Panther Smiles Clinic: Reducing Barriers to Acute and Comprehensive Dental Care at a Free Community Health Clinic

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Abstract

Dental caries, also known as dental cavities, is the most common noncommunicable disease in the world. Left untreated, some dental infections can be life threatening. Dental disease is a public health concern: poor oral health outcomes are most often seen in individuals with low-income or uninsured status, which can be compounded by other barriers to care. Establishing the dental home early is a critical tool to combat caries rates in children, but the concept of a dental home is also applicable to adults re-entering the dental setting. A proposed theory of change to reduce barriers to acute and comprehensive dental care assumes that interventions should be focused on increasing access to the dental healthcare sector and therefore establishing the dental home. Interventions should be targeted at all levels: individual outreach through large-scale policy.

Free clinics exist to provide care to underserved populations and are staffed by volunteers. These clinics often exclude dentistry. Dental students in their clinical years are encouraged to participate in volunteer opportunities for their own benefit and services to the community. In Pittsburgh, the Panther Smiles Clinic began as a community outreach opportunity for students at Pitt Dental Medicine at an established free medical clinic. The project has since grown into an oral health care resource for the region's uninsured community. At the clinic, patients receive a dental screening where oral health needs are identified and referrals are made to Pitt Dental Medicine and other community clinics for acute or comprehensive dental care. Hopefully, with the goal of establishing a dental home.

Evaluation of the clinic's outcomes and impact on the population it serves is essential to guide decisions about the future of the Panther Smiles Clinic and similar volunteer efforts nationwide. Such student operated clinics have the opportunity to fill the profound gap in access to oral health care in America.

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Preface

This culmination of my secondary education was made possible by those who have supported, encouraged, and educated me along the way. I would like to express my deepest gratitude to my committee, Drs. Cooke and Finegold, for their profound belief in my ability to succeed, and to the Panther Smiles Clinic team of students, faculty, and young leaders who have contributed so greatly to our patients and my learning. Thanks also to my Pitt Dental Medicine leadership and administrative team for allowing us to build a framework for measurable change, and to my School of Public Health professors who taught me how to measure that change. Special thanks to my closest Pitt Dental Medicine classmates who never let me down during four demanding years of balancing dental school alongside my public health education. And last but definitely not least: Thank You, Mom and Dad, for working so tirelessly to support me in every new adventure I undertake.

1.0 Introduction

1.1 Barriers in Access to Dental Care

According to the World Health Organization (WHO), the disease that causes dental cavities, or "dental caries" is the most common noncommunicable disease in the world (World Health Organization, 2017). Left untreated, dental caries and other oral diseases progress with time and often lead to pain and infection, requiring more serious and expensive treatment as the condition worsens (Bersell, 2017). In some cases, infections originating from dental disease can even become life threatening without treatment. In a culture that values high beauty standards, an "ugly" smile can also affect a person's self-image, confidence, and perceived and actual employability, which may in turn affect their income and consequently other health indicators (Otto, 2017).

Poor oral health outcomes are most often seen in individuals with low-income or uninsured status. Due to America's separate systems of dental and medical care, even those with private medical insurance may find that dental insurance is not part of their health insurance plan. These risk factors can be standalone or compounded if the individual is of a racial or ethnic minority, immigrant, or rural population (Northridge, 2020). Health journalist Mary Otto describes in her book ***Teeth: The Story of Beauty, Inequality, and the Struggle for Oral Health in America***, that "toothaches are not just an occasional inconvenience, but rather a chronic reality for millions of people, including disproportionate numbers of the elderly and people of color." She also reveals that many experiencing oral health issues often resort to prayer to absolve their dental pain and its consequential effects with nowhere else to turn (Otto, 2017). The WHO also reports that severe dental decay is a common cause of missed work and school (World Health Organization, 2017).

Typically individuals present to a dental or medical professional for the first time with a dental chief complaint relating to one of two reasons: 1) the patient is seeking routine care with a new dentist for any number of causes (patient moved, dentist retired, scheduling issues, patient preference etc.), or 2) the patient is in pain and experiencing an acute dental problem or other signs of infection. Treatment relating to the former typically involves a full clinical and radiographic exam and a comprehensive treatment plan. These treatment plans address all oral and dental conditions from small cavities to larger problems and includes the replacement of missing teeth. This type of care will hereafter be referred to as "comprehensive care." Treatment relating to the latter, however, is problem focused. If a patient presents to a dental professional, treatment such as extractions or initiating pulp (tooth nerve) therapy may be rendered to relieve the patient of pain, swelling, and risk of further systemic involvement. This type of treatment will be referred to as "acute care." However, if a patient presents to a medical professional with the same problem, they are often prescribed an antibiotic and referred to a dentist. Patients with barriers to dental care may have difficulty establishing comprehensive care with a dentist, leaving them to present to medical professionals only for acute care when the pain becomes unbearable. These patients then experience continued undiagnosed dental disease which eventually progresses to more serious problems—feeding the cycle of acute dental problems in underserved populations (Otto, 2017).

