Educational Program For Caregivers Of Children With Tympanostomy Tube Otorrhea: Impact On Caregiver Self-Efficacy And Clinical Outcomes

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EDUCATIONAL PROGRAM FOR CAREGIVERS OF CHILDREN WITH TYMPANOSTOMY TUBE OTORRHEA: IMPACT ON CAREGIVER SELF-EFFICACY AND CLINICAL OUTCOMES

Submitted to the Faculty
Yale University School of Nursing

In Partial Fulfillment
of the Requirements for the Degree
Doctor of Nursing Practice

Wendy Lord Mackey, MSN, APRN-BC, CORLN

May 23, 2022
TTO Educational Program

This DNP Project is accepted in partial fulfillment of the requirements for the degree Doctor of Nursing Practice.

______________________________

Martha K. Swartz, PhD, RN, CPNP, FAAN

Date: March 30, 2022
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Wendy Lord Mackey, MSN, APRN-BC, CORLN

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No more countdowns …

We will forever be YSN’s first Clinical DNP graduates.

And thank you to my besties- for always being there for me.

This project is dedicated to

My husband John Joe,

My children James, Tess, and Lily,

My parents Joan and Lovel and my sister April.

Together you have taught me the most important lessons in life - to live every day to the fullest,
believe in yourself to conquer your dreams and to always keep love and family close by.
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Abstract

There is an overuse of oral antibiotics and acute care visits conducted to treat children with acute uncomplicated tympanostomy tube otorrhea (TTO), a condition easily identified by the child’s caregiver who can then independently initiate treatment with ototopical antibiotic drops (TAD). Yet, some caregivers seek urgent medical attention for children with TTO, which often results in mismanagement of the condition including the administration of oral antibiotics. This quality improvement initiative involved the development and implementation of an educational program for caregivers of children with tympanostomy tubes (TT). Resources for caregivers included a web-based instructional video, informational pocket-card, and a post-operative text reminder to educate, empower and improve the self-efficacy of caregivers of children with TTO to initiate treatment independently when clinically indicated. Fifty-eight caregivers were enrolled. Caregiver self-efficacy mean scores were analyzed (paired T-test) and significantly higher (p=<0.0001) after implementing the educational program when compared to pre-intervention scores on all 7 self-efficacy items measured. Caregivers were surveyed regarding their perception of the educational program, and the majority felt the resources were helpful and valuable for future use. Twenty-one percent of the patients experienced post-operative TTO; 100% of those caregivers reported initiating TAD, 58% of whom referred to the educational resources. Those who did not refer to the educational material all had children who had previous TTs. No children received oral antibiotics following tube placement related to TTO. Recommendations pertaining to scaling, sustainability and dissemination of the project are also presented.
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Abbreviations

Clinical (in order of appearance in manuscript)
- TT - Tympanostomy tubes
- TTO - Tympanostomy tube otorrhea
- TAD - Topical antibiotic otic drops
- CPG - TT - Clinical Practice Guideline for children with tympanostomy tubes
- DNP - Doctor of Nursing Practice
- ED - Emergency Department
- PDSA - Plan, Do, Study, Act Cycle
- SWOT - Strength, weakness, opportunity, threat

Organizations (alphabetical order)
- AANP - American Association of Nurse Practitioners
- AAO - American Academy of Otolaryngology
- AMA - American Medical Association
- CDC - Center for Disease Control and Prevention
- IOM - Institute of Medicine
- NAPNAP - National Association of Pediatric Nurse Practitioners
- SENTAC - Society of Ear Nose and Throat Advancement in Children
- SOHN - Society of Otolaryngology Head and Neck Nursing
- WHO - World Health Organization
Chapter 1

Introduction

Tympanostomy tube (TT) insertion is the most common ambulatory surgical procedure performed in children in the United States (Rosenfeld et al., 2022; Chang et al., 2018). Data from the National Health Interview Survey of 2014 note 6.26 million children (95% CI, 5.70-6.82 million) underwent TT placement during childhood in the US with a prevalence of 8.6% (7.9 - 9.3%) of children under the age of 17 years (Bhattacharyya & Shay, 2020). Numbers have fluctuated over past years with a significant reduction likely due to improved vaccination rates with pneumococcal conjugate- 670,000 children in 2006 versus 413,000 children in 2010 (Chang et al., 2018; Cullen et al., 2009). TT placement accounts for 20% of all surgeries performed in children in the United States, with one in every 15 children undergoing the procedure by three years of age (Rosenfeld et al., 2022; Cullen et al., 2009). The primary indications for TT placement include persistent middle ear effusions or recurring otitis media, the result of an immature or dysfunctional eustachian tube (Rosenfeld et al., 2022; Rosenfeld et al., 2016). Otitis media affects 8.7 million children per year in the US, with an estimated healthcare cost of $2.88 to 4.3 billion dollars per year (Ahmed et al., 2014; Tong et al., 2018). This diagnosis is one of the most common indications for systemic antibiotic prescriptions and outpatient healthcare visits world-wide (Ahmed et al., 2014; Tong et al., 2018).

Tympanostomy tube otorrhea (TTO) is the most common sequela of TTs with at least one episode occurring in up to 83% of children, the incidence increasing the longer the tubes have been in place (Ah-Tye et al., 2001). It is characterized by brief, sporadic, painless, purulent drainage visible within the ear canal. TTO in this paper refers to acute (lasting less than 4 weeks), uncomplicated otorrhea which denotes a temperature less than 38.5C and absence of
TTO Educational Program

concurrent illness or cellulitis requiring systemic antibiotics (Rosenfeld et al., 2022). TTs allow access to the middle ear space, which accounts for the drainage when an infection is present, but also allows access to the middle ear for administration of topical medication. Other advantages to TT placement include improved hearing and speech, improved quality of life for the child and caregivers and decreased need for systemic antibiotics to treat infections (Rosenfeld et al., 2022).

Problem Statement

There is an overuse of oral antibiotics and acute care visits being conducted to treat children with uncomplicated TTO; a condition easily identified by the child’s caregiver who can then initiate treatment with ototopical antibiotic drops (TAD) without the need for an urgent care visit. Yet some caregivers seek urgent medical attention for children with TTO, which often results in mismanagement of the condition including the administration of oral antibiotics. One study identified parents’ desire to pursue unscheduled medical visits due to the perception that their child’s condition was urgent or the need for reassurance regarding approach to care (Nicholson et al., 2020).

