity, and roles and responsibilities (Parsell & Bligh, 1999). High RIPLS scores are reflective of a high level of readiness for interprofessional learning. The Cronbach Alpha value for the total scale was ($\alpha = 0.89$).

Table 1:

Student Participants By Major

Student Major	**Number of Participants**
Nursing	90
Business	60
Occupational Therapy	20
Dietetics	15
Communication Sciences and Disorders	27
Social Work	48
Total	**260**

Data Analysis

We used one descriptive statistic, primary major discipline, for the identifier of the participant. Paired-samples t-test was used to compare pre-test scores with post-test scores by discipline and for the entire group. A one-way analysis of variance (ANOVA) was conducted to examine significant differences among the specific dimensions of RIPLS by discipline. SPSS version 25 was used for all analyses.

Results

In this sample, the pretest and posttest scores for business students was significantly different on the subscale of Perception of Teamwork and Collaboration (pretest M = 36.3; posttest M = 40.5; t(26)=-2.815, p = 0.009). A pretest/posttest difference was found for the items on student perception of learning with other healthcare/professional students before qualification would improve relationships after qualification (pretest M= 4.44; posttest M = 4.48; t(194)= -2.57, p = 0.011); shared learning will help me to understand my own limitations (pretest M= 4.24; posttest M = 4.41; t(194)= -2.040, p = 0.043); and I would welcome the opportunity to work on small-group projects with other health-care/professional students (pretest M = 3.88; posttest M= 4.17; t(194)= -2.851, p = 0.005). Interestingly, an improvement was noted for the reverse coded item I don't want to waste my time learning with other healthcare/professional students (pretest M = 2.14; posttest M = 1.90; t(194)= 2.219, p = 0.028).

Table 2 illustrates the pre-test and post-test scores for each of the items on the RIPLS.

Table 2:

RIPLS Results

Question	**Pretest**	**Posttest**	**Paired Samples t-test**	**p-value**
Learning with other students will help me become a more effective member of a team	M= 4.51 SD= 0.756	M= 4.51 SD= 0.814	t(194)=0.023,	p = 0.982
Patients would ultimately benefit if health-care/professionals worked together to solve patient problems	M= 4.73, SD = 0.66	M= 4.65 SD= 0.756	t(194)=1.171,	p = 0.243
Shared learning with other health-care/professional students will increase my ability to understand clinical problems	M= 4.44, SD= 0.780	M= 4.48, SD= 0.788	t(194)= -0.497,	p = 0.620
Learning with health-care/professional students before qualification would improve	M= 4.28, SD= 0.847	M= 4.49, SD= 0.727	t(194)= -2.57,	p = 0.011

relationships after qualification				
Communication skills should be learned with other health-care/professional students	M= 4.41, SD= 0.816	M= 4.56, SD= 0.739	t(194)= -1.90,	p = 0.058
Shared learning will help me to think positively about other professionals	M= 4.39, SD= 0.794	M= 4.37, SD= 0.866	t(194)= -0.223,	p = 0.823
For small group learning to work, students need to trust and respect each other	M= 4.69, SD= 0.648	M= 4.59, SD= 0.729	t(194)= 1.538,	p = 0.126
Team-working skills are essential for all students to learn	M= 4.44, SD= 0.862	M= 4.56, SD= 0.739	t(194)= -1.509,	p = 0.133
Shared learning will help me to understand my own limitations	M= 4.24, SD= 0.853	M=4.41, SD= 0.796	t(194)= -2.040,	p = 0.043
I don’t want to waste my time learning with other health care/professional students	M= 2.14, SD= 1.162	M= 1.90, SD= 1.053	t(194)= 2.219,	p = 0.028
It is not necessary for undergraduate students to learn together	M=1.76, SD= 0.930	M= 1.71, SD= 0.965	t(194)= 0.510,	p = 0.611
Clinical problem-solving skills can only be learned with students from my own department	M= 1.77, SD= 0.965	M= 1.80, SD= 0.993	t(194)= -0.305,	p = 0.761
Shared learning with other health-care/professional students will help me to communicate better with patients and other professionals	M= 4.36, SD = 0.810	M= 4.37, SD= 0.890	t(194)= -0.076,	p = 0.939
I would welcome the opportunity to work on small-group projects with other health-care/professional students	M= 3.88, SD= 1.056	M= 4.17, SD = 0.953	t(194)= -2.851,	p = 0.005
Shared learning will help to clarify the nature of patient problems	M= 4.25,	M= 4.33,	t(194)= -0.979,	p = 0.329

	SD= 0.825	SD = 0.866		
Shared learning before qualification will help me become a better team worker	M= 4.22, SD= 0.791	M= 4.38, SD= 0.861	t(194)= -1.830,	p = 0.069
The function of nurses and therapists is mainly to provide support for doctors	M= 2.14, SD = 1.221	M= 2.19, SD = 1.290	t(194)= -0.473,	p = 0.637
I'm not sure what my professional role will be	M= 2.16, SD = 1.237	M= 2.34, SD= 1.248	t(194)= -1.395,	p = 0.164
I have to acquire much more knowledge and skills than other health-care/professional students	M= 2.97, SD= 1.105	M= 3.36, SD= 1.161	t(194)= -3.297,	p = 0.001

Discussion

Interprofessional education is an integral component for students entering professional fields to introduce and reinforce concepts of teamwork and collaboration. Our results indicate that once exposed to a team-based learning interprofessional education experience, students have a more favorable attitude toward IPE. Introducing students to theoretical concepts of IPE early in each program and exposing students to IPE regularly during each program is likely to enhance students' role development in the domains of teamwork and collaboration. Indeed, starting early and gradually introducing students to IPE has been reported to be a valuable method for fostering collaborative spirit and to mutual respect (Cooper, Spencer-Dawe, & McClean, 2005).

Interestingly, there was not a significant difference in student perception in the overall subscales of teamwork and collaboration or negative and positive professional identity pre- and post-summit event. Many factors contribute to student perceptions of these subscales and professional programs teach theoretical concepts of IPE. Exposure to IPE concepts, even without a structured IPE event, may have affected student scores in these areas. However, business students were found to be significantly different in their perception of teamwork and

collaboration between groups, indicating that there is an opportunity to enhance these concepts in business curricula.

Conclusions

Emerging healthcare professionals are often consumed with the intensity of their work in learning to provide needed healthcare services. Students may underestimate their abilities to work together across disciplines in civic education for legislators on the need for health policy change. Implementing IPE activities to build student capacity to solve important real-world problems may enhance the likelihood of positive application of discipline specific concepts to public issues in the future. Healthcare professional students may have stronger attitudes toward interprofessional learning, which has implications for future work and continuing education. Further research on discipline specific attitudes toward working inter-professionally with an emphasis on understanding how these attitudes are promoted or discouraged in undergraduate education and how the value of teamwork and collaboration influence student learning will add to the developing body of work on this topic and inform future IPE endeavors.

Recommendations

IPE is recognized by professional healthcare related careers and accreditation bodies as foundational to promoting good, quality services to patients. Events such as the Health Policy Summit can help educate students from all health professions practice collaborative work. There is considerable evidence to support implementing IPE and ideally fosters specific competencies in the learner such as leadership, consensus building, and collaboration. Although there are barriers to IPE, we advocate consideration of this type of model to implement IPE across an undergraduate curriculum. New curricular events can be exciting, but the operational support and commitment of faculty must exist to support truly effective, long-term IPE. As this project is approaching the seventh year, it is evident that the faculty are demonstrating their own IPE in action.

References

Addy, C. L., Browne, T., Blake, E. W., & Bailey, J. (2015). Enhancing interprofessional education: Integrating public health and social work perspectives. *American Journal of Public Health*, *105*, S106-S108.

Charles, G., Barring, V., & Lake, S. (2011). What's in it for us? Making the case for interprofessional field education experiences for social work students. *Journal of Teaching in Social Work*, *31*(5), 579-593. doi:10.1080/08841233.2011.615265

Chen, F., Delnat, C. C., & Gardner, D. (2015). The current state of academic centers for interprofessional education. *Journal of Interprofessional Care*, *29*(5), 497-498. doi:10.3109/13561820.2014.1002908

Cooper, H., Spencer-Dawe, E., & McClean, E. (2005). Beginning the process of teamwork: Design, implementation and evaluation of an inter-professional education intervention for first year undergraduate students. *Journal of Interprofessional Care*, *19*(5), 492-508.

Dow, A., & Thibault, G. (2017). Interprofessional education - A foundation for a new approach to health care. *New England Journal of Medicine*, *377*(9), 803-805. doi:10.1056/NEJMp1705665

Earnest, M., & Brandt, B. (2014). Aligning practice redesign and interprofessional education to advance triple aim outcomes. *Journal of Interprofessional Care*, *28*(6), 497-500. doi:10.3109/13561820.2014.933650

Jutte, L. S., Browne, F. R., & Reynolds, M. (2016). Effects of an interprofessional project on students' perspectives on interprofessional education and knowledge of health disciplines. *Athletic Training Education Journal*, *11*(4), 189-193. doi: 10.4085/1104189

Kolomer, S., Quinn, M. E., & Steele, K. (2010). Interdisciplinary health fairs for older adults and the value of interprofessional service learning. *Journal of Community Practice*, *18*(2/3), 267-279. doi:10.1080/10705422.2010.485863

Lipton, H. L., Lai, C. J., Cutler, T. W., Smith, A. R., & Stebbins, M. R. (2010). Peer-to-peer interprofessional health policy education for medicare part D. *American Journal of Pharmaceutical Education*, *74*(6), 1-6.