Since 2001, the American Academy of Pediatric Dentistry (AAPD) defined the "dental home" as "the ongoing relationship between the dentist and the patient, inclusive of all aspects of oral health care delivered in a comprehensive, continuously accessible, coordinated, and family-centered way." The AAPD derived this concept from the American Academy of Pediatrics' definition of a medical home, which refers to an approach of providing comprehensive, high quality primary care, not to a location or physical structure. The AAPD recommends that infants

establish a dental home as early as the first tooth comes in, or at the latest by their first birthday (American Academy of Pediatric Dentistry, 2021).

Establishing a dental home early is a critical tool in the fight against early childhood caries in families of all socioeconomic backgrounds. However, there are many reasons why children, adolescents, and adults may either fall out of their original dental home or had never established one in the first place. Though the term "dental home" is primarily used in literature to describe the need for the pediatric patient to establish regular care with a dentist, a similar term has not been described to reflect the comprehensive care needs of adult patients. Delivering "comprehensive, continuously accessible, coordinated, and family-centered" dental care should be a priority for providers treating patients of all ages, especially adults with risk factors for poor oral health outcomes. Therefore, the concept of a "dental home" should also be used to describe the new dentist-patient relationship of adult patients who are re-establishing comprehensive dental care or entering the setting for the first time.

1.2 Public Health Relevance of Barriers in Access to Dental Care

The prevalence of dental disease is not simply an individual problem but also a public health concern. As previously mentioned, dental disease and infection are extremely common and sometimes life-threatening health issues which disproportionately affect communities and individuals who experience barriers to care or are of a minority status. Oral problems can also lead to acute systemic disease, causing absenteeism and therefore pulling individuals out of a community's work force. Dental treatment is also expensive – not just for the individual, but for the nation at large when considering the source of funding for state insurance programs. Most

dental emergencies may have been prevented if caught early by routine comprehensive care. These preventative measures include: fluoride applications and prescriptions, diet and risk factor counseling, appropriate oral hygiene instructions, and removing cavities and restoring the tooth prior to nerve involvement. Public health efforts will have the greatest benefit if the focus is on the prevention of acute conditions through establishing comprehensive care for all.

For those who experience dental emergencies such as abscesses or swellings without an established dentist, emergency care at a hospital is often the first line of defense. However, emergency department (ED) visits for dental problems frequently leave patients without many answers or adequate treatment. ED physicians are not dentists – they cannot provide comprehensive dental care, and they are likely to prescribe antibiotics or pain medications to manage, but not treat, an acute problem before ultimately referring the patient to a dentist. These referrals, however, are difficult to track or ensure that patients do not fall through the cracks – the patient presented to the ED because they didn't have a dentist in the first place, which accentuates a vicious cycle of loss to follow-up. Surprisingly, these ED visits are mostly not related to cases of trauma, meaning the cause of the dental emergency may have been preventable with routine dental care (Bersell, 2017). Unfortunately, the frequency of dental related ED visits continues to increase: "in 2012, ED dental visits cost the U.S. health care system $1.6 billion, with an average cost of $749 per visit" (Wall T, 2015). According to the WHO, treatment of dental caries in general takes up 5-10% of healthcare budgets in industrialized countries, and dental issues are one of the most common reasons for childhood hospitalization in some high-income countries (World Health Organization, 2017).

In addition to the acute systemic effects of a dental infection, certain systemic diseases are also associated with or exacerbated by poor oral health. "There is increasing recognition among

those in public health that oral diseases such as dental caries and periodontal disease and general health conditions such as obesity and diabetes are closely linked by sharing common risk factors, including excess sugar consumption and tobacco use, as well as underlying infection and inflammatory pathways" (Northridge, 2020). Integration of oral and systemic health care tailored to a patient's specific needs can help improve health outcomes in both sectors. Resultingly, interventions aimed at improving access to care in either sector should go hand-in-hand at safety net and community clinic settings in order to increase access to comprehensive dental care and a dental home over a patient's lifetime (Northridge, 2020).

Mary Otto also covers the public health implications of "America's silent epidemic of oral disease" in her book, ***Teeth***. She namely focuses on the connections between oral disease and decreased employment opportunities, lower academic achievement, and problems with moving out of poverty. She speaks upon the American image and ideal of a bright, sparkling smile that began a century ago in Hollywood's film industry juxtaposed with individual accounts of young people losing their lives due to abscessed teeth and the policy changes which did (or did not) follow (Otto, 2017).