For the past two decades, multiple studies and meta-analyses have shown that TAD are superior to other treatment options resulting in faster cessation of otorrhea, more clinical cures, superior microbial eradication rates, reduced recurrence rates and a superior safety profile (Chee et al., 2016; Dohar et al., 2006; Goldenblatt et al., 2006; Heslop et al., 2010; Dohar et al., 1999; van Dongen et al., 2014; Granath et al., 2008; Steele et al., 2017). Despite this evidence and national guidelines which strongly recommend TAD over oral antibiotics, some providers continue to prescribe oral antibiotics (Rosenfeld et al., 2022; Badalyan et al., 2013). The American Academy of Otolaryngology (AAO) Choosing Wisely and The Canadian Choose Wisely Campaigns, programs focused on raising consumer and provider awareness regarding
unnecessary tests and treatments, have both indicated this as a top priority with statements recommending that oral antibiotics not be used for patients with uncomplicated TTO (Ma et al., 2019; AAO, 2019).

The goal of this Doctor of Nursing Practice project is to create an educational program including a web-based video and instructional pocket-card to educate and empower caregivers of children with TTO to initiate treatment independently when clinically indicated. The long term goal of this work is to improve clinical outcomes, increase satisfaction and autonomy of caregivers, decrease cost of care, and decrease unnecessary oral antibiotic prescriptions.

Significance of the Problem

Antibiotic resistance is a global health crisis (WHO, 2021). In the US alone, more than 2.8 million antibiotic resistant infections occur each year resulting in more than 35,000 deaths (CDC, 2019). The CDC has focused national attention on antimicrobial stewardship and resistance reduction, mandating improvements in the appropriate use and reduction in unnecessary use of antibiotics (CDC, 2019). Additionally, the National Action Plan for Combating Antibiotic-Resistant Bacteria (2020) was established to offer a coordinated evidence-based strategic plan to reduce antibiotic consumption and resistant infections. It is imperative that patients receive antibiotics only when indicated – and that it be the correct antibiotic, by the correct route, with correct dose, duration, and timing. Antibiotics are prescribed in approximately 20% of pediatric outpatient encounters, resulting in over 73 million prescriptions yearly in the US, with at least 29% unnecessarily and inappropriately prescribed (Fleming-Dutra et al., 2016; Hicks et al., 2015; Hersh et al., 2011). Key contributing factors include concern for patient satisfaction and pressure to prescribe, time constraints, and diagnostic uncertainty (Zetts et al., 2018). There is no evidence that antibiotic resistance develops with TAD (Roland et al., 2004).
Antibiotics have the inherent risk of causing patient harm due to possible adverse drug reactions, ranging from mild to life-threatening symptoms resulting in additional urgent visits and accrued medical costs. These events account for approximately 70,000 yearly emergency department (ED) visits for children in the US, with 3% requiring hospitalization (95% CI, 53 488–85 441) (Lovegrove et al., 2018). Antibiotics account for 64% [95% CI, 60.0%–67.8%] of ED visits for adverse drug events from systemic medications in children under two years (Lovegrove et al., 2018). Antibiotic exposure is the most significant risk factor for increasing Clostridium difficile infection, a toxin producing organism which causes mild to lethal gastrointestinal symptoms, with potential for community spread (Miranda-Katz et al., 2020; Leffler & Lamont, 2015). The inappropriate prescribing practices for children with TTO directly impact clinical outcomes, have global implications for antibiotic resistance and financial implications resulting from the cost of additional medical encounters and associated missed work and school days.

A key objective from the Federal Task Force on Combating Antibiotic Resistant Bacteria (2020) is to promote public engagement and education focused on antibiotic responsibility. This approach is consistent with the Institute of Medicine document Health Professions Education: A Bridge to Quality which prioritizes delivery of patient centered care to “… clearly inform, communicate with, and educate patients; share decision making and management; and continuously advocate disease prevention, wellness and promotion of healthy lifestyles, including a focus on population health” (IOM, 2003, p. 45 ). Thus, it is incumbent on health care providers to produce and prescribe high quality, evidenced based educational resources that offer parents guidance to ensure safe and effective care, while promoting caregiver autonomy in the care of their children’s health.
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Chapter 2

Literature Search

Two comprehensive literature searches were conducted for this project. The initial search focused on best treatment options for TTO in children, with a focus on TAD compared to oral antibiotics. Electronic databases searched in this literature review included OVID Medline, Scopus, and Cochrane Reviews. The search terms included “tympanostomy tube” OR “myringotomy tube” OR “grommet” AND “otorrhea” OR “infection” OR “otitis media” OR “drainage” AND “child*” OR “infant*” AND “treatment” OR “antibiotic” OR “management”. Articles were selected from all countries and any time range as early studies built the foundation for current treatment for TTO. Exclusion criteria included publications in languages other than English and without full text availability via Yale University. The search yielded a total of 996 studies. After screening, 125 articles were assessed for relevance, of which 35 studies were relevant and included in the review of literature (See Appendix A1 and B1) (Moher et al., 2009).

A second search focused on web-based health care education for parents of children with TTs. Electronic databases searched in this literature review included OVID Medline, Scopus, and CINAHL. The search terms included “digital health” OR “internet” AND ‘information seeking” OR “health behavior” AND “tympanostomy” OR “otolaryngology” OR “grommet” AND “child*” OR “parent”. Search dates were limited to 2015-2021 as internet use has increased dramatically in the past decade in both consumer use and products available (Anderson et al., 2019). Exclusion criteria included only using articles published in English and within North America. The search yielded a total of 342 studies. Once screened, 70 articles were assessed for relevance; eighteen were considered relevant and included in the review of literature (See Appendix A2 and B2) (Moher et al., 2009).