Loversidge, J., & Demb, A. (2015). Faculty perceptions of key factors in interprofessional education. *Journal of Interprofessional Care*, *29*(4), 298-304. doi:10.3109/13561820.2014.991912

Michaelsen L, & Sweet M. (2008). The essentials of team-based learning: small-group learning's next big step. *Wiley InterScience: New Dir Teach Learn (116).* 7–27.

Murphy, J. I., & Nimmagadda, J. (2015). Partnering to provide simulated learning to address interprofessional education collaborative core competencies. *Journal of Interprofessional Care*, *29*(3), 258-259. doi:10.3109/13561820.2014.942779

Thompson, B. M., Bratzler, D. W., Fisher, M. J., Torres, A., Faculty, E., & Sparks, R. A. (2016). Working together: Using a unique approach to evaluate an interactive and clinic-based longitudinal interprofessional education experience with 13 professions. *Journal of Interprofessional Care*, *30*(6), 754-761. doi:10.1080/13561820.2016.1227962

World Health Organization. (2010). *Framework for action on interprofessional education & collaborative practice.* Retrieved from http://www.who.int/hrh/resources/framework_action/en

Parental Characteristics Related to Specialty Therapy Service Utilization Among Children – A Virginia and National Comparison

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Abstract

Purpose:

Identify how parental characteristics impact specialty therapy service utilization among children between the ages of 1-17 from the 2016 National Survey of Children's Health (NSCH).

Methods:

Data for this study included 50,212 parents from a nationally representative sample and 1,158 parents in the state of Virginia where characteristics were identified that negatively influenced the utilization of specialty therapy services for child.

Results:

Of 1,158 children between the ages of 1-17 years in Virginia, 9.5% of children needed special therapy such as physical, occupational, or speech therapy. Of those children in need of special therapy services, 3.6% did not receive the necessary health resources. Impacting variables associated with the needed health care not received included, coordination of care among health care providers or services (75%), health care costs (58.3%), difficulties paying for child's medical bills (88.9%) and complications accumulating necessary specialist care (83.3%).

Conclusions:

Long-lasting consequences will arise if children are not receiving early intervention specialty services such as educational and employment disadvantages, low socioeconomic status, and poor health outcomes. This analysis suggests public health concerns should be focused on what parental characteristics directly impact specialty therapy services among children and what

type(s) of intervention services would promote the uptake of services to improve health outcomes.

Introduction

Despite public and private programs to improve social determinants of health and health equality within at-risk populations, evidence continues to demonstrate the depth of this public health concern. Within recent decades, research has examined the outcomes of medical care access shown to improve children's health. According to Leininger & Levy (2015), access to health care and providers plays a small role in the uptake of services, where other contributing factors are much more alarming. For example, lack of medical access makes up a mere 10% of early mortality in the population associated with variables such as genetic makeup and environmental factors (McGinnis & Foege, 1993). As a result, public health representatives may consider seeking out other variables to improve necessary health outcomes for children.

A knowledge gap exists that seizes to identify what contributing factors associated with the parent or guardian are halting the uptake of specialty services such as physical, occupational and speech therapy of their child. Furthermore, a lack of knowledge exists to identify the repercussions associated with these services not being utilized and the life-long consequences that may arise. The purpose of this study seeks to identify what parental characteristics impact specialty therapy service utilization among children aged 1 to 17 years. It is critical to recognize parental characteristics that are impacting these services in view of the fact that interventions can be implemented to assist in the uptake of such services. These characteristics may suggest that necessary health services are not being met for their children where specialty therapies (i.e., physical, occupational and speech) are lacking. Negative health outcomes that can have lifelong consequences are likely to occur if children are not receiving these services.

Despite tremendous progression, not all children have health insurance coverage, where immigrant children are the most vulnerable population. In addition, accumulated health insurance coverage does not guarantee access to care where insured children may continually face barriers to receive access of care needed (Leininger & Levy, 2015). Insurance coverage among low-income children is fluid where children actively move between public and private insurance and being uninsured. For example, according to one nationally represented study, over

one-quarter of child enrollees in Medicaid had left the program, where half had become uninsured (Sommers, 2005). A phenomenon described as "churn" has been named to explain high Medicaid dropout rates coupled with readmission into the program in a momentary time period (Hayes & Schoen, 2013). Unfortunately, this pattern is foreseen to continue over the next decades where children's eligibility for health insurance coverage will churn between subsidized and employer-based coverages and Medicaid (Sommers & Rosenbaum, 2011). The Affordable Care Act (ACA) currently imposes a fine on families if their children are uninsured; however, a grace period allows a lapse in health insurance coverage of up to three months in any given year (Gardner, 2019). This lapse in coverage is alarming as undesired outcomes are likely to occur such as high medical costs, decreased uptake of necessary services and family distress.

The requirement for healthcare is dominated by their health status; the poorer health a child is in, an increase is medical services will be necessary. However, inferior health may also create specializations of care for the child, which may be difficult to accumulate. For example, physician availability to provide necessary services is determined by the number of physicians/providers within a geographical location (Gardner, 2019). Moreover, specialty service providers such as physical therapists, occupational therapists and speech therapists may lack within a location, creating unavailable access to services. The lack of services within a geographical location requires access to transportation, which may cause supplemental burdens to families who are already at disadvantages. The state (i.e., Virginia) a child lives in has been shown to affect access to health care needs in light of differing demands of the healthcare system. For example, the healthcare system is heavily dependent on the population size as well as states' health policy decision making and has been shown to affect access to health care needs (Gardner, 2019).

Methods

The conceptual model of Anderson and Newman on Health Service Utilization was identified as the framework and foundation of this study. This conceptual model set out to determine circumstances that facilitate or hamper utilization of access to medical care (Andersen, 1995). The Andersen and Newman framework distinguished three identifiable characteristics considered to influence an individual's access; predisposing factors, enabling factors and need factors.

The initial characteristic highlighted in this conceptual model includes predisposing factors. Factors that have been identified include socio-cultural characteristics of the patient that were present preceding the individual's illness. Social structure is recognized as one predisposing factor and is associated with multitudinous attributes such as education and ethnicity (Andersen, 1995). Education level was one parental feature that was identified within the present study that is a well-established predictor of socioeconomic status. The second factor that influences access to medical care is enabling factors. Enabling factors are described as the organization or planning of the obtained health care such as personal/family and community influences (Andersen, 1995). Inferior health care access in various geographical locations creates transportation requirements, leading to additional burden to families.

Within this present study, geographical location was taken into consideration to identify whether health care availability and accessibility is a factor on the uptake of specialty therapy services among children. Finally, the third characteristic Andersen & Newman (1995) identified that affects an individual's access to health services is the need factor. The need factor is influenced by two variables including the perceived outcome and the evaluated outcome. A perceived need factor is driven from the individual's personal view upon their own general health and functional state, where the evaluated need factor represents the judgment of a professional (i.e., physician) (Andersen, 1995). When evaluating the effect of parental characteristics on specialty therapy service utilization among children, an apparent need to seek out health care resources and services to improve the overall health and well-being of the child is desired.

Data

The data were obtained from the 2016 National Survey of Children's Health (NSCH) (United States Census Bureau, 2018). Parents or guardians knowledgeable of the study child's health and health care were asked to complete the NSCH survey. The sample for this study was derived from the original 50,212 households nationwide with age eligible children (0-17 years old) whose caregivers completed the survey. The first filtering criteria selected for this study to identify the cases was age. Age was filtered to include children between the ages of 1 to 17 years. The next filter added to the data included isolating households from the state of Virginia. Finally, the necessity of specialty services such as whether the child needed physical, occupation or speech therapy was filtered for both national and state data. Nationally, 50,212 children

between the ages of 1 to 17 were examined from a representative sample drawn from all regions of the United States. When identifying identical factors solely in the state of Virginia, 1,158 children included in the sample were examined.

Variables

The dependent variable in this investigation asked the respondents, 'Does [study child] need or get special therapy, such as physical, occupation, or speech therapy?'. Responses for the dependent variable were dichotomous and recorded as either 'yes' or 'no'. All pertinent independent variables for the present study were selected from the 2016 NSCH as defined by the Andersen Newman Framework and categorized into predisposing factors, enabling factors and need factors.

When identifying parental characteristics, independent variables targeted within this study examined race, education, primary household language, employment status, health insurance coverage and geographical location. Race of selected child was presented to the parent/guardian as, 'What is [study child]'s race?' and included responses of White alone, Black or African American alone, American Indian or Alaska Native alone, Asian alone, Native Hawaiian and other Pacific Islander alone, some other race alone, and two or more. Coupled with this question, a separate ethnicity question was presented within the NSCH questionnaire which asked, 'Is [study child] of Hispanic, Latino, or Spanish origin?'. Responses for this independent variable were dichotomous and recorded as 'Hispanic or Latino Origin' or 'Not Hispanic or Latino Origin'. For the purposes of this study, responses were collapsed down into 4 races; 'White', 'Black', "Hispanic' and 'Other'.