2.0 Defining and Addressing a Theory of Change

Efforts to reduce barriers to acute and comprehensive dental care should be based on an appropriate theory of change. The proposed theory assumes that any given intervention is focused on creating an accessible path of entry into the dental healthcare sector and therefore establishing the dental home. Generally low-income groups are at higher risk for dental disease in part because lower cost, processed food options often contain free sugars, which are cavity-causing fuel (World Health Organization, 2017). Because these individuals can't afford to go to the dentist and are also at higher risk for dental disease, they likely have undiagnosed dental problems. These problems could lead to lost teeth or even serious medical problems. If these individuals have an accessible path of entry into the dental healthcare sector, they may seek dental care and have dental problems diagnosed and treated before more serious medical complications or social impacts arise. With an established dental home, those who previously experienced shame about their smiles may become more self-confident. This self-confidence can help propel individuals into employment and encourage them to tackle other challenging barriers to changing socioeconomic status (Otto, 2017). Consequently, prevalence of dental caries overall may decrease.

How has this theory of change been acted upon in the past? Increasing access to dental care and decreasing caries rate have long been on the radar of public health officials and practitioners. Historically, large-scale initiatives by federal and state organizations include policy enacted by the US Surgeon General in the 1950s to add fluoride, a tooth strengthening mineral, to public drinking water. Fluoridated water has unquestionably decreased caries rate in the US, but communities which lack access to fluoride do not receive the benefits (Vargas, 10).

Other state and federal solutions to problems stemming from access in care include programs which incentivize medical or dental providers to practice in underserved communities through loan repayment and scholarship opportunities. The National Health Service Corps is a federally funded program through the department of Health and Human Services which provides financial incentives for dentists to work at community clinics in high-need areas. These clinics treat patients regardless of their ability to pay and focus on providing primary care services to all. Similar programs exist at the state level with provider support varying by state. Such programs serve as a pipeline for primary care providers in rural or underserved communities with limited access to care where older providers are retiring (Health Resources & Services Administration, 2021).

Medicaid, a federally funded and state-run social program, is a safety net to support individuals with limited resources. Expansion to include greater dental benefits for adults would decrease the financial burden of ED visits and furnish a greater number of visits in the dental setting, where treatment can be rendered in a more efficient and cost-effective manner (Wall T, 2015). These types of programs are essential.

Community outreach and volunteer efforts have been suggested to be part of the solution in bridging access to care. In our legislative reality, many uninsured individuals rely on pop-up events for free dental care. These events include nationwide initiatives like Give Kids a Smile Day and locally organized missions where dental professionals volunteer their services for free. In Pittsburgh, this need is fulfilled by the Mission of Mercy organization (A Call To Care, 2020). Though a remarkable number of patients are served during such events, their greatest downfall is that they are one-day events, not pathways to establish a dental home (Otto, 2017).

Volunteer efforts that occur more frequently often begin with dental student outreach programs. Literature about the efficacy of these programs focuses primarily on the impact on the student provider, or on patient outcomes such as oral health literacy which are easier to measure than oral health outcomes (Farokhi MR M. A.-P., 2018). This will be discussed in depth in following sections.

Overall, efforts to reduce barriers to acute and comprehensive dental care should be concerted in a conceptual model across many levels to increase patient outcomes. Interventions should be designed with a macro lens at the policy, community, and organization levels. Other programs should focus more specifically at the provider, social support, and patient levels. The goal is to lower cost and improve outcomes for all stakeholders (Northridge, 2020).

The remainder of this essay will focus on one part of the solution: utilizing dental students in the provider role for underserved communities at free community health clinics.

3.0 Dental Student Community Outreach to Address Barriers to Care

Dental students in their clinical years of education are often encouraged to participate in community service and volunteer opportunities for their own benefit while increasing access to care for their community. The American Student Dental Association (ASDA) encourages dental student involvement to reduce barriers to care for patients. The organization "…encourages the participation of interested dental students in efforts to impact the oral health of the public through projects, education, internships, externships and outreach to underserved populations" (American Student Dental Association, 2022).

The ASDA blog features articles by dental and pre-dental students across the nation. One featured article, "How my childhood influenced my need to pay it forward" by a University of Missouri-Kansas City (UMKC) dental student describes the volunteerism of UMKC students in their community. and faculty at a biweekly evening dental clinic hosted at an established free medical clinic. Though these students only provide care to about ten individuals each clinic, their efforts reach ten individuals who may have gone without dental care if not for the clinic. Simple observation of such a clinic would quickly demonstrate that this type of project goes a long way when it comes to making a direct, immediate, and visualizable impact in a community (Stetson, 2021). Ideally a few individuals can receive treatment for acute care needs at this clinic, but this model is only part of the solution. Some individuals may not be able to access the clinic due to geographic, transportation, or language barriers, while others in need simply may be unaware of the clinic. Additionally, though this model may be transferrable to other dental schools, establishing a clinic with such smooth operations typically requires a group of individuals with a

strong vision and commitment, profound administrative and legal support, and many volunteer hours from dental students and faculty—none of which are easy to come by.

Research about similar student-run dental clinics exists, but surprisingly it is more focused on the impact of such volunteer-based programs on the student providers. Others are limited by the realities of evaluating long-term outcomes and only measure outcomes such as "health education" or "oral health literacy," but not dental disease or acquisition of a long-term dental home.