Review of the Literature - Treatment of Tympanostomy Tube Otorrhea in Children

Clinical Practice Guideline on Tympanostomy Tubes in Children

In 2022, the AAO published an updated multidisciplinary, evidenced-based Clinical Practice Guideline for Children with TT (CPG-TT) for clinicians caring for children, 6 months to 12 years in any clinical setting (Rosenfeld et al., 2022). This publication was updated from the original and only version in the US from 2013 (Rosenfeld et al., 2013). Three Guideline Key Action Statements are particularly important to this project and are itemized in Table 1. There is a strong recommendation regarding the use of TAD without oral antibiotics for children with uncomplicated TTO. There is also a strong recommendation for the surgeon or designee to examine the child within 3 months of tube placement and educate families regarding routine follow-up care until the tubes are out and the ears are healthy. Of the 16 action statements in this

Table 1

Summary of Key Action Statements Applicable to this Project from CPG-TT

<table>
<thead>
<tr>
<th>Topic</th>
<th>Key Action Statement</th>
<th>Recommendation Strength</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acute Tympanostomy tube otorrhea</td>
<td>&quot;Clinicians should prescribe topical antibiotic ear drops only, without oral antibiotics, for children with uncomplicated acute tympanostomy tube otorrhea.&quot; (p. S39)</td>
<td>Strong recommendation</td>
</tr>
<tr>
<td>Follow-up</td>
<td>&quot;The surgeon or designee should examine the ears of a child within 3 months of tympanostomy tube insertion AND should educate families regarding the need for routine, periodic follow-up to examine the ears until the tubes extrude.&quot; (p. S42)</td>
<td>Strong Recommendation</td>
</tr>
<tr>
<td>Perioperative Education</td>
<td>&quot;In the perioperative period, clinicians should educate caregivers of children with TT regarding the expected duration of tube function, recommended follow-up schedule, and detection of complications.&quot; (p. S33)</td>
<td>Recommendation</td>
</tr>
</tbody>
</table>

Note: Adapted from Rosenfeld et al., 2022
guideline, these are the only strong recommendations. CPG-TT also made a recommendation for clinicians to educate caregivers regarding the tubes, care, and detection of complications to improve patient outcomes and caregiver autonomy (Rosenfeld et al., 2022).

Although CPG are exceptional tools which summarize current evidence and provide recommendations to drive practice for evidenced based diagnosis and treatment, they are only effective if operationalized. Badalyan et al (2013) reported that 54% of ED physicians and 9% of otolaryngologists routinely prescribe oral antibiotics to treat TTO. One study investigated adherence to the CPG-TT regarding patient selection for TT placement and found that 75% of the patients clearly met the recommended guideline criteria, with a 5% deviation from guideline insertion criteria (Hughes et al., 2017). Another study surveyed otolaryngologists to identify the influence of various CPGs on their practice. Results indicated that 70% reported that CPGs influenced their daily practice (median, 75% [IQR, 61%-85%]), with a higher percentage of adherence in academic versus general practices (59% vs 29% - difference 30% [95% CI, 11%-49%]), and greater adherence among younger otolaryngologists (30-39 years), than in older age groups (Aarts, 2012). Herigon and colleagues (2021) reviewed adherence to otitis media CPG for antibiotic prescriptions in children and noted only 42% were fully adherent to guidelines.

**Tympanostomy Tube Complications**

TTO is the most common sequelae of TTs with a mean occurrence of at least one episode in 26.2% of patients (95% CI- 25-27.3, range 4.3-68.2) (Kay et al., 2001). However, Ah-Tye and colleagues (2001) prospectively identified a rate of 83%, noting the incidence of infection increases the longer the tubes have been in place. TTO typically presents as painless, purulent drainage that is visible within the ear canal, making identification easy for caregivers. TTs allow access to the middle ear space, which accounts for the drainage when an infection is present; but
also allows access to the middle ear for administration of topical medication. Factors increasing
the incidence of TTO include age under 3 years, recurrent upper respiratory tract infection,
presentation in the colder months, living in urban areas, daycare attendance, having an older
sibling, and cigarette smoke exposure (Wang et al., 2021; Ah-Tye et al., 2001; van Dongen et al.,
2013). A lower incidence of TTO is appreciated in children who have undergone adenoidectomy
(Ferlito et al., 2020; Pereira et al., 2005). Chronic TTO is defined as otorrhea that persists beyond
four weeks with an incidence of 4%; and recurrent TTO, more than three discrete occurrences,
affects 7% of children (van Dongen et al., 2013).

Although TTO may first seem like a negative consequence, it may also be considered an
advantage. Instead of otalgia, fever, and hearing difficulty (symptoms associated with otitis
media), the child typically experiences painless drainage, easily identified by the caregiver who
can initiate topical treatment. Additionally, the TTO itself may be evidence that the child has not
yet outgrown the eustachian tube dysfunction and the TTs are still needed. One study noted low
parental decisional regret regarding the surgical placement of the TTs, noting no correlation of
regret to incidence of TTO, need for additional sets of tubes, need for follow-up visits, or need
for TAD treatment (Carr and al., 2017).

To reduce unnecessary office visits and provide more efficient treatment, Shaffer and
colleagues (2020) developed a telehealth clinical pathway which prompted parents of children
with TT to call their ‘nurse line’ if they identified TTO. They reported that 100% of the parents
who called correctly identified TTO which prompted treatment with TAD; 83% of patients did
not require a subsequent clinic visit. Patel and colleagues (2019) noted a dramatic drop in phone
calls from parents seeking guidance for TTO following parental education with a small
illustrated TTO management card compared with those who did not receive the educational card
(pre-intervention calls 59.3% versus post-intervention calls 16.7%). Encouraging a safe and supportive family-centered environment for engagement in healthcare decision making promotes caregiver autonomy and confidence.

Additional sequelae related to TTs include post-extrusion perforation (1.1-5.1%), persistent TT requiring surgical removal (2.6-3%), tympanic membrane retraction (39.7%), and tympanosclerosis (23.3%) (O’Niel et al., 2015; Padia et al., 2018; Pereira et al., 2005). Nineteen to 30.9% of children with TTs will require a second set following displacement due to ongoing middle ear disease, and 4.6-10.9% will require three or more sets (Padia et al., 2018; O’Niel et al., 2015; Goel et al., 2021). Pereira and colleagues (2005) identified the need for an additional set of tubes to be higher in children who had their initial set placed at a younger age (children requiring only one set of TT were aged 35.9+/−19.1 months versus children who needed more than one set were 26.6+/−12.5 months, P=0.04). Typically, TTs will displace on their own about 1 year after insertion (12.13 ± 6.06 months with an average retention time of 445 days); however, a small percentage may displace in the first month (<0.01%) or persist for longer than intended requiring intentional removal (2.6%) (Ferlito et al., 2020; Ah-Tye et al., 2001; Padia et al., 2018; O’Niel et al., 2015; Pereira et al., 2005).