The second independent variable that was identified within this study was educational status. The questionnaire asked, 'What is the highest grade or year of school you have completed?' where responses included '8th grade or less', '9th-12th grade; no diploma', 'High school graduate or GED completed', 'Completed a vocational, trade, or business school program', 'Some college credit, but no degree', 'Associate degree', 'Bachelor's degree', 'Master's degree' and 'Doctorate or professional degree'. For the purposes of this study, the examined variables when identifying educational status included; no diploma, high school graduate, some college credit, associate degree, bachelor's degree, master's degree, and doctorate or professional degree. In conjunction

to education, primary household language was identified as a parental characteristic as it relates to Andersen and Newman's Framework model where social structure affects the access of healthcare services. Respondents reported to the question, 'What is the primary language spoken in the household?' and responses included 'English', 'Spanish' and 'Other'.

Enabling factors pinpointed in Andersen and Newman's Framework model identified personal/family enabling factors that contributed to the accumulation or lack of care obtained. This aspect was included within the current study by including independent variables associated with employment (5 out of 52 weeks) and health insurance coverage (over past 12 months). Employment was identified when respondent answered, 'Were you employed at least 5 out of the past 52 weeks?'; answers were dichotomous in nature and recorded as 'Yes' or 'No'. Health insurance coverage was recorded by presenting the question, 'During the past 12 months, was [study child] ever covered by any kind of health insurance or health coverage plan?'; responses to this question included 'Yes, this child was covered all 12 months', 'Yes, but this child had a gap in coverage' and 'No'. The final parental characteristic that was identified in relation to the independent variables was geographical location, in accordance with Andersen and Newman's Framework model where enabling factors such as community influences affect received health care services. This independent variable derived from the response holders' home and associated zip codes presented within the NSCH survey.

Additional independent variables identified that may contribute to the lack of uptake of specialty services were accessed. Initially, a dichotomous question with responses of 'Yes' or 'No' was presented to parents stating, 'During the past 12 months, was there any time when [study child] needed health care but it was not received? By health care, we mean medical care as well as other kinds of care like dental care, vision care, and mental health services.' Other variables identified which had responses of 'Yes' or 'No' included: 'Which of the following contributed to [study child] not receiving needed health services: there were issues related to cost, the services [study child] needed were not available in your area, there were problems getting an appointment when [study child] needed one and there were problems with getting transportation or child care'.

Simple descriptive statistics (means, medians, standard deviation, ranges, and proportions) for the primary dependent variable, and independent variables were conducted. In addition to

descriptive statistics, analysis between our independent and dependent variables was performed through SPSS version 25 (IBM Corp, 2017).

Results

The current study identified parental characteristics that could potentially hamper the uptake of specialty therapy service utilization among children between the ages of 1 to 17 years. Results were grouped in accordance with Andersen and Newman's Framework model. Predisposing factors and enabling factors were coupled together when evaluating parental characteristics. Need factors were identified as outcome variables that contributed to the necessary health care services (physical, occupational and speech therapy) not being utilized.

Predisposing Factors

Predisposing factors included race, education and primary household language (Table 1). Nationally, out of 50,212 respondents, 38,961(77.6%) were White, 3,075(6.1%) were Black, 5,523(11.0%) were Hispanic and 8,176(16.2%) identified as a race other than White, Black or Hispanic. Virginia data held a total number of 1,158 respondents where 792(68.4%) were White, 120(10.4%) were Black, 104(9.0%) are Hispanic and 246(21.3%) identified as another race. Out of the 50,212 respondents nationally, 1,552(3.2%) held no diploma, 5,372(11.0%) were high school graduates, 7,052(14.5%) had some college credit, 5,131(10.5%) hold an associate's degree, 15,475(31.8%) hold a bachelor's degree, 9,769(18%) hold a master's degree and 3,080(6.3%) hold a doctorate or professional degree. Finally, the last predisposing factor that was identified in this study when identifying parental characteristics was the primary household language. Nationally, 46,687(93.7%) of respondents stated the primary household language spoken was English. In comparison, within the state of Virginia, 1,063(92.3%) of respondent's primary household language was English. Nationally, 1,397(2.8%) speak Spanish and 1,751(3.5%) speak a language other than Spanish or English. In comparison, 33(2.9%) of respondents in the state of Virginia identified as a Spanish speaking household and 56(4.9%) stated that a language counter to Spanish or English is spoken.

Table 1.

Predisposing Parental Characteristics of National and Virginia Samples from the 2016 NSCH

Predisposing Parental Characteristics		*National Freq(%)*	*Virginia Freq(%)*
Race	White	38961(77.6)	792(68.4)
	Black	3075(6.1)	120(10.4)
	Hispanic	5523(11.0)	104(9.0)
	Other	8176(16.2)	246(21.3)
Education	No Diploma	1552(3.2)	20(1.7)
	High School Graduate	5372(11.0)	93(8.3)
	Some College Credit	7052(14.5)	167(15.0)
	Associate Degree	5130(10.5)	91(8.1)
	Bachelor's Degree	15475(31.8)	370(33.1)
	Master's Degree	9769(18.0)	275(24.6)
	Doctorate or Professional Degree	3080(6.3)	77(6.9)
Primary Household Language	English	46687(93.7)	1063(92.3)
	Spanish	1397(2.8)	33(2.9)
	Other	1751(3.5)	56(4.9)

Enabling Factors

Enabling factors distinguished in this study included employment (5 out of 52 weeks), health insurance coverage (past 12 months) and geographical location (Table 2). Nationally, 37,592(73.5%) respondents stated that they were employed a total of 5 weeks out of 52 weeks. In comparison, nationally, 11,538(23%) of individuals were not employed 5 out of 52 weeks. When examining the state of Virginia, 856(73.9%) of respondents were employed during the same parameters; however, 271(24%) stated they were unemployed. Nationally, 47,488(95%) of individuals responded that their child had health insurance coverage all 12 months, 1,202(2.4%) had health insurance coverage during the past 12 months, but with a gap in that coverage, and 1,310(2.6%) had no health insurance coverage. Virginia respondents stated that 1,092(94.6%) had complete health insurance coverage for their child over the past 12 months, 31(2.7%) had health insurance coverage, but a gap in coverage, and 31(2.7%) had no health insurance coverage. Finally, national data on parental characteristics illuminated results where 28,367(83.9%) of respondents lived in a metropolitan statistical area and 5,428(16.1%) did not live in a metropolitan statistical area. In comparison, in the state of Virginia, 1,158(100%) of respondents live in a metropolitan statistical area, derived from the zip code of respondent's homes.

Table 2.

Enabling Parental Characteristics of National and Virginia Samples from the 2016 NSCH

Enabling Parental Characteristics		*National Freq(%)*	*Virginia Freq(%)*
Employment (5 out of 52 weeks)	Yes	37592(73.5)	856(73.9)
	No	11538(23)	271(24.0)
Health Insurance Coverage (past 12 months)	Yes, child covered all 12 months	47488(95.0)	1092(94.6)
	Yes, but child had	1202(2.4)	31(2.7)

	gap in coverage		
	No	1310(2.6)	31(2.7)
Geographical Location	Metropolitan Statistical Area	28367(83.9)	1158(100.0)
	Not Metropolitan Statistical Area	5428(16.1)	0(0.0)