For example, consider the student operated service experience at the University of Texas Health Science Center at San Antonio. At this clinic, dental students and faculty collaborate to triage patients and tailor treatment options following assessment of patients' dental, medical, and social histories. The clinic primarily serves an ever-growing refugee population with limited resources in their new host country. Studies have shown that refugees are at a high risk for poor oral health for many reasons including limited availability of nutrient rich food sources, lack of access to water fluoridation, preventative care, and dental treatment; high frequency of dental trauma due to torture related injuries; and all access to care issues associated with limited English proficiency. In combination with a lower health literacy, these risk factors translate again to increased frequency of emergency care services to treat dental problems. The higher use of emergency department visits translates to an overall higher health care cost for both the patient and community at large. The objective of the clinic is to provide free health care and education and then connect individuals to San Antonio's local primary health care system (Farokhi MR M. A.-P., 2018). Common general chief complaints at the clinic included problems with musculoskeletal systems, dermatology, gastrointestinal, and dental. Dental chief complains included caries, periodontal disease, and other dental diseases requiring urgent care. This clinic

also offers a student interpreter program and a ladies' health education program, among others (Farokhi MR G. B., 2014).

A study from the clinic was published in 2018 with the aim to "assess the oral health literacy knowledge gained by patients who are refugees, community members, and medical and nursing students after participating in an interprofessional education collaborative of students and faculty from the University of Texas Health San Antonio Schools of Dentistry, Medicine, and Nursing" (Farokhi MR M. A.-P., 2018). This study primarily focused on the interprofessional education aspect of the outreach program. A community needs assessment showed that the patient population had limited oral health literacy, volunteers were curious about the clinic's operations, and non-dental professional students were eager to learn about oral health. It was postulated that all stakeholders would benefit by engaging patients and non-dental professional student in an oral health literacy campaign. Convenience sampling was used with a pre & post-test methodology to assess gained knowledge of participants and non-dental providers after an oral hygiene instruction demonstration by dental professionals, a presentation with an illustrated booklet about oral health literacy, and written oral hygiene instructions in the patient's native language. Translators were available for all services and patients were also provided an oral hygiene kit (Farokhi MR M. A.-P., 2018).

Outcomes revealed that "the oral health literacy initiative helped increase all participants' oral health literacy and knowledge of preventive care." All groups had a significant increase in their oral health literacy score as derived by the pre-posttest. It was found that the most common gain in oral health knowledge in medical and nursing students was regarding flossing and diet, in community volunteers was acidic drink consumption, soft toothbrush use, and caries prevention using xylitol, and in patients was when and with what frequency to visit the dentist and when to

floss. Interestingly, the medical and nursing student's posttest scores were similar to those of the patients despite their previous oral health care and medical training (Farokhi MR M. A.-P., 2018).

This study emphasizes the importance of professional student involvement in reaching patients with inadequate access to medical and dental care as a tool to increase health literacy in underserved populations, but falls short in drawing conclusions associated with actual patient health outcomes.

An educational report on the clinic published in 2014 considered the critical question of what happens to these patients and where do they seek care after they leave the free clinic. At the time, they reported that collaboration with local San Antonio clinics such as the San Antonio Christian Dental Clinic was under development to serve as the patients' dental home. They concluded that the interprofessional model resulted in increased health care accessibility for San Antonio refugees. The experience, also, impacted the volunteering students who developed a better understanding of cultural competence and deep-rooted humanitarian values. Ultimately, these volunteers are often the same students who become providers in underserved communities. Students reflected on their experience: "We started attending the clinic as a service learning project. We then became their advocates, treated them at our dental school, and became knowledgeable about our community's dental clinics wile offering tailored referrals" (Farokhi MR G. B., 2014).

In the greater Pittsburgh community, the San Antonio clinic's interprofessional collaborative space best reflects that of the Birmingham Free Clinic. While transient dental clinics such as Mission of Mercy and more established clinics like the North Side Christian Health Center serve as safety nets for those with barriers to dental care, they either are infrequent or have limited dental student involvement.

The Panther Smiles Clinic is a student organized dental clinic hosted at the Birmingham Free Clinic, and the remainder of this essay will describe the efforts of Pitt Dental Medicine students to reduce barriers to acute and comprehensive dental care in their community. This was accomplished through an established affiliation between Pitt Dental Medicine and Birmingham Free Clinic.

4.0 Panther Smiles Clinic

4.1 Project Goals and Operations at Birmingham Free Clinic

The Panther Smiles Clinic was born in 2019 as a community outreach opportunity for first- and second-year dental students. The clinic was a single Saturday morning at the Birmingham Free Medical Clinic (BFC) in the Southside of Pittsburgh, where volunteer Pitt Dental Medicine students and faculty offered a cursory glance into patients' mouths, a fluoride varnish application, and a refresher on oral hygiene instructions. Since then, the Panther Smiles Clinic has grown into a monthly resource for Pittsburgh's uninsured population to seek identification of oral health needs with options for direct acute and comprehensive dental care referrals to Pitt Dental Medicine and other community dental clinics.