**Tympanostomy Tube Otorrhea Pathogens**

The most common pathogens contributing to acute TTO are communicated from the nasopharynx to the middle ear (*Hemophilus influenzae, Streptococcus pneumoniae, Moraxella catarrhalis*) and those invading the middle ear via the external auditory canal (*Staphylococcus aureus, Pseudomonas aeruginosa*) (Roland et al., 2003; Ruohala et al., 2007). In general, TAD are superior to systemic options because they produce a substantially higher concentration of antibiotic at the infection site when compared to oral (Billings, 2016; Rosenfeld et al., 2013).
This results in an amplified capacity to exceed the minimum inhibitory concentration (MIC), the lowest concentration of an antibiotic that inhibits the growth of a bacteria (Renukananda et al., 2014). Specifically comparing middle ear antibiotic concentration of high dose oral amoxicillin (10-12 µg/mL) to 3% topical ciprofloxacin or ofloxacin (3000 µg/mL), the concentration is 300 times higher with topical therapy (Roland, 2004). Even though most acute TTO will respond to empiric TAD, some clinicians obtain cultures to identify the causative organism. However, even when resistant organisms such as Methicillin-resistant Staphylococcus aureus are identified on culture results, the sensitivity profiles are based on systemic concentrations of antibiotics. Some clinicians may rely on reported resistance profiles, ignoring potentially appropriate TAD options that will likely result in bactericidal outcomes by exceeding the MIC (Walker et al., 2018). Therefore, culture acquisition is unnecessary in acute TTO as the reported resistance levels are irrelevant (Rosenfeld, 2020). Although systemic quinolone antibiotics are not recommended in pediatric patients due to safety concerns, topical administration is approved due to limited systemic absorption (Rosenfeld et al., 2013; Hersch et al., 2015). An additional advantage is the avoidance of adverse reactions commonly attributed to systemic delivery of antibiotics (Chee et al., 2016; Dohar et al., 2006; Goldenblatt et al., 2006; Heslop et al., 2010; van Dongen, 2014).

Treatment of Tympanostomy Tube Otorrhea

The literature is rich with sound evidence documenting the superiority of TAD versus alternative treatments in children with TTO, much of the original research dating back two decades. A table summarizing these studies with statistical relevance can be found in Appendix C. Multiple meta-analysis and randomized control studies have observed statistically significant superior results when treating with TAD (with or without steroids) versus oral antibiotics including faster cessation of otorrhea (4 versus 7 days), more clinical cures (76-85% versus 30-
69%), fewer treatment failures (23% versus 70%), superior microbial eradication rates (96% versus 65%) and reduced recurrence rates (Steele et al., 2017; Venekamp et al., 2016; Chee et al., 2016; Dohar et al., 2006; Heslop et al., 2010; Dohar et al., 1999; Goldblatt et al., 1998; van Dongen et al., 2014). When comparing TAD to normal saline drops alone, corticosteroid ototopical drops alone, watchful waiting or placebo, TADs were superior on all parameters measured, noting similar but higher treatment failures in those treated with oral antibiotics versus saline drops (Heslop et al., 2010; Steele et al., 2017; Chee et al., 2016; Venekamp et al., 2016). Of note, the addition of topical steroids to TAD is statistically superior to non-steroid containing preparations in respect to mean time to cessation of TTO, clinical cure, microbiologic success, and fewer treatment failures (Steele et al., 2017; Chee et al., 2016, Roland et al., 2003; Roland et al., 2004; Spektor et al., 2017). One study showed that an oral antibiotic did significantly accelerate the resolution of acute TTO over placebo (3 versus 8 days, P=.002) and reduce the duration of bacterial growth in the middle ear fluid (1 versus 8 days, P<.001); however, TADs were not used in this study (Ruohola et al., 2003). Granath et al (2008) found the addition of an oral antibiotic to TAD treatment did not significantly reduce the duration of TTO, providing yet more evidence for the exclusive use of TAD in the treatment of TTO.

In addition to superior clinical outcomes, there are significantly fewer treatment related adverse events experienced with TAD compared to oral antibiotics (Chee et al., 2016; Dohar et al., 2006; Goldenblatt et al., 2006; Heslop et al., 2010; van Dongen, 2014). Complications cited with topical treatment ranged from 5.1 to 12.8% and included otalgia, local rash, taste distortion and tinnitus (Taro Pharmaceuticals, 2020; Dohar, 2006; Heslop, 2010; van Dongen, 2014; Dohar, 1999). Oral antibiotic complications included primarily gastrointestinal symptoms (diarrhea and gastritis) with an incidence of 19.1 to 23%, with a possibility of *Clostridium difficile* infection
and rash in 4 to 7.3% (Dohar, 2006; van Dongen, 2017; Chee, 2016; Miranda-Katz et al., 2020). No treatment significantly altered hearing acuity (Goldenblatt, 2006), and there were no severe complications observed in the above studies.

Walker and colleagues (2017) documented that 50% of patients treated with TAD have resolution of TTO within three to four days, and 90% of patients within seven days. Poor response to treatment in that timeframe is typically related to need for aural toilet of the external auditory canal or poor technique instilling the drops (Rosenfeld et al., 2013; Boyd & Gottschall, 2011). Evidence is clear that the use of TAD drops without oral antibiotics is safer and more therapeutic than known alternatives.

**Literature of the Literature - Web-Based Education**

*Web-Based Health Information Seeking by Caregivers for their Children*

Access to the internet has become a vital tool used by over 300 million individuals in the United States, with more than 90% of the population having access (Anderson et al., 2019). Historically, patients would rely primarily on the recommendation of their provider when making health care decisions. The internet has changed that dramatically with access to worldwide information on multiple platforms within seconds. Up to 98% of caregivers are utilizing the internet to search for answers to their child’s general or specific medical or health-related concerns, with some parents reporting daily use (Pehora et al., 2015; Kubb & Foran, 2020; Glynn et al., 2013; Yardi et al., 2018; Brkic et al., 2021). Sykora and colleagues (2021) found that 16.7% of parents reported belonging to a ‘Facebook group’ pertaining to their child’s otolaryngologic condition, noting the benefits of obtaining helpful information (26.7%), connection to a community (16.7%), receiving advise (11.1%), gaining hope (11.1%) and helping other caretakers (5.6%). There is also substantial evidence that children and adolescents are using
the internet including social media platforms for health-related concerns that influence their understanding of medical conditions and topics (Luptin, 2021; Park & Kwon, 2018).

Unfortunately, there are limited studies evaluating the impact of web-based health information seeking by caregivers specifically within pediatric otolaryngology. Early studies indicate that up to half of caregivers report internet consultation in search of otolaryngology related information for the child (Glynn et al., 2013; Boston et al., 2005). However, this data was gathered over a decade ago, likely under-representing current trends of up to 98% of parents utilizing internet searches (Pehora et al., 2015). There were several significant caregiver factors associated with increased internet use (p≤0.001) including younger age (<40 years), university education, and having private health insurance (Glynn et al., 2013). Most caregivers (88-96.2%) reported that information found on the internet was helpful, and 55-84% noted the information influenced their treatment decisions for the child (Sykora et al., 2021; Glynn et al., 2013; Boston et al., 2005). These studies also indicate that most caregivers do not routinely discuss the information they have found in their independent searches with their healthcare provider, though they would prefer to and welcome the opportunity. A more recent study by Sykora and colleagues (2021) noted that 96.2% of parents of children with otolaryngologic needs found information discovered on the internet or social media helpful, 83.5% of whom discussed the information with their healthcare provider—much higher than initially reported.