Need Factors

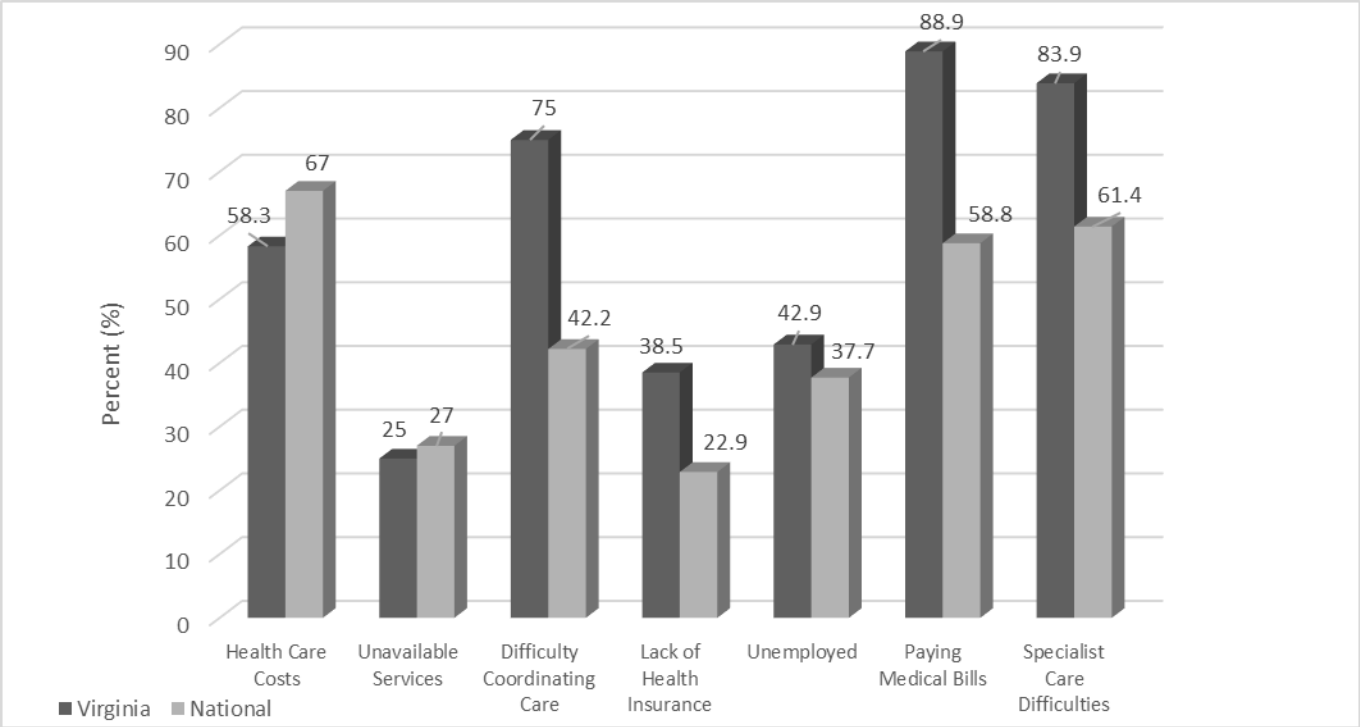
Of the 1,158 children between the ages of 1-17 years in Virginia, 9.5% of children were in need of special therapy services such as physical, occupational, or speech therapy. Of those children in need of special therapy services, 3.6% did not receive the necessary health resources. Contributing variables associated with the needed health care not being received included parental characteristics that would hamper the uptake of services (Figure 1). A total of 58.3% of Virginia respondents stated that health care costs hampered their child receiving therapies, 25% had unavailable services in their geographical location and 75% had difficulty coordinating care among health care providers or services. Difficulty coordinating care in this instance is described as inconveniences working with multiple doctors (i.e., physician vs therapist), unfavorable hours of operation when creating appointments and lack of transportation to accommodate appointments. Next, 38.5% of respondents had a lack of health insurance coverage for a consecutive 12 months, 42.9% were unemployed at least 5 out of the past 52 weeks, and 88.9% had difficulties paying for the child's medical bills. Finally, within the state of Virginia, 83.3% of respondents experienced challenges getting the needed specialist care. These challenges, for the purpose of this study, was described as difficulties receiving necessary referrals from physicians and hardships when creating appointments to receive needed services.

National data found that 7.9% of 50,212 children between the ages of 1-17 were in need of special therapy such as physical, occupational, or speech therapy. Of those children, 7.4% did not receive the necessary health resources. A total of 67% of respondents stated that health care costs was a contributing variable associated with the needed health care not being received.

Other variables that affected the child's uptake of special therapy services included unavailable services in area (27%), difficulty coordinating care (42.2%), lack of health insurance (22.9%), and unemployment (37.7). Nationally, two of the most influential variables that affected the uptake of services included the payment of medical bills (58.8%) and complications accumulating necessary specialist care (61.4%).

Figure 1.

Need Factor Variables Halting Uptake of Specialty Services of National and Virginia Samples from the 2016 NSCH



Discussion

We examined how parental characteristics impacted specialty therapy (i.e., physical, occupational and speech) service utilization among children between the ages of 1 to 17 using the Andersen and Newman Framework model. Our results indicated that in the state of Virginia, the most impacting variables halting the uptake of specialty services included the payment of medical bills and challenges accumulating needed specialist care. This analysis correlates with the Andersen and Newman Framework as enabling factors in that personal/family and

community influences are both strongly impacting variables that affect an individual's access to the utilization of health care services.

When examining the state of Virginia, 89% of respondents expressed that one parental characteristic that negatively impacts the utilization of specialty therapy services is the payment of medical bills. This analysis coincides with the literature review in that the financial burden of children's out-of-pocket health care expenditures has increased over time for all income groups. However, socioeconomic disparities are persisting, placing those families at a greater disadvantage from up taking needed services. During the examination of the data, it was imperative to identify demographics of the population as inferences can be made as to what groups would be at a larger disadvantage in comparison to others. Virginia data identified 84% of respondents experienced specialist care difficulties negatively impacting the utilization of needed services for their child. According to the Institute of Medicine Committee on the Consequences of the Uninsured (2002), children of families considered to be of lower-income, minority, or uninsured have worse access and utilization of specialty services in comparison to children with none of these characteristics.

When examining identified variables, and selecting for those who needed specialty therapy services, population size was significantly smaller than the initial study design desired. Initially, the study set out to exclusively examine children between the ages of 8 to 17 years both nationally and in the state of Virginia; however, with a small population size specifically in the state of Virginia, children between the ages of 1-17 years were examined. By widening the scope of age ranges for national and Virginia data sets, the population size doubled, allowing for an increased accuracy when evaluating factors that may halt the uptake of specialty therapy services of children. Furthermore, National and Virginia data from the preexisting 2016 National Survey of Children's Health was utilized which further limited more specific questions to be pursued. Although the NSCH survey is a nationally represented data set, variables were limited where inferences were drawn. For example, one question within the survey states, 'There were problems getting an appointment when [subject child] needed one' with dichotomous responses of 'Yes' and 'No'. This presented question to respondents is vague in nature and could pertain to multiple variables where formulated inferences were drawn from responses.

Future Directions

Simple and multivariate logistic regression to create a statistic model will be performed to evaluate the associations of correlates of uptake of specialty services. It would be beneficial to examine other contributing factors not identified within the NSCH survey that may affect the uptake of specialty therapy services of children. Literature correlated with this study points out that children are affected by cultural, social, and spiritual aspects of the environment that they live in, a variable not included within the NSCH survey. It would be interesting to explore the notion that culture, and spiritual influences may contribute to the lack of specialty services being utilized.

Conclusions

Social determinants of health and health equality within at-risk populations continue to burden communities. Early intervention specialty services such as physical, occupational and speech therapy are critical to youth if services are required. Long-lasting consequences will arise if the child is not receiving these specialty services such as educational and employment disadvantages. These consequences suggest that low socioeconomic status and poor health outcomes will occur within the child's lifetime. Outcomes of the analysis suggest that a public health focus should be directed towards what intervention services could be implemented to assist in the uptake of specialty therapy utilization. Examples of interventions that could be implemented include; increasing the utilization of social workers in targeted families to assist in the coordination of care, implementation of specialty services in locations where services are unavailable and the provision of financial planners to aid in payment planning towards accumulated medical costs. Through the identification of parental characteristics that impact specialty therapy (i.e., physical, occupational and speech) service utilization among children, improved health outcomes are likely to arise when interventions persist.

References

Anderson, R. (1995). Revisiting the behavioral model and access to medical care: Does it matter? *Journal of Health and Social Behavior, 36*(1), 1-10. https://doi.org/10.2307/2137284

Gardner, A. K. (2019). The effect of the affordable care act on access to care for children in the South. (Thesis). Retrieved from https://repository.library.georgetown.edu/bitstream/handle/10822/1055049/Gardner_georgetown_0076M_14183.pdf?sequence=1

Hayes, S. L., Schoen, C. (2013). Stop the churn: Preventing gaps in health insurance coverage. Retrieved from https://www.commonwealthfund.org/blog/2013/stop-churn-preventing-gaps-health-insurance-coverage

Institute of Medicine. (1970). Health-Related Outcomes for Children, Pregnant Women, and Newborns. Retrieved from https://www.ncbi.nlm.nih.gov/books/NBK221019/

Leininger, L, & Levy, H. (2015). Child health and access to medical care. *The Future of Children, 25*(1), 65-90. https://doi.org/10.1353/foc.2015.0003

McGinnis, J. M., & Foege, W. H. (1993). Actual causes of death in the United States. *Journal of the American Medical Association (JAMA), 270*(18), 2207-12. https://doi.org/10.1001/jama.1993.03510180077038

Sommers, B. D. (2005). From medicaid to uninsured: Drop-out among children in public insurance programs. *Health Services Research, 40*(1), 59-78. https://doi.org/10.1111/j.1475-6773.2005.00342.x

Sommers, B. D., & Rosenbaum, S. (2011). Issues in health reform: How changes in eligibility may move millions back and forth between Medicaid and insurance exchanges. *Health Aff (Millwood) 30*(2), 228-36. https://doi.org/10.1377/hlthaff.2010.1000

United States Census Bureau (2016). National survey of children's health: Methodology Report. (2018). Retrieved from https://www.census.gov/content/dam/Census/programs-surveys/nsch/tech-documentation/methodology/2016-NSCH-Methodology-Report.pdf

Two Cases of Infantile Botulism in Virginia that Highlight the Importance of Early Clinical Diagnosis and Proper Reporting, Treatment, and Prevention.