At the Panther Smiles Clinic, dental screenings are offered to Birmingham Free Clinic patients of record. The onsite dental screening includes an exam by a dental student and faculty member where problems are identified, and the patient is informed of the severity and urgency of each problem. Patients receive a "report card" to take home which details their dental problems, a dental resource guide of low- and no-cost dental clinics including Pitt Dental Medicine, as well as oral hygiene instructions, an oral hygiene kit, and a preventative fluoride varnish application. All services are provided in the patients' native language utilizing translating services via iPad if necessary. Intake forms and take-home materials are available in both English and Spanish.

The Panther Smiles Clinic target population is new and existing BFC patients. BFC serves patients who are medically uninsured and includes those experiencing homelessness, refugees, and those whose income is too high to be eligible for Medicaid but too low to afford private health insurance. Many patients struggle with other financial or discriminatory barriers to care in addition

to their uninsured status. Panther Smiles Clinic patients are familiar with the location and services offered at the BFC and use the BFC as a resource for medical care, enhancing integrated interprofessional collaboration (Birmingham Free Clinic, 2021). The screening clinic offers referrals to 1) acute care clinics for management of dental infections, and 2) comprehensive care clinics to establish a dental home and address typical dental needs.

The Panther Smiles Clinic offers a direct pathway to become a patient at Pitt Dental Medicine. Patients bypass Pitt Dental's on-site screening clinic required for all new comprehensive care patients, and continuity of care is ensured by assigning patients to providers who have previously seen the patient at the Panther Smiles Clinic. Additionally, radiographs and the first exam at Pitt Dental Medicine are free-of-charge for Panther Smiles patients, ensuring that all screened patients are able to receive a full oral and dental diagnoses despite financial barriers. However, after the initial exam, treatment is rendered at traditional Pitt Dental Medicine fees.

Though dental student providers at Pitt Dental Medicine may provide a dental home for Panther Smiles Clinic patients, ultimately Pitt Dental Medicine may not be the best dental home for all patients' needs and circumstances. A comprehensive resource guide is presented and given to all patients to take home at the Panther Smiles Clinic. Resources on the guide include free and reduced-cost clinics such as Catholic Charities, North Side Christian Health Center, nearby Federally Qualified Health Centers, Mission of Mercy, etc. The goal of the Panther Smiles Clinic is to meet patients where they are, serving as a bridge to accessible oral health care – not necessarily to make a referral to Pitt Dental Medicine.

4.2 Shifting to Electronic Health Records (EHR) during COVID-19 Pandemic

As the Panther Smiles Clinic began to pick up stride during the 2019-20 academic year, the COVID-19 pandemic brought its progress to a halt in March 2020. Patients and providers alike were hesitant to spend unnecessary time in public spaces, and patients were hesitant to be seen for elective care. To mitigate risk and ensure the BFC was able to meet the medical needs of its own patients during the pandemic, the Panther Smiles and Birmingham Clinic teams decided to pause the dental screening clinic until January 2021.

Panther Smiles Clinic has experienced great evolution due to its COVID-19-era re-opening. A silver-lining of the pandemic was Pitt Dental Medicine's need to digitize workflows which previously relied on face-to-face interaction. Outcomes included the ability of students to remotely access and schedule appointments using Pitt Dental Medicine's EHR system, AxiUm, via their personal laptop – a feature which is incredibly useful when screening patients at a remote clinic.

A few days before each clinic, charts are created by Pitt Dental Medicine's Patient Experience Specialist team in AxiUm for patients scheduled to present to Panther Smiles Clinic screenings. Notes and forms documenting the screening visit are completed in the patient's Pitt Dental EHR during the screening clinic by remotely accessing AxiUm on dental students' personal laptops via a VPN. Patients seeking comprehensive care at Pitt Dental Medicine are then scheduled for the next appointment directly from their exam room during the screening visit, while acute care needs are most often addressed via referral to the walk-in emergency clinic at Pitt Dental Medicine.

Initial Comprehensive Oral Exams (COEs) are scheduled either with the dental student at the Panther Smiles Clinic who provided the screening, or with another dental student at the clinic

better suited for the patient based on patient and provider preference. At the time of screening, students and faculty work together to determine appropriate diagnostic radiographs for each patient. Patients are instructed to arrive early to Pitt Dental Medicine to complete radiographs before the COE. Remote access to AxiUm as well as remote appointment requests and scheduling abilities have streamlined the ability for Panther Smiles Clinic patients to ensure continuity of care and minimize patient loss to follow up.