**Reliability and Accuracy of Web-Based Information**

Accuracy and reliability of internet-based information varies drastically due to lack of regulation and quality control. Hence, caregivers may access information that is inaccurate and may negatively impact perceptions and outcomes. Clinicians are concerned about the quality of online information accessed by caregivers unless involved in the production or selection of the
material (Sorenson et al., 2014; Abreu et al., 2008). Multiple cross sectional studies evaluating websites for educational material for parents of children with otolaryngologic needs note a consistent theme of poor quality, incomplete information, and variability in accuracy (Joury et al., 2018; Kulasegarah et al., 2018; Wozney et al., 2017; Chi et al., 2017). For example, Sorenson (2013) evaluated the quality of information found on YouTube pertaining to TT placement and adenotonsillectomy surgery in children noting only 5.9% of the videos were of high quality with accurate and comprehensive information and identified testimonial videos as being more common and associated with significantly lower quality. For pediatric health topics, Pehora et al (2015), found higher overall quality information on professional and academic websites as opposed to public search engines; yet public search engines have a much higher utilization rate (80%) versus those controlled by health organizations (26.7%). Additionally, the perception of quality by viewers, demonstrated by “likes”, did not correlate with professional assessment of quality (Sorenson et al., 2013).

Advantages of Web-Based ‘Prescribed’ Education

Multiple advantages are noted when providers prescribe endorsed internet resources to caregivers, including improvements in clinical outcomes, patient and family satisfaction, compliance with treatment, and reduction in health-related anxiety (Rice et al., 2017; Morawska et al., 2014; Parga-Belinkie & Merchant, 2019; Glynn et al., 2013). Goggin and colleagues (2020) demonstrated the positive impact of a prescribed ninety-second educational video on parent’s perception of the need for an oral antibiotic when one was not warranted (mean, $57.0 \pm 20$ to $M \pm 21$; $P < 0.0001$). The biggest positive impact was found in parents with the highest pre-video interest in receiving antibiotics ($83.0 \pm 12.0$ to $63.4 \pm 22$; $P < 0.0001$). It is concerning that caregivers frequently unknowingly access unreliable and inaccurate information that influences
decisions regarding their child’s medical care. Access to inaccurate information may also negatively influence parental trust in providers. Sood and colleagues (2019) used a hypothetical situation to investigate the impact of web-based information on parental trust in providers and found that when internet information contradicted provider diagnosis there was a significant reduction in provider trust and a higher likelihood of seeking a second opinion (p<0.001).

Parents want validation of the online information from their health care provider and guidance on searching for appropriate accurate information (Yardi et al., 2018; Glynn et al., 2013). However, search information is infrequently discussed with providers at the time of the visit making it difficult for providers to validate the information or source, correct misconceptions or augment information retrieved (Kubb & Foran, 2020; Glynn et al., 2013). Clinicians should be aware of the internet resources related to their specialty and openly discuss them with families. Prescribing quality web-based education encourages shared decision-making and directs families safely in their web research to reliable and accurate information and resources.

**Access to Web-Based Information**

Equitable access to information and education is an essential public health priority for reducing disparities in healthcare. Although access and use of the internet is very high in this country, there are still 10% of Americans without access and 2.2% of parents who report not using it for purposes of health information and education (Anderson et al., 2019; Pehora et al., 2015). Inaccessibility is highest in individuals who classify themselves as black or Hispanic (29%), over 65 years (27%), income below $50,000 (25%), education less than a high school degree (29%), and rural (15%) (Anderson et al., 2019). However, Sykora and colleagues (2021) note that internet or social media use as a resource for caregivers seeking pediatric
otolaryngology health information did not differ significantly based on the parent’s race (p=0.31) or education (p=0.30), and internet use for this reason was significantly more likely when total family income was more than $35,000 (p=0.0091). It is essential to ensure traditional educational options such as pamphlets and other hands-on visuals remain available and accessible for those without internet access.

The American Medical Association (AMA) advocates that readability of patient educational materials be at or below the 6th grade reading level to ensure comprehension of the material and enhance understanding and compliance in care (AMA, 2017). Multiple studies have reviewed the health literacy level of on-line materials related to pediatric otolaryngology, including professional and academic sites, noting that at least half the sites were well above the recommended reading level for patient education (Shetty et al., 2020; Harris et al., 2018; Jouy et al., 2017; Chi et al., 2017; Sood et al., 2019). Ideally, healthcare education should ensure high-quality evidence-based information that is pertinent to the patient and family, available at the suitable time, at a level of understanding that is appropriate, in a language they understand and that is culturally sensitive.

**Project Management Framework**

The Plan-Do-Study-Act (PDSA) cycle, developed by Walter Shewhart in the 1920s and refined by Edward Deming is based on inductive and deductive thinking and allows application of a method to document a ‘test of change’ for quality improvement (IHI, 2021). It is an active learning, problem solving cycle which begins by asking three practical questions that directly parallel with the identified problem statement and goals identified for this project. The framework then incorporates four stages to effect change and act on outcomes to improve the cycle. The cycle begins with a “Plan” stage which involved creation of the TTO instructional
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video and pocket card along with development of the self-efficacy questionnaire and caregiver feedback survey. The cycle continues into the “Do” phase which involved implementation of the developed tools to caregivers of children with TTs. The “Study” stage allowed for analysis of the data and summarization of lessons learned. The final stage “Act” included evaluation of the entire cycle with identification of potential areas for improvement or expansion of the project.

Figure 1 provides a visual of this project articulated through the PDSA cycle (IHI, 2021).