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Purpose:

Infantile botulism is a rare condition that primarily affects infants under the age of 6 months. This disease is caused by ingestion of Clostridium Botulinum spores that are found in soil or honey. Once ingested, the spores germinate into bacteria that colonize the infant's immature intestinal tract and synthesize a toxin. This toxin irreversibly binds acetylcholine receptors, leading to the clinical presentation of progressively worsening constipation, weakness, hypotonia, poor feeding, weak cry, and decreased activity. If enough toxins are released, life-threatening flaccid paralysis with respiratory failure can ensue. Fortunately, with high clinical suspicion, a physician can gain access to life-saving Botulism Immune Globulin Intravenously (BIG-IV) prior to laboratory confirmation. Early administration of Botulism Immune Globulin Intravenous (BIG-IV) can significantly improve outcomes by neutralizing any systemically circulating botulinum toxin. With early diagnosis and treatment, full recovery without neurologic sequelae is likely. Here we present two infants from Southwest Virginia who were admitted to a children's hospital. These cases illustrate the typical presentation of infantile botulism, an approach to management, the possible clinical course, and opportunities for prevention.

Case Summaries

Case 1

A previously healthy 5-week-old Caucasian male was taken to his primary care provider (PCP) for poor feeding and decreased activity. His mother reported that he was in his normal state of health until 2 days prior when he was noted to be increasingly somnolent. He was too weak to suck and had started to refuse the bottle. She also described a weak cry. These symptoms continued to progress until she noticed increased work of breathing. Review of systems was positive for decreased urination and stooling with his last bowel movement being two days

ago. She denied any fever, congestion, cough, vomiting or seizures. He was breast fed with formula supplementation and had not been introduced to any other foods or had any other ingestions. She denied sick contacts. His past medical history was notable for a 2-week NICU stay for jaundice, hypoglycemia and respiratory distress after being delivered via C-section at 37 weeks. He received his Hepatitis B vaccination prior to discharge without complication.
On physical exam at his PCP's office, his vitals were normal. He was noted to be somnolent and mottled with poor tone, a weak gag, and minimal suck. These findings prompted immediate transport to a tertiary medical center.

In the Emergency Department (ED), he was still afebrile with normal vital signs. His physical exam revealed hypotonia with poor head control. He had a weak cry and inadequate swallow. A broad work-up was pursued in line with the differential diagnosis. A septic work-up, including lumbar puncture returned reassuring results. The patient had no electrolyte abnormality, a negative urine drug screen, a normal brain CT, and an unremarkable X-ray of the chest and abdomen. He received intravenous fluids and antibiotics and was transferred to the pediatric intensive care unit (PICU) for further evaluation and treatment.

In the PICU, results continued to come back normal, including ammonia, thyroid stimulating hormone (TSH), lactate, and homocysteine. His newborn screen was tracked down and was normal. The Infant Botulism Treatment and Prevention Program in California (IBT&PC) (2020a) was called shortly after admission and recommended further work-up and a neurology consult, feeling that a longer history of constipation would be likely if this was botulism. His EEG was normal, EMG was unavailable for infants his age at this institution and the neurologist suspected botulism. The approval process for treatment with BIG-IV was started after consultation with the Virginia Department of Health, Centers for Disease Control (CDC), and stakeholders at the IBT&PC. A sterile enema was used to obtain a stool sample for botulinum toxin testing following a strict protocol on sample collection. On day 2 of hospitalization, the patient's respiratory distress worsened, and he was placed on BIPAP which progressed to intubation by day 3. Meanwhile, approval was granted for treatment with BIG-IV and it was sent to the patient's medical center and administered that evening.

The patient tolerated BIG-IV administration without complication. On day 4 of admission, he had zero respiratory drive, no motor response to stimulation, minimal eye-opening and no cough or gag reflex. On day 5, he showed mild improvement in symptoms, but developed a fever and was treated for ventilator-associated pneumonia. Three days post-BIG IV treatment, the patient regained his gag, suck, and cough reflexes and had improved tone, moving all of his extremities. He also began having multiple bowel movements a day with the help of polyethylene glycol and glycerin suppositories. The patient was extubated on hospital day 7, returned a positive *Clostridium botulinum* test on day 10, and discharged home on hospital day 21 with nasogastric gavage feedings. Neurologically, he has made a full recovery.

During his hospital stay, additional history uncovered that the mother's fiancé worked for a concrete company and regularly came home covered in concrete, mud, and dirt. He rarely changed clothes or removed his shoes prior to entering the home. We believed this to be the source of our patient's exposure.

Case 2

A previously healthy 4-week-old Latino male was taken to his PCP multiple times over a week for constipation. Several home interventions such as rectal stimulation and Karo syrup added to his formula were unsuccessful. During the second week of his constipation, he started to have signs of poor feeding and was taken to the emergency department (ED) where the mother reported decreased oral intake and urine output. She also reported a weak cry and less activity. In the ED, he received an abdominal x-ray that was normal and IV fluids for dehydration. The family was discharged home with return precautions. He returned to the ED less than 4 hours after discharge with continued concerns. He had had one small dark bowel movement after a suppository. He was not taking any formula and his activity levels had continued to decline. He was no longer interacting with his caregivers, and they noticed that he was weaker. Review of systems was otherwise negative for cough, congestion, vomiting or fever. Past medical history revealed a previously healthy male born at 37.6 weeks via caesarean section without complications. He had received Hepatitis B immunization without adverse reaction and had a normal newborn screen. The mother denied any sick contacts or ingestions other than formula.

He lived with his mom, dad, and older siblings and also spent time at his grandparents' house where there was ongoing construction inside and outside the home.

On physical exam, the ED physician noted a sunken fontanelle, dry mucous membranes, a weak cry, sluggish capillary refill, decreased eye tracking, and global hypotonia. He was found to be hypothermic and tachycardic on vital signs but was not in respiratory distress. Given his presentation, he was given IV fluids and empiric antibiotics following blood, urine and spinal fluid cultures. Because of his lethargy, the PICU was consulted for admission. He did not have increased white blood cells in his blood, urine or spinal fluid. He also did not have an electrolyte abnormality or elevated lactate or ammonia to suggest an inborn error of metabolism. There was no history of trauma and a head CT was unremarkable. He had a nasogastric (NG) tube placed to provide enteral nutrition and was admitted to the PICU.

Prior to admission to the PICU, the clinical suspicion for botulism was high. The Infant Botulism Prevention and Treatment Center (2020a) was contacted. They agreed this patient had a high suspicion for infantile botulism and sent BIG-IV the next morning. He had no clinical signs of improvement until day 4 of hospitalization when he showed improved strength and mental status. By day 5, he was tolerating all his feeds orally and his nasogastric tube was removed. On day 7, he was discharged home with near baseline status and no further interventions at home. Five days after being discharged home, his stool became positive for *Clostridium botulinum* toxin B.

Discussion:

Infantile botulism is caused by neurotoxins released into an infant's circulation following the ingestion of *Clostridium botulinum* spores. The Clostridium bacteria is an obligate anaerobe that is a spore-forming gram-positive bacillus. It produces a heat-labile neurotoxin that is the most potent toxin known on planet earth. Clostridium can produce 7 different toxins, identified as A-G with some debate about an 8th (H). The vast majority of infantile botulism cases are from neurotoxin A and B. Infantile botulism is more common than both food and wound botulism combined (Cox & Hinkle, 2002; American Academy of Pediatrics, 2018).

The botulinum toxin disrupts the release of acetylcholine from the presynaptic neurons and prevents muscle excitation and contraction (American Academy of Pediatrics, 2018). When 70% of terminals are impaired, the disease begins to manifest itself. Common symptoms are constipation, weakness, hypotonia, cranial nerve impairment, including ptosis, sluggish pupillary reflex, weak gag, cry, suck and difficulty swallowing. These can be vague complaints and ones often heard in the pediatric office. It is not until 90% of the neuromuscular terminals are impaired that you will start to have respiratory failure and flaccid paralysis. Around half of all infants with infantile botulism will require mechanical ventilation (Clemmens & Bell, 2007). The presentation is predictable once a certain level of toxemia is reached. It is always a descending, bilateral, symmetric, flaccid paralysis.

Due to the vague nature of these presenting symptoms and the low incidence, infantile botulism is often misdiagnosed in the early stages of the disease (Francisco & Arnon, 2007) Patients are often seen multiple times and undergo extensive workups as lethargy progresses (Infant Botulism Treatment & Prevention Program, 2020a). *Clostridium botulinum* infection should be on the differential diagnosis of an infant presenting with subacute progression of motor weakness, lethargy, poor feeding, and constipation. Workup should evaluate for infection, inborn errors of metabolism, non-accidental trauma, spinal muscular atrophy, electrolyte derangements, hypothyroidism, and other toxic ingestions. By excluding these other possibilities and narrowing your differential, you will be able to solidify your suspicion of infantile botulism and proceed with appropriate management.

Summary Recommendation:

Management and Treatment:

Botulism is at first a clinical diagnosis. Management of infant botulism consists of both supportive care and the administration of the botulism antitoxin, Botulism Immune Globulin Intravenous (BIG-IV)**.** You should not wait for laboratory confirmation to begin treatment. BIG-IV neutralizes all circulating toxins, stopping the progression of the disease while the body regenerates motor neurons (Infant Botulism Treatment & Prevention Program, 2020b; Thompson, Filloux, & Van Orman, 2005). To obtain the antitoxin expeditiously, you should

contact both your state health department and the Infantile Botulism Treatment and Prevention Center in California (Figure 1) (Infant Botulism Treatment & Prevention Program, 2020b; Centers for Disease Control, 2020). The state health department will assist in obtaining the stool specimen using a strict collection protocol (Virginia Department of Health, 2019). They will also help coordinate with the IBT&PC, which is the gatekeeper for the national supply of the antitoxin.