4.3 Evaluating Impact

The clinic has established rapport and consistency within Pittsburgh's uninsured community. Assessment of the clinic's value for the population it serves is imperative. Evaluating impact requires understanding patient needs and is multifactorial. Patients' oral health needs vary drastically depending on many variables, including oral hygiene, genetic predisposition, diet, systemic disease, and socioeconomic status just to name a few. Each of these factors can contribute to oral health stability or disease, and each factor often compounds the effects of another. Additionally, patient needs—perceived needs by the patients themselves – may vary even between patients with similar oral health status. This vast variation in oral health status and perceived patient need presents challenging questions which must be addressed when evaluating the "success," "efficacy," or "impact" of the clinic. Future studies on the Panther Smile Clinic may benefit by dividing patients into at least two categories upon presentation to the screening clinic: 1) patients seeking comprehensive care (full workup including an exam and x-rays, then treatment for any issue subsequently identified), and 2) patients seeking acute care (problem focused treatment such as infection elimination, pain relief, etc.).

To illustrate the concept above, consider this example: An uncontrolled diabetic patient presents to the Panther Smiles Clinic in pain. Upon examination, our team identifies many dental issues: a draining abscess, rampant caries (many cavities), and advanced bone loss or periodontal disease. We present each of these issues and recommend a full comprehensive care work-up with immediate attention to the active infection at either Pitt Dental Medicine or another clinic on the dental resource guide. We address the poorly controlled diabetes, as inferred from the previous HbA1c, and council the patient on the association of poor glycemic control and bone loss. The patient expresses concern: abscess and pain, limited finances, inability to take time off from work, and English as a second language. Each of these challenges are barriers. They are reluctant to address anything beyond the acute issue. We present the option for a direct referral to the Emergency Clinic at Pitt Dental Medicine the next morning, where the infection can be treated. Now, it is time to evaluate the impact of the Panther Smiles Clinic for this patient. Was the intervention a "success" because we provided a pathway to a referral for the acute problem? Is a referral only for acute care an unacceptable outcome? Does "success" mean something else entirely? A formal process and outcomes evaluation would be useful to determine how the clinic should tailor to its populations' needs in the future.

Once perceived patient needs are identified, it will be possible to evaluate if the needs have been met within the patients' respective category. Questions to help evaluate the impact, efficacy, and success of the clinic which can be implemented immediately include:

1. Are patients who seek comprehensive care ultimately receiving comprehensive care?

2. Are patients who seek acute care receiving acute care?

3. Did the screening clinic provide patients with the resources and information they needed to pursue comprehensive or acute care either at Pitt Dental Medicine or elsewhere?

Answers to the above questions will help paint the picture of the overarching question in evaluation of the Panther Smiles Clinic – Is the Panther Smiles Clinic a pathway to a dental home for Pittsburgh's uninsured population?

In a step toward an outcomes evaluation design, the complete digitization of record keeping for Panther Smiles Clinic patients provides the opportunity to run automated AxiUm reports on patient population data. Utilizing a digital workflow to analyze Panther Smiles Clinic population trends streamlines analyzation and markedly decreases the administrative burden associated with tracking such data by hand. With a quicker, more efficient process, patient trends in seeking dental care are more quickly identified, and the Panther Smiles Clinic intervention can be adjusted earlier to better patient outcomes and best accommodate the population it serves. This data is important not only for patient care, but also for the sustainability of the clinic from an administrative standpoint. Panther Smiles Clinic student leadership has worked diligently to ensure the clinic has a sustainable process and procedure by training workers on the ground, but administrative support is also crucial to the clinic's longevity and stability in the community.

Tables developed to visualize the data and determine the digital reports which may be most contributory to our outlined questions can be found in Appendices A and B. These indicators were developed with a collaborative approach with the goal to best categorize Panther Smiles Clinic patient barriers to care and treatment needs. A form was created to facilitate collection of this data, which is outlined in Appendix C. Any columns not described in the form can be acquired by running reports based on specific completed treatment codes.

4.4 Implications, Limitations, and Growth of Panther Smiles Clinic

Evaluation outcomes should guide decision making and support for the future of the Panther Smiles Clinic. If most patients who present to Pitt Dental Medicine are receiving comprehensive care such as cleanings, deep cleanings, fillings, crowns, or any removable prosthesis, one could assume that the Panther Smiles Clinic is bridging the gap in access to care and helping patients establish a dental home. This result would indicate that the clinic is functioning as intended and can continue its operations as-is.

However, if a significant proportion of patients who present to Pitt Dental Medicine are receiving acute care services such as extractions or an incision and drainage with no other comprehensive care provided, the implications are vastly different. Since any person can present to Pitt Dental Medicine to receive same-day dental emergency treatment, one could infer that the Panther Smiles Clinic is not bridging the gap in access to care but is instead creating an artificial barrier in the process for a patient to receive emergency treatment at the dental school. If this is the case, the Panther Smiles Clinic should reconsider its role in barrier reduction for underserved communities and advocate for providing acute dental care services onsite at the Birmingham Free Clinic during the initial screening.

As mentioned, a current limitation is that acute and comprehensive care services are not offered during Panther Smiles Clinic screenings, and ultimately the clinic is simply providing a referral. Providing dental services at the clinic would certainly elevate its role in the reduction of barriers to dental care in the Pittsburgh community.