Figure 1

PDSA Model- Educational Program for Caregivers of Children with Tympanostomy Tubes

Adapted from IHI, 2021
http://www.ihi.org/resources/Pages/HowtoImprove/ScienceofImprovementTestingChanges.aspx
Project Theoretical Model

Albert Bandura created a model of self-efficacy, defined as an individual’s belief in their personal ability to manage a task effectively and successfully (Bandura, 1977). Perceived self-efficacy is not a global trait but “a differentiated set of self-beliefs linked to distinct realms of functioning” (Bandura., 2006, p. 307). Self-efficacy scales should be linked to specific factors or domains of interest to determine the quality of function within that focus (Bandura., 2006). This model provides a framework to help recognize influences that may impact on a caregiver’s confidence to independently initiate treatment for their child’s TTO (Figure 2). Bandura believes an individual’s actions are influenced by four factors: performance accomplishments (past experiences to similar experiences), vicarious learning (lessons learned through modeling or experiencing through others), social or verbal persuasion (coaching or encouragement), and emotional arousal (Bandura, 2006). The provision of educational materials that direct caregivers on the care of TT and TTO treatment influences vicarious learning. TTO education is reinforced during postoperative and surveillance TT medical encounters; the addition of a postoperative reminder text provides encouragement to use the provided resources when indicated- social persuasion. Furthermore, all caregivers were instructed to administer TAD following TT placement, which added to the influence of performance accomplishments. The caregiver’s level of self-efficacy in this environment affects their motivation to try the intervention or give up and seek outside help. Hence, a high self-efficacy will likely lead to a willingness to attempt and accomplish independent administration of TAD; conversely a low self-efficacy will more likely lead to avoidance, either by ignoring the TTO or seeking an urgent care visit.
System Description and Assessment

*Description of the System*

This project was implemented at a private pediatric otolaryngology practice in New England, dedicated to providing the highest quality of care to children with otolaryngologic disorders and their families, servicing patients throughout Connecticut and neighboring states. There are six clinicians responsible for evaluation and treatment of patients including three pediatric otolaryngologists and three pediatric nurse practitioners who specialize in otolaryngology; and a triage nurse who handles clinical calls and other clinical support. The practice has three practice facilities strategically located throughout the state and consult at a major Children’s Hospital. Surgical procedures occur at a Children’s Hospital and a privately owned surgical center. One of only three pediatric otolaryngology practices in the state, we care for all otolaryngologic conditions affecting children. Some of the most common presenting
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corcerns include otitis media, persistent middle ear fluid, otalgia, failed hearing screens and speech concerns. Many of these conditions lead to the need for TT placement. In the year 2019, this practice performed just under 20,000 encounters (surgery and office visits) including over 1,000 surgical myringotomies with TT placement. Consistent with national trends, the number of children undergoing TT placement dropped drastically during the COVID-19 pandemic, the result of a lower incidence of otitis media (+ effusion) and decreased access to surgical intervention due to closures (Adjemian et al., 2021; Iannella et al., 2021).

Tympanostomy tube placement is performed as a one-day procedure at a children’s hospital or an outpatient surgical center. All patients are prescribed, and caregivers are directed to administer, TAD for a minimum of three days following tube placement to treat any residual middle ear infection or inflammation and prevent early TTO. Currently, TT and TTO education is verbally provided to caregivers during multiple encounters including when the need for tubes is identified, the surgical encounter, the postoperative visit, and all subsequent appointments (typically every 3 to 6 months) until tube extrusion and healthy ears. The verbal directions are reinforced with educational sheets which are provided at the time of surgery as well as available on the practice website. The surveillance visits are conducted in person to allow assessment and visualization of the child, TT patency, middle ear health, hearing assessment, developmental progress and rule out any associated complications or pathology.

Setting

The setting is ideal for this project. A key priority of this practice is to ensure patients and families have a clear understanding of their medical issues and treatment, with efficient easy access to care and clinicians. Efficiency in care, reduction in health care utilization and cost and improvements in health care outcomes are at the foundation of this project. Caregiver education
pertaining to the care of the child with TT and initiation of TAD treatment is supported by the CPG-TT and directly intersects this project. Furthermore, health care institutions and clinicians are invested in improving antibiotic stewardship in their practice.

Need

Consistent with national statistics, there is a high incidence of postoperative TTO in this practice, with a subset of patients seeking urgent care and being treated with oral antibiotics. The evidence is clear: first line treatment for TTO is initiation of TAD due to a superior therapeutic and safety profile. Clinicians support initiatives intended to improve patient outcomes. Moreover, there is a national effort for antibiotic stewardship to eliminate antibiotic misuse, improve quality care, reduce cost of care, and comply with national guidelines. This project supports the above identified needs and priorities.

SWOT Analysis (Strengths, Weaknesses, Opportunities, Threats)

SWOT analysis allows an evaluation of the clinical system with careful consideration of internal strengths and weaknesses as well as external threats and opportunities that impact the success of an innovation. There are multiple internal strengths for this project, primarily the exceptional reputation and expertise of the clinicians and practice where this project was implemented. The clinicians focus on effective, efficient, cost-effective care based on evidence, while providing exceptional services to families and striving for the best patient outcomes. There is mutual support, respect, and excellent communication among clinical providers. There was support for the project, agreement with the identified clinical problem, a commitment to implementation, and opportunity for professional constructive feedback.

One of the most significant external opportunities came from the Society of Otolaryngology Head and Neck Nurses (SOHN), a professional organization who provided
networking, feedback and will be instrumental in national dissemination. Additionally, the CPG-TT provided evidence-based support for implementation. Nurses working in the surgical facilities were key as they support postoperative education following TT surgery. Community pediatric clinicians also serve as allies in the process once aware of the new educational options that serve to benefit their patients.

Several factors were identified that had the potential to be harmful in achieving the project objectives. Language barriers and limited access to the internet for some families is an internal weakness that needs to be considered. The most impactful external threat was the COVID-19 pandemic resulting in reduced need for TT, closures of medical offices, surgical areas, and consumer fear of attending a medical visit or surgery. The impact of the pandemic has significantly reduced the numbers of children requiring TT and the incidence of TTO, likely the result of ‘virtual schooling’, social distancing, mask wearing and handwashing. Adjemian and colleagues (2021) compared the pre-pandemic to pandemic changes in the number of weekly ED visits in children noting a significant reduction in the incidence of otitis media (PR 95%CI, 0.36 [0.35-0.36]) along with several other common illnesses associated with otitis media including influenza (PR 95% CI- 0.01 [0.01-0.01]), acute bronchitis (PR 95% CI- 0.17 [0.16-0.17]), sinusitis (PR 95% CI, 0.42 [0.39-0.45]) and viral infections (PR 95% CI, 0.53 [0.52-0.53]). Similarly, Iannella and colleagues (2021) noted a 63.3-68.1% reduction in middle ear effusions during the pandemic year when compared to two previous years in 5 referral centers. An additional barrier relates to the financial incentive for medical practices treating patients in person versus allowing independent initiation of treatment. Yet, this ultimately could be a benefit, allowing more time to see patients who really do need in person visits. Appendix D provides a graphic representation of the project SWOT for this project.
Goal of the Project

The goal of this DNP project was to create an educational program including a web-based video, instructional pocket-card, and post-operative text reminder to educate, empower and improve the self-efficacy of caregivers of children with acute uncomplicated TTO to initiate treatment independently when clinically indicated. The long-term goal of this work is to improve clinical outcomes, increase satisfaction and autonomy of caregivers, decrease cost of care, and decrease unnecessary oral antibiotic prescriptions. Efficiency in care, reduction in health care utilization and cost, improvements in health care outcomes and patient education are at the foundation of this project.