The infant should fully recover from the illness with appropriate supportive care with or without treatment with BIG-IV. In a 5-year randomized, double-blinded, placebo-controlled trial, however, there was a substantial decrease in all measures of disease-associated morbidity with the use of immune globulin in the first few days of admission. The length of intensive care stay, mechanical ventilation, and tube feedings were decreased and the most significant of these reductions was the length of the average hospital stay from 5.7 weeks to 2.6 weeks in the treatment group ($P<0.001$) (Arnon, 2007; Long, 2007; Arnon et al., 2006). To date, there have not been any reported studies showing significant adverse effects associated with BIG-IV. This risk to benefit ratio strongly supports early administration of the drug **(**Arnon et al., 2006).

Most cases are treated in the intensive care unit as around 50% of cases will need respiratory support. Since it also affects the cranial nerves, successful swallowing can become compromised and affected patients are at risk of aspiration and metabolic derangements (Cox & Hinkle, 2002; Clemmens & Bell, 2007; Long, 2007). Supportive care should be given via intravenous fluids and nasogastric tube feedings when appropriate. The prognosis is excellent with appropriate supportive care **(**Arnon et al., 2006). Recovery is progressive as it takes time to replenish the motor endplates **(**Infant Botulism Treatment & Prevention Program, 2020a). Diaphragmatic function tends to recover before peripheral muscles allowing the patient to come off respiratory support and transfer out of the ICU as they make their full recovery (Cox & Hinkle, 2002).

Public Health Message and Prevention:

Most cases of infant botulism have no definitive source of exposure and can be very difficult to fully prevent because the bacteria is found naturally in the soil and dust. There are, however, measures that can be done to reduce the likelihood of exposure. The most common preventive

measure is not to expose an infant to honey or honey products prior to the age of one. This is an absolute recommendation. Honey can contain the bacteria even after processing. Honey is safe only for people over the age of one as the botulism spores are no longer dangerous to a healthy and mature digestive tract. A detailed history should include asking about honey consumption. Per the Redbook on Pediatric Infectious Diseases, the incubation period can be between 3-30 days (American Academy of Pediatrics, 2018).

Unfortunately, more than 85% of infants have no honey exposure and other causes should be investigated. Since Clostridium spores are naturally occurring in the soil, it is important to ask about the occupation of all caregivers and any recent construction in or near the home. Occupations such as construction workers, excavators, farmers, and those employed in concrete and masonry are at high-risk of bringing spores into the home. Both of our cases had no exposure to honey but had a parent or caregiver in a high-risk occupation.

Most cases of infantile botulism worldwide are diagnosed in the United States with greater than 50% of cases being in California (Centers for Disease Control & Prevention, 2016). Clostridium botulinum spores have been found in the soil in all 50 states. Cases in Virginia have been primarily caused by toxin B with some reports of toxin A (Centers for Disease Control & Prevention, 2016). The cases in Virginia historically have all been responsive to the BIG-IV.

It is important for health care providers to ask about caregiver occupations and childcare arrangements at each visit. If a parent or caretaker is employed in a high-risk occupation, health care providers should take time to educate families on the risk factors for exposure to infants. They should be advised to remove work boots outside and remove all work clothes prior to contact with the infant. A clean breast milk or formula prep area is important and those preparing the bottle should be aware of possible exposures. If there is any construction near or in the home, homeowners should make sure all windows are shut and the area where the infant's food is prepared should be protected from any dust or dirt contamination (Figure 2).

While still rare, infantile botulism exists in Virginia. It is the responsibility of the medical and public health teams to identify high-risk families, educate them on prevention strategies, identify

botulism cases and initiate timely, appropriate treatment. A good social and occupational history is important as honey consumption is not the most common way to contract the disease. Nailing the diagnosis of infantile botulism and initiating timely treatment will expedite a full, sweet recovery.

Figure 1:

Reporting Suspected Infantile Botulism and Obtaining BIG-IV in Virginia:

Healthcare Providers

Reporting and Treating Suspected Infantile Botulism in Virginia:

When you suspect a case of infantile botulism, the Virginia Department of Health requires that you notify your local health department immediately to discuss the case and laboratory testing. With your health department on board, you should call the Infant Botulism Treatment and Prevention Program in California to obtain the antitoxin.

- To locate your local health department during business hours: http://www.vdh.virginia.gov/local-health-districts/.
  The Emergency Officer can be reached 24 hours a day/7 days a week at 804-335-4617.
- The California Department of Public Health's Infant Botulism Treatment and Prevention Program can be reached 24/7 at 510-231-7600. http://www.infantbotulism.org/

The classic signs and symptoms of infantile botulism are lethargy, poor feeding, constipation, a weak cry and poor muscle tone in a baby under 6 months old.
Stool collection has to be done following the health department's protocol.
Treatment with intravenous, human-derived botulism immune globulin (BIG-IV) should be started as soon as possible.
Treatment decisions should be based on the clinical presentation and exam findings and should not be delayed for confirmatory test results.
The time and date of administration of BIG-IV should be noted in the patient's chart.
Routine live virus vaccines should be delayed for 6 months after BIG-IV because of potential interference with the normal immune response.

Virginia Department of Health

Botulism: Guidance for Health Care Providers
Infection Control:

- Use Standard Precautions
- Patients do not need to be isolated.
- Infants with botulism can shed C. botulinum and toxin in the stool for weeks to months after onset.
- Hand hygiene among caregivers is critical.
- Diapers should be disposed of so that other people or animals cannot come into contact with them.
- People with open cuts or wounds on their hands should wear gloves when handling soiled diapers.
- Close contact with other infants (e.g., sharing crib and toys) should be avoided while excretion might be continuing.

Figure 2:

Caregiver Handout on Preventing Infantile Botulism:

References:

American Academy of Pediatrics (2020). *Botulism and infant botulism*. Retrieved from https://redbook.solutions.aap.org/chapter.aspx?sectionid=189640068&bookid=2205

Arnon, S.S. (2007). Creation and development of the public service orphan drug-human botulism immune globulin. *Pediatrics, 119*(4), 785-789.

Arnon, S.S., Schechter, R., Maslanka, S.E., Jewell, N.E., & Hatheway, C.L. (2006). Human botulism immune globulin for the treatment of infant botulism. *New England Journal of Medicine, 354*: 462-471

Centers for Disease Control and Prevention (CDC). (2017). *National botulism surveillance summary 2016.* Retrieved from https://www.cdc.gov/botulism/pdf/Botulism-2016-SUMMARY-508.pdf

Centers for Disease Control and Prevention (CDC). (2020). National notifiable diseases surveillance system case definitions. Retrieved from https://wwwn.cdc.gov/nndss/conditions/botulism/

Cox, N. & R. Hinkle, R. (2002). Infant botulism. *American Family Physician, 65*(7), 1388-1392.

Francisco, A.M.O. & Arnon, S.S. (2007). Clinical mimics of infant botulism. *Pediatrics, 119*(4) 826-828

Infant Botulism Treatment and Prevention Program. (2020a). *Clinical diagnosis*. Retrieved from http://www.infantbotulism.org/physician/clinical.php

Infant Botulism Treatment and Prevention Program: Patient management. (2020b). Retrieved from http://www.infantbotulism.org/physician/patient.php

Long, S.S. (2007). Infant botulism and treatment with BIG-IV (BabyBIG). *The Pediatric Infectious Disease Journal*, *26*(3), 261-262.

M.R. Clemmens, M.R. & Bell, L. (2007). Infant botulism presenting with poor feeding and lethargy. *Pediatric Emergency Care*, *23*(7), 492-494.

Thompson, J.A., Filloux, F.M., & Van Orman, C.B. (2005). Infant botulism in the age of botulism immune globulin. *Neurology*, *64*(12), 2029-2032

Virginia Department of Health (VDH). (2019). Botulism: Guidance for healthcare providers. Retrieved from http://www.vdh.virginia.gov/content/uploads/sites/3/2019/02/ Botulism_ClinGuid_2019.pdf

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Use of a Decision Aid to Improve Decisional Comfort in College Students Treated for Respiratory Tract Infections

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Abstract

Decision aids have been shown to facilitate shared decision making, recognize and respect patient values, improve patient experience by designing care around those values and increase patient comfort with decisions made. The objective of the study was to determine the effectiveness of a decision aid to 1) increase decisional comfort with the appropriate use of antibiotics for respiratory tract infections and 2) maintain antibiotic prescribing rates at current levels. Participants were English-speaking college students age 18 and over diagnosed with a respiratory tract infection in the general medical clinic of a university health center from August 31, 2015-May 6, 2016. Pre- and post-intervention surveys were used to measure decisional conflict of students. Intervention included staff training in shared decision making and the use of a decision aid. Students who received routine care were 2.2 times [N=643; p=<.001; 95% CI (1.55, 3.12)] more likely to experience decisional conflict than students whose care included the decision aid. Antibiotic prescribing rates were maintained at pre-intervention levels. Use of a decision aid shows promise to increase comfort with the appropriate treatment of respiratory tract infections while maintaining antibiotic prescribing rates.