Another limitation arises when a patient chooses to receive care for identified needs at a site on the resource guide which is not Pitt Dental Medicine. Patients may choose a different clinic for several reasons including limited finances, inaccessible transportation to the dental school, poor

availability during business hours, a personal preference to not be treated by a student, and many others. The goal of the clinic is not to make referrals to Pitt Dental Medicine, but to make referrals which reduce an individual's barriers to care and increase their likelihood of establishing a dental home. Often, a completely free or sliding-scale clinical setting, or a clinic in their neighborhood, is the best place for these patients and their oral health outcomes. However, if a patient states intention to establish a dental home outside of Pitt Dental Medicine, following up to evaluate the patient's medium and long-term oral health outcomes as a result of the Panther Smiles Clinic becomes difficult or impossible.

Finally, the measured outcomes may not necessarily reflect the population of the entire Birmingham Free Clinic if the Panther Smiles Clinic isn't reaching all patients who are in need. Though posters are regularly posted in the medical clinic's waiting room in English and Spanish, a patient may not be aware of the dental screenings if they have been using telehealth or have not recently needed medical care. Additionally, if a patient contacts the BFC to be seen with complaints of dental pain or urgent infection, BFC staff may directly refer the patient elsewhere to be seen faster and to avoid an extra appointment without treatment. Both issues should be considered when making future changes to the Panther Smiles Clinic

Ultimately, a long-term goal of the Panther Smiles Clinic is to expand to providing treatment onsite. The volunteer force is ready and able; however, adequate on-site dental space has been a limiting factor for developing this project. The six medical exam rooms at the BFC are not plumbed for dental water or suction lines. They also lack focused lighting options essential for completing dental procedures. Additionally, there are no dental operatory chairs nor fittings for dental handpieces. However, these obstacles are not insurmountable. Portable equipment could solve several of these problems, and the goal of providing treatment onsite could be accomplished

with a substantial grant, or an equipment or financial donation. Additionally, the Panther Smiles Clinic was pioneered in a fashion that allows its volunteer efforts to physically happen at any location. In the future, screenings do not and should not be limited to just the Birmingham Free Clinic but could be hosted in other high-need neighborhoods, at different community clinics, or even in homeless shelters.

5.0 Conclusion

Dentistry continues to be one of the most unmet health care needs in Americans. Student operated free dental clinics such as the Panther Smiles Clinic serve as a pivotal resource for those with barriers to oral health care. Hopefully these clinics can help patients establish a dental home and obtain comprehensive care. They also support the opportunity for professional development and continued provider humanitarianism. Student volunteer clinics and other measures to increase access to oral healthcare should be concerted across multiple levels of the healthcare system to create lasting change. Until a systemic change integrates medicine and dentistry and reduces barriers to healthcare, Americans will continue to face sometimes life-threatening oral health issues. It is still possible to make significant contributions to improving the overall and oral health of communities who are underserved through locally sourced dental initiatives. These options should be endorsed by dental organizations and institutions in their communities.

Appendix A Panther Smiles Clinic Patient Indicators

Table 1. AxiUm reported outcomes of Panther Smiles Clinic Patients at Pitt Dental Medicine

	Show rate for Panther Smiles Clinic Screening (#pts screened)/ (#pts scheduled)	**Number of patients screened (n)**	**Percent interested in pursuing care at Pitt Dental Medicine of patients screened** (#pts verbally expressing interest in COE at Pitt Dental Medicine) / (#pts screened)	**Percent presenting for initial appointment COE and radiographs of patients screened** (#pts presenting for COE, radiographs at Pitt Dental Medicine) / (#pts screened)	**Percent receiving any *comprehensive care* of patients screened** (#pts w/completed treatment code for prophy, SRP, or any restorative – any treatment after COE outside of simple/surg exts, I&Ds, or LOE/emergency clinic visits) / (# pts screened)	**Percent receiving *ONLY acute care* of patients screened** (# pts w/completed code for simple or surg exts, I&Ds, or LOE/emergency clinic visits WITH NO OTHER completed comp care codes) / (# pts screened)	**No show rate to COE and radiograph appt, compared to typical Pitt Dental Medicine patient no show rate**
Jan							
Feb							
March							
April							
May							
June							
Six-month average	**%**	**n**	**%**	**%**	**%**	**%**	**% vs %**

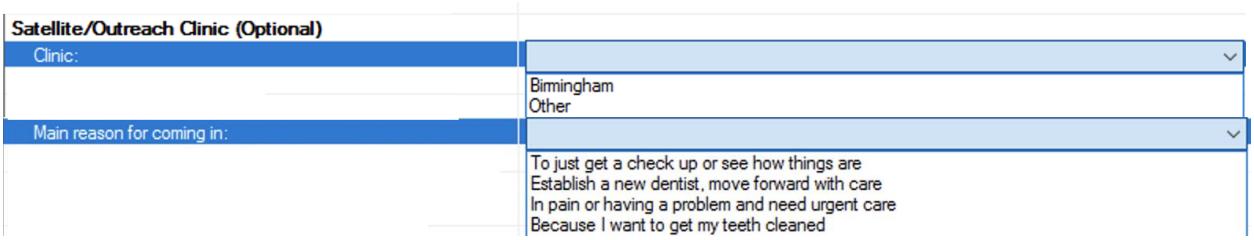
Appendix B Panther Smiles Clinic Patient Barriers