Aims of the Project

1) Develop an educational program for caregivers of children with TTO to initiate treatment independently when clinically indicated.

2) Implement the educational program and evaluate impact on caregiver self-efficacy and TTO actions.

3) Make recommendations and take steps toward scaling and sustainability of the educational program.
Chapter 3

Methods

Aim 1: Develop an educational program for caregivers of children with TTO to initiate treatment independently when clinically indicated.

This quality improvement initiative included the development of three components targeting the caregiver of children with TT- 1) a web-based video on TT and TTO treatment, 2) an instructional pocket-card on TTO treatment and 3) a postoperative texting reminder to caregivers.

Program Introduction for Clinicians Support and Feedback

The initial step involved meeting with clinicians where the project was executed to explain the educational program, elicit feedback, and establish support for implementation within the practice. Their buy-in was essential to ensure the tools would be used for all patients within the practice. This took place during routinely scheduled academic meetings with regular updates at meetings and email communication.

Video Development

A three minute evidenced based video with visual, accurate and concise information regarding care of a child with TT and TTO was produced and implemented to ensure the provision of quality information and serve as a vehicle to tackle the clinical problem. The product aimed to be desirable and practical to the caregiver consumer, with a human centered approach to allow for habituation of the solution. Health literacy and language considerations were considered to allow caregiver understanding of the material presented.

Video development was completed in a multistep process starting with determination of material to be included in the video. Video content was planned based on evidence-based
resources including the CPG-TT and networking sessions with clinical experts (pediatric otolaryngology clinicians and a representative group from SOHN). Additionally, input was incorporated from informal interviews with patients and caregivers conducted during routine office visits to understand their perspective regarding TTO treatment and education.

Consultation with a video developer and graphic designer took place to help narrow in on the logistics of the video itself including format, design, length, and development. The video was hand drawn in cartoon format and was short and concise to keep the interest of the consumer, showcasing the “how to” approach to care with visuals and directions. Appendix E shows the video development and script plan.

Once developed, the video was reviewed by an expert panel of clinicians (pediatric otolaryngology practice clinicians, representative group from SOHN) as well as a small group of caregivers to ensure quality of the video. Modifications were made based on feedback. The video was then published on the internet (YouTube and Pediatric Otolaryngology practice website) to ensure it was readily available to caregivers for easy access whenever and wherever the need arose.

**Educational Pocket Card Development**

The pocket card served as an additional reminder with written instructions and diagrams on TTO treatment, along with video access information. Consultation with a professional graphic designer and photographer shed light on the importance of not only what information to include on the card, but the layout of information and diagrams, the size, color, and production material of the card to ensure easy storage, access, and durability. Hence, the pocket card was credit-card sized, printed on card stock with bright visuals and easy to follow bulleted information. A QR
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code was also produced and placed on the card for easy access to the video. Cost and production were considered.

Expert review of the product occurred with the panel identified above (with video review) and modified based on the feedback. A reproduction of one side of the Educational Pocket-card is found below in Figure 3. The other side of the card provides clinician names, practice logo and contact information. Note that the QR code on the pocket card is a working link to the education video.

**Figure 3**

*Instructional Pocket-Card for Treatment of Tympanostomy Tube Otorrhea*

![Image of the Educational Pocket-Card](image)

**WHAT TO DO IF MY CHILD HAS AN EAR INFECTION WITH EAR TUBES?**

Signs of ear infection include drainage (clear, mucousy, or bloody) and/or foul odor

1. Wipe outer ear drainage with tissue
2. Place 4 antibiotic ear drops in draining ear, 2 times a day for 1 week
3. Push flap in front of ear (Tragus) to push drops into ear canal

*Avoid getting ear that is draining wet. Oral antibiotics are NOT RECOMMENDED to treat ear infection with ear tubes in. Call if drainage does not stop after 7 days or child has pain. For more information watch our video at [https://youtu.be/dfW9vRIL6EE](https://youtu.be/dfW9vRIL6EE)*

*Note: Actual size 4 x 2.5 inches on card stock*
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**Text Reminders**

Postoperative texts were incorporated into the education program as a reminder to caregivers of the postoperative visit details and provide a link to the educational video. This recommendation came from previous caregiver feedback regarding what form of education is most helpful. A pediatric otolaryngology practice staff member was identified by the office manager to perform the task. This process had previously been used for appointment reminders. A text script was developed and sent to all study patients one week following TT placement. A transcription of the text is noted in Appendix F.

**Data Collection Tools**

**Pre-Intervention Survey for Caregivers of Children with Ear Tubes.** This survey was developed to gather information from caregivers regarding past experiences with TTs, ear drainage and administration of ear drops, as well as an adapted Bandura’s Self Efficacy scale to measure caregiver self-efficacy pre-intervention in relation to care of a child with TTO (Appendix G1).

**Post-intervention Survey for Caregivers of Children with Ear Tubes.** This survey was developed to prompt feedback from caregivers regarding their experience with resources within the educational program, clinical questions related to TTO, and a repeat of the adapted Bandura’s self-efficacy scale questions from the pre-intervention survey. Additionally, it elicited quantitative data regarding the incidence of TTO since tube placement and caregiver actions when TTO was identified (Appendix G2).

**Bandura Self-efficacy Psychometrics.** Self-efficacy, specific to this population and task, was measured with seven questions titled "Confidence in Care" in the pre and post surveys. These questions were developed based on Bandura’s *Guide for Constructing Self-efficacy*
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*Scales* (2006). Banduras scales were designed to measure the specific tasks in each situation under study to assess the true perceived self-efficacy of that action, as broader questions may have little relevance or predictive value to the item being measured (Bandura, 2006). The scales use a standard methodology, asking respondents to rate the strength of their perceived ability to accomplish different aspects or levels of a task using a 100-point scale. The scale increases in 10-point increments from 0 “cannot do”, through a mid-range of 50 “moderately certain I can do”, to 100 “highly certain I can do”, measuring confidence in performing each specific activity within a domain (Bandura, 2006). Many authors have taken Bandura’s scale and adapted it specific to their desired domain of investigation (Son et al., 2018; Tripp et al., 2013; Pollard, 2011). Psychometrics reveal acceptable alpha coefficients ( > .80) over numerous studies and in varying samples. Additionally, Scholz and colleagues (2002) determined self-efficacy to be a unidimensional and universal construct despite language or culture by investigating the psychometric properties of Bandura’s General Self-Efficacy scale in 19,120 subjects from twenty-five countries. For this project, item scores ranging from 0-100 as well as total domain scores ranging from 0- 700 will be analyzed for each participant.