Key Words: Respiratory tract infections, shared decision making, decision aid, college students, antibiotic use

Background

Haltiwanger, Hayden, Weber, Evans, & Possner (2001) found that 55% of college students seeking care for an upper respiratory tract infection expected to receive an antibiotic. More than fifteen years later college health providers continue to endure challenges related to antibiotic prescribing and often feel pressure to prescribe unnecessary antibiotics for respiratory tract infections (Blyer & Hulton, 2016). In recent years, antibiotic resistance has gained global attention as a serious threat to modern medicine making the treatment of patients difficulty and costly. In the United States alone, it is estimated that antibiotic resistance costs $21 to $34 billion annually and equals more than eight million additional patient hospital days (World Health Organization, 2014). Respiratory tract infections are the most common diagnosis for antibiotics prescribing and overuse which leads to the promotion of antibiotic resistance (Shapiro, Hicks, Pavia, & Hersh, 2014; World Health Organization, 2012). In addition, The National Strategy for Combating Antibiotic-Resistant Bacteria (2014) calls for cooperation of health care providers and patients to work together to combat overuse of antibiotics (Phillips, 2015).

The university health center participating in the current study had a pre-study antibiotic prescribing rate of 33% for respiratory tract infections. In the United States, outpatient clinic antibiotics are prescribed, on average, 51% of the time for adults with respiratory tract infections with the lowest reported prescribing rate being 38% (Shapiro et al., 2014). While the participating site has a relatively low antibiotic prescribing rate, the prescribing providers are regularly pressured by patients to prescribe antibiotics. These patients often come from family doctors and pediatricians who prescribe antibiotics at higher rates, leading to a patient preference for treatment with antibiotics over other more appropriate treatment options. In fact, patient expectations are often the reason that inappropriate antibiotics are prescribed (Blyer & Hulton, 2016). Lack of knowledge regarding treatments and treatment options that are not a patient's preference can lead to decisional conflict (Ferron et al., 2014). Decisional conflict is defined as an, "individuals' level of comfort with a decision" (Ferron et al., 2014). Decisional conflict can lead to physical and emotion stress for the patient and can lead the patient to lay blame on the health care provider (Ferron et al., 2014). Assessment of a patient's decisional conflict is an important piece of shared decision making and leads to good health care decisions (Ferron et al., 2014).

College health centers are in a position to produce educated patients who understand and adhere to appropriate antibiotic prescribing for respiratory tract infections, promoting life-long antibiotic stewardship (Blyer & Hulton, 2016). Haltiwanger et al. (2001) found receipt of antibiotics, a clear diagnosis, and an explanation of the reason for treatment were significantly associated with patient satisfaction in college students. Study recommendations included better patient education and improved clinician-patient communication. Likewise, Alden, Merz, and Akashi (2012) found college students in the United States prefer a collaborative role in health care decision making. Shared decision-making, a clinician-patient communication process that encourages patients to take a collaborative role in medical decision making, shows promise as a method to promote appropriate use of antibiotics for respiratory tract infections in the college population (Blyer & Hulton, 2016).

Considering that shared decision making has not been shown to decrease prescribing in providers with already low antibiotic prescribing rates (Briel et al., 2006) and the fact that the setting already has relatively low prescribing rates, the focus of this study was to increase student's comfort with treatment of respiratory tract infections, not to decrease antibiotic prescribing rates. The study question was "In the college population, does shared decision making, through the use of a decision aid, increase decisional comfort with treatment of respiratory tract infections while maintaining current antibiotic prescribing rates?" The objectives of this study were to determine the effectiveness of a decision aid to 1) increase student comfort with the treatment of respiratory tract infections while 2) maintaining antibiotic prescribing rates at or below current levels.

Methods

Setting and Population

The study took place in the general medical clinic of a university health center located in the Mid-Atlantic region. The health center serves a student body of over 21,000 and provides health care services for over 30,000 student encounters each year. Respiratory tract infections account for approximately 5,000 student visits to the clinic each year, accounting for 22% of visits. Four providers from the general medical clinic, including two physicians and two nurse practitioners, participated in the study. The study included a convenience sample of consecutively selected, English speaking patients, 18 years and older who made an appointment with participating

providers at the University Health Center General Medicine Clinic between August 31, 2015 and May 6, 2016 and who were diagnosed with a respiratory tract infection (no sample size calculations were performed).

Design

The study consisted of pre- and post-intervention phases and was guided by the Ottawa 5 Step Process for the Implementation of a Decision Aid (The Ottawa Hospital Research Institute, 2014). The Ottawa 5 Step Process includes: 1) Identify the decision, 2) Find patient decision aids, 3) Identify barriers, 4.1) Implementation, 4.2) Provide Training, and 5) Monitor use and outcomes. The pre-intervention phase of the study provided baseline data on decision comfort and took place from August 31, 2015 to December 18, 2015, when participating providers offered students diagnosed with a respiratory tract infections usual care and participation in the study through an anonymous self-administered patient survey. Students who chose participation in the study completed the patient survey at the checkout area of the clinic after leaving the exam room. The contents of this survey are described below.

Following the pre-intervention phase, participating providers completed shared decision making training using online training videos. Provider participation in the study was voluntary and no providers had previous experience with shared decision making or the use of decision aids. Video material was based on the SHARE Approach developed by the Agency for Healthcare Research and Quality (AHRQ) (Agency for Healthcare Research and Quality, 2014). Role play and hands-on training were used to educate providers on the use of shared decision making and use of the selected patient decision aid.

The post-intervention phase of the project took place from January 11 to May 6, 2016. Students were offered participation in the study using the same survey and method as during the pre-intervention phase. Providers indicated whether or not they used the decision aid at the bottom of the patient survey. The study was approved by the Institutional Review Board (IRB) at the participating university.

The patient decision aid selected for use was, “Taking an Antibiotic or Not? Acute Respiratory Tract Infections (ARI) ©” (Labrecque, LeBlance, Légaré, & Cauchon, 2010). Permission for use was obtained. This decision aid satisfies criteria for a patient decision aid and is listed in the

Ottawa Hospital Decision Aid Library Inventory (The Ottawa Hospital Research Insititute, 2016). The aid has been used as part of the training program DECISION +2 which has been shown to increase patient involvement in the decsion making process related to use of antibiotics for respiratory tract infections (Légaré et al., 2012). The decision aid consists of six steps which faciliate communication and ultimately shared decision making between the patient and the provider during the visit (Figure1). The aid was designed to be printed and filled out by the provider, with input from the patient, during the medical encounter. After completing the history and physical exam portions of the medical encounter, the provider completes Steps 1 and 2 of the aid to determine the probablity of the patient having a bacterial infection. In Steps 3 and 4, the provider then shares this probability with the patient and explains the benefits and risk of taking an antiboitic or not. Steps 5 and 6 are used to help the patient determine their values and preferences related to the decision and to determine their comfort with the decision they are making (Labrecque et al., 2010). Patient comfort with the decision is assessed on the decision aid using the SURE© test which determines if decisional conflict is present before the patient makes their final decision. The SURE© test was also used on the patient survey as described below.

Figure 1.

Steps in Decision Aid, “Taking an Antibiotic or Not?

Step 1 & 2- Complete Diagnostic Decision Support Tool to estimate probability of bacterial infection

Step 3- Share estimate with patient

Step 4- Communicate treatment options of taking an antibiotic or not and benefits and risks of each

Step 5- Clarify values and preferences of patient

Step 6- Evaluate patient decisional comfort regarding decision

Acute Respiratory Tract Infections (ARI) ©” (Labrecque, LeBlance, Légaré, and Cauchon, 2010)

Data Sources and Analysis

Patient decisional conflict was assessed pre- and post-intervention using the SURE© test (duplicated by permission) on the patient survey. The SURE© test shows adequate psychometric properties (94.3% sensitivity; 89.8% specificity) to determine decisional conflict in the primary care setting and has been used specifically for decisions related to respiratory tract infections (Ferron Parayre, Labrecque, Rousseau, Turcotte, & Legare, 2014). The instrument is recommended as a proxy for determining the quality of a decision and whether or not shared decision making occurred in the decision making process (Ferron et al., 2014). The four items on the SURE© test are summed to determine the decisional conflict score for each individual. Scores range from extremely high decisional conflict (0) to no decisional conflict (4). A score of ≤ 3 indicates clinically significant decisional conflict is present and indicates that the patient is not certain about the best option for them or that they do not have all the information needed to make the decision (Légaré et al., 2010). Student surveys also included demographic information including age, gender identity, and year in college.

Antibioitic prescribing rates for respiratory tract infections were collected during both pre-and post-intervention phases using data from the electronic health record (EHR) system. Diagnosis codes included those associated with acute rhinosinusitis, acute bronchitis, acute pharyngitis, and acute otitis media. EHR reports created for this data included ICD-9/ICD-10 codes for respiratory tract infections to account for the coding changes that occurred during the study. Reports also included the transactions codes for antibioitics commonly used for respiratory tract infections.