Table 2. Barriers to care for patients seeking oral health care referrals outside Pitt Dental Medicine

	Finances	**Time**	**Transportation**	**Language barrier**	**other**
Of patients not interested in pursuing care at Pitt Dental Medicine, what was the reported reason?	%	%	%	%	**include an addendum list of other reasons in "results"

Appendix C Indicator Collection in Electronic Health Record

Part 1:



Part 2:

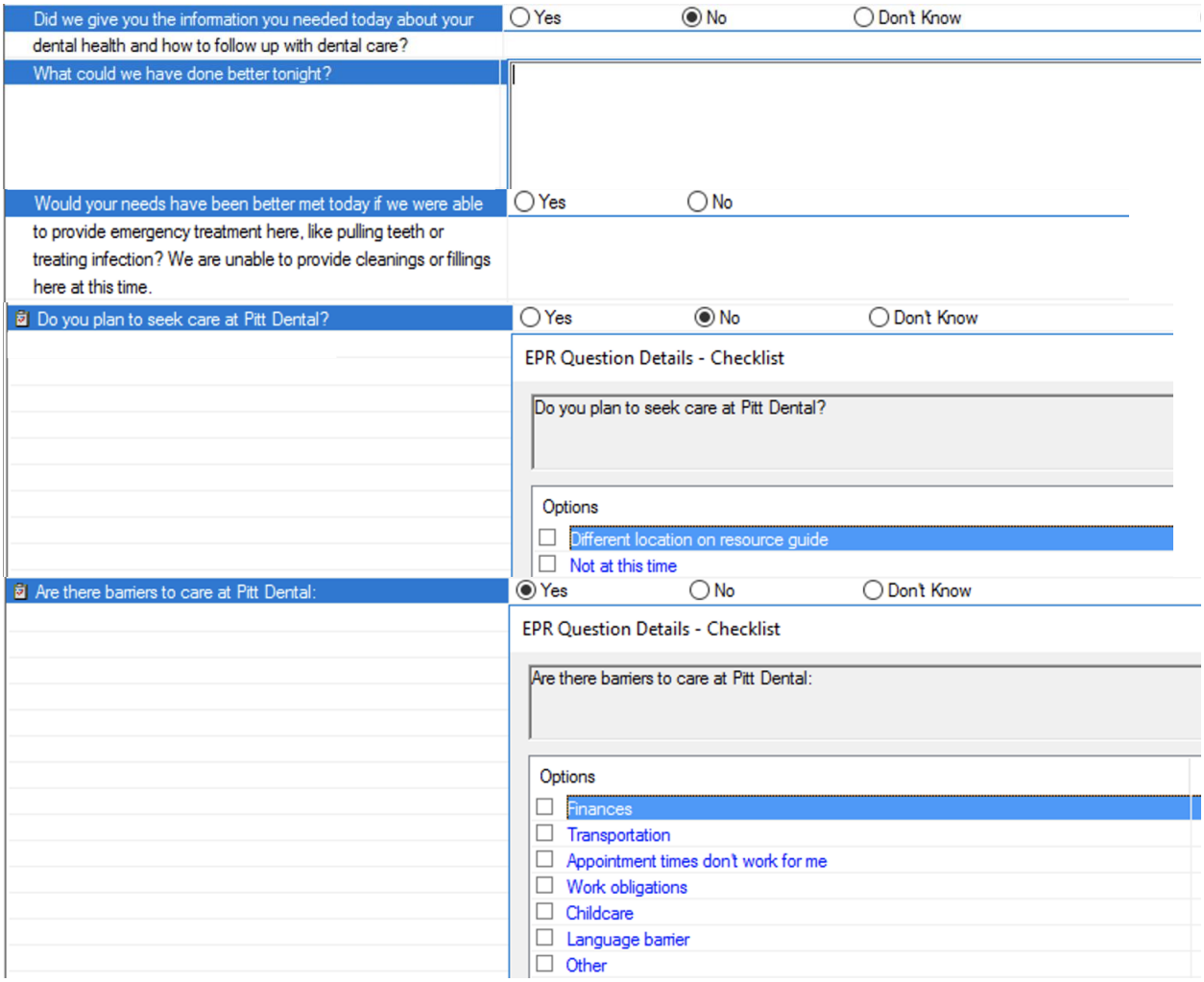


Figure 1. Screenshots of screening survey from AxiUm EHR

Part 1 is designed to be completed by the provider, while Part 2 should be completed by a third party who was not in the room during the screening to reduce bias in patient responses.

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