**Chart Review.** A focused chart review was conducted to ensure accuracy of the clinical information and some demographics (Appendix H).

**Aim 2: Implement the educational program and evaluate the impact on caregiver self-efficacy and TTO actions.**

**Implementation**

Implementation involved incorporation of the TTO educational program (web-based video, educational pocket card and postoperative text reminder) into the care of TT patients within the practice. Ensuring staff and clinicians were aware of the educational resources, their
content, location, and plan for implementation was essential. All pediatric otolaryngology
practice clinicians were educated on the educational program to ensure all patients receive the
resources as part of their standard care. Pediatric otolaryngology practice staff who answer the
phone and interface with patients were also educated on the program to ensure patient calls were
directed appropriately. Additionally, nurses who work in the two surgical sites were educated on
the educational tools as they reinforce postoperative education to our patients. The investigator
met with leadership of the two surgical sites and established a plan for introduction of the project
and educational tools with the nurses.

Patients receiving TTs in a 2-month period were introduced to the educational video and
pocket card at the time of surgery by the project lead. A minimum goal of 30 caregiver
participants was established for involvement in the project study group for implementation. All
caregivers watched the video via iPad in the surgical center waiting area while their child was
having surgery. Caregivers were provided with the educational pocket-care at that time with a
link to the video for future reference. Educational resources are reinforced by practice clinicians
at every office visit, including a postoperative visit four to six weeks after surgery, and
subsequent follow-up every three to six months until the TT are displaced, and the ears are
healthy.

The primary care providers who see our patients for routine and urgent care were key to
the process as well. Networking and sharing the educational resources occurred through personal
communication, correspondence regarding patients and bulletins to make them aware of this
resources and how it benefits their patients. The video information was shared with the lead
pediatrician liaison who oversees the Community Pediatricians council who distributed it to
community pediatric providers.
The texting reminder system was also initiated by an appointed pediatric otolaryngology practice staff member who sent a reminder text to caregivers one week following surgery. The text included postoperative visit information along with a link to the video.

**Evaluation**

The Pre-Intervention Survey for Caregivers of Children with Ear Tubes was administered pre-intervention at the time of TT placement (Appendix G1). As the project lead, the survey was given to caregivers to complete on their own while in the waiting area of the surgical center, while their child was in the operating room having the TTs placed. The Post-intervention Survey for Caregiver of Children with Ear Tubes was administered post-intervention at a scheduled postoperative visit with pediatric otolaryngology practice clinicians, four to six weeks following tube placement. The survey was given to the caregiver prior to the encounter for immediate completion on their own and returned to the front desk staff (Appendix G2).

Descriptive and bivariate statistics were used to analyze the data from the surveys. Caregiver confidence as measured on the adapted Bandura Self-efficacy scale was analyzed using paired T tests for each of the seven measures and the overall score. Non-parametric testing (Signed Rank test) was additionally used due to the skewed distribution. All other data was analyzed using descriptive statistics and examined for trends pre and post intervention.

**Aim 3: Make recommendations and take steps toward scaling and sustainability of the educational program.**

**Scaling**

Scaling of this program involves making recommendations for the translation of the educational program into other languages representative of our patient population. The practice has a high volume of patients who speak Spanish, hence adapting material to the Spanish
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language would be a priority, followed by additional high-volume languages of families we care for. Application of the web-based video and pocket card program format can be expanded to additional diagnoses and procedures within our practice.

Additionally, this product will likely have value to pediatric and otolaryngology practices as well as the caregivers of children with TT nationally and beyond. I am involved with several state and national professional organizations (SOHN, NAPNAP, AANP, ANA, CT Society of ENT) whose members care for patients who will benefit from this product. I will look for ways to share this project and product with these organizations and its members to help facilitate and disseminate this project. I will be reaching out to the AAO who publishes the CPG-TT in the hopes that they will link this program to the guideline resources and website.

Sustainability

There are several means of sustainability of this educational program within the otolaryngology practice. The program is implemented by all clinicians as part of standard practice. Scheduled check-ins with practice clinicians at routine academic meetings is essential to ensure the program is being implemented consistently and universally throughout the practice by all clinicians at all practice sites. Updates will be made based on patient and clinician feedback to ensure the content is current, evidence-based, useful and user friendly. Scaling with additional languages will also improve sustainability. It will also be important to ensure new staff, clinicians as well as nurses at our surgical sites are appropriately educated on the program and its implementation. Audits of patient charts at the surgical sites regarding delivery of the patient education will identify gaps in providing the resource. Additionally, it is my hope to continue to follow this patient population through the longevity of the tube placement to see the true impact of education on TTO, which increases with the time the tubes have been in place.
Dissemination

This work will be presented at a yearly symposium our practice provides to community pediatric clinicians. The videos and resources were shared with community pediatric providers through the pediatric community liaison as well as area urgent care facilities and minute clinics through posters with links to educational video to increase community education and access to resources. A practice newsletter highlighting this project and resources was produced and shared with pediatric practices throughout the state of Connecticut. I plan to share the program and project outcomes through oral and poster presentations at various national conferences including SOHN, NAPNAP, AANP and SENTAC to allow for expansion to other practices nationwide. Additionally, I plan to submit a manuscript to peer reviewed professional journal for publication.

Project Timeline

The project plan and timeline for implementation and evaluation is represented in Gantt chart (Appendix I). Phase one included development of the educational resources (video, pocket card and texting prompt) and data collection tools (Pre and Post survey). Phase two was dedicated to the preparation and training of staff and clinicians regarding the project and their role in implementation. Phase three was devoted to implementation of the project to caregivers of children receiving TTs, data collection and analysis.

Human Subjects Considerations

This project was deemed a Quality Improvement project by the Yale University Institutional Review Board (IRB). It posed minimal risk or ethical concerns to participants. The independent pediatric otolaryngology practice where the project was implemented does not have a separate IRB process