Odds ratio were employed to determine the effect of predictor variables on the outcome of decisional conflict. Variables examined included age, gender, academic year, use of decision aid, and antibioitc prescribing. Table 1 depicts the predictor variables in relation to the oucome of decisional conflict.

Table 1:

Logistic Regression Analysis Predicting Decisional Conflict

Predictor Variable	B	Wald Chi-Square Test	*p*	Exp(B)	95% CI
Gender	.033	.034	.854	1.034	.725 - 1.474
Age	.111	.760	.383	1.117	.871 – 1.432
Year in School	-.183	1.449	.229	.832	.617 – 1.122
DA not Used	.788	19.646	.000	2.199	1.552 – 3.116
Constant	-2.499	1.296	.255	.082	

Analysis of decision aid use was not based on before and after data as the same patients were not surveyed in each phase. Analysis of decision aid use was based on provider indication of use verses no use of the decision aid across the study. Antibiotic prescribing was reported as the aggregate percentage of antibiotics prescribed by participating providers for patients with the diagnosis of a respiratory tract infections.

Results

Odds ratios were calculated to determine the potential effect of provider use of decision aids on decisional comfort in this student population. Use of the decision aid was the only statistically significant predictor of decisional conflict. Those who did not have the decision aid used in

consultation were almost 2.2 times more likely than those who did to experience decisional conflict [*N*=643; *p*=<.001; 95% CI (1.55, 3.12)] (Table 1; Table 2). Gender, age, and year of college did not show significant effects on decisional comfort (*p*=<854; 95% CI (.725, 1.47; *p*=.383; 95% CI (.871, 1.43); and *p*=.23; 95% CI (.617, 1.12), respectively) (Table 1).

Table 2.

Frequency Counts of Decision Aid use and Gender

Decision Aid Use	Male	Female	%
Used	64	152	33.5
Not Used	121	307	66.4
Total (*N* = 644)			

Antibiotic prescribing rates did not show any statistically significant (p= .34) change (33% pre-intervention; 31.69%, post-intervention). Demographic differences (gender, age, and year of college) assessed in the study showed no significant effect on decisional comfort.

Discussion

Literature suggests that shared decision making shows promise as one method to promote the appropriate use of antibiotics in the college student population (Blyer & Hulton, 2016). The study aimed to determine if shared decision making in the form of a decision aid could increase college student comfort with the appropriate use of antibiotics for respiratory tract infections while maintaining current antibiotic prescribing rates. For this study, use of the decision aid was the only predictor variable that had a significant effect on decisional comfort. Students in which the decision aid was used were more comfortable with the treatment decision related to their respiratory tract infection, although there was no significant change in antibiotic prescribing rates in this already low-prescribing environment.

One limitation of the study is the degree to which the decision aid was used. Within one week of study implementation providers reported that the student population was making decisions

quickly without needing to complete all six steps of the decision aid. Providers felt that completing the final steps after students declared their decision was redundant and unecessary. Upon being made aware of this phenomenon, the researchers received IRB approval to add a Provider Use of Decision Aid Survey to the end of the implementation phase. The purpose of the additional survey was to assess the extent of decision aid use. All four providers self-reported using Step 1 and Step 2 (diagnostic decision support tool) of the aid “almost always”. Two providers reported using Step 3 (probablity of bacterial infection) and Step 4 (benefits and risks) of the decision aid “almost always” and two providers reported using these steps “sometimes”. Providers reported using Step 5 (values and preferences) from “always” to “not at all”. Step 6 (decisional comfort) was reported to be used from “sometimes” to “not at all”.

Another limitation of the study was the inablity to measure the use of shared decision making within the patient provider interaction. Use of the decision aid to promote shared decision making was assessed but no direct observational data were collected. In addition, patient surveys were anonymous and did not report the diagnosis or antibiotic prescribing for individual patients correlated to decisional comfort. Only aggregate data on prescribing rates pre and post intervention was reported.

While varied use of the decision aid was a limitation of the study, this limitation also provides some important knowledge. Steps 1-4 of the decision aid were the most used in the current study. The content within these steps guided patient-provider communication and educated patients on the risks and benefits of treatment. Haltiwanger et al. (2001) recommended better patient-provider communication and education as a way to promote the appropriate use of antibiotics in college students. The current study supports this recommendation as most students were ready to move forward with treatment following patient-provider communication and education. The previous study also showed that college students were more satisfied with care if an antibiotic was prescribed. While the current study did not measure satisfaction, it did show promise for increasing comfort with treatment without increasing antibiotic prescribing rates.

In the study by Légaré et al. (2012), in which the same decision aid was used, the authors noted that the “active ingredients” of their program where not identified. The current study may also provide knowledge related to some of these “ingredients” related to the decision aid. While all steps of the decision aid are vital to the shared decision making process, steps 1-4 appear to be

the “active ingredients” for the college student population. As the decision aid was developed and validated in Canada, this study also shows promise for use in the United States. Further studies should focus on the use of this decision aid in other settings within the Unitied States, including other college health centers. Further studies with varied populations may lead to recommendations for adaptations based on population.

Conclusions

The Institute of Medicine describes patient-centered care as care that is respectful and responsive to patient preferences, needs and values, and that these values guide clinical decisions-making (IOM, 2001). College health centers are in a position to collaborate with student patients, practice patient-centered care, and promote life-long antibiotic stewardship (Blyer & Hulton, 2016). Shared decision making, specifically using the decision aid, “Taking an Antibiotic or Not? Acute Respiratory Tract infections (ARI) ©” (Labrecque et al., 2010) demonstrates promise to increase college student’s comfort with treatment for respiratory tract infections while maintaining antibiotic prescribing rates at relatively low levels.

References

Agency for Healthcare Research and Quality. (2014). *The SHARE approach essential steps of shared decision making trainer's guide*

Alden, D. L., Merz, M. Y., & Akashi, J. (2012). Young adult preferences for physician decision-making style in Japan and the United States. *Asia-Pacific Journal of Public Health, 24*(1), 173-184. doi:10.1177/1010539510365098 [doi]

Blyer, K., & Hulton, L. (2016). College students, shared decision making, and the appropriate use of antibiotics for respiratory tract infections: A systematic literature review. *Journal of American College Health, 64*(4), 334-341. doi:10.1080/07448481.2015.1099105 [doi]

Briel, M., Langewitz, W., Tschudi, P., Young, J., Hugenschmidt, C., & Bucher, H. C. (2006). Communication training and antibiotic use in acute respiratory tract infections. A cluster randomised controlled trial in general practice. *Swiss Medical Weekly, 136*(15-16), 241-247. doi:smw-11342 [pii]

Ferron Parayre, A., Labrecque, M., Rousseau, M., Turcotte, S., & Legare, F. (2014). Validation of SURE, a four-item clinical checklist for detecting decisional conflict in patients. *Medical Decision Making, 34*(1), 54-62. doi:10.1177/0272989X13491463 [doi]

Haltiwanger, K. A., Hayden, G. F., Weber, T., Evans, B. A., & Possner, A. B. (2001). Antibiotic-seeking behavior in college students: What do they really expect? *Journal of American College Health, 50*(1), 9-13. doi:10.1080/07448480109595705 [doi]

Institute of Medicine (2001). *Crossing the quality chasm: A new health system for the 21st century*. National Academy Press, Washington DC.

Labrecque, LeBlance, Légaré, and Cauchon. (2010). *Taking an antibiotic or not? Acute respiratory tract infections (ARI).* Retrieved from *http://www.cmaj.ca/content/suppl/2012/08/03/cmaj.120568v1.DC1/train-legare-1-at.pdf*

Légaré, F., Labrecque, M., Cauchon, M., Castel, J., Turcotte, S., & Grimshaw, J. (2012). Training family physicians in shared decision-making to reduce the overuse of antibiotics in

acute respiratory infections: A cluster randomized trial. *Canadian Medical Association Journal*, *184*(13), E726–E734. http://doi.org/10.1503/cmaj.120568

Phillips, A. (2015). *National strategy and action plan for combating antibiotic resistant bacteria*. Nova Publishers.

Shapiro, D. J., Hicks, L. A., Pavia, A. T., & Hersh, A. L. (2014). Antibiotic prescribing for adults in ambulatory care in the USA, 2007-09. *The Journal of Antimicrobial Chemotherapy*, *69*(1), 234-240. doi:10.1093/jac/dkt301 [doi]

The Ottawa Hospital Research Institute. (2014). *Patient decision aids implementation toolkit*. Retrieved from https://decisionaid.ohri.ca/implement.html

The Ottawa Hospital Research Institute. (2016). Patient decision aids. Decision aid summary. To take antibiotics or not? Acute respiratory tract infections (ARIs): A diagnostic decision support tool. Retrieved from https://decisionaid.ohri.ca/Azsumm.php?ID=1618

World Health Organization. (2012). *The evolving threat of antimicrobial resistance: Options for action*. Retrieved from http://whqlibdoc.who.int/publications/2012/9789241503181%5Feng.pdf

World Health Organization. (2014). *Antimicrobial resistance: Global report on surveillance*. Retrieved from http://apps.who.int/iris/bitstream/handle/10665/112642/9789241564748_eng.pdf;jsessionid=AA28C19A8DA8DAD516B339955CDCA3BB?sequence=1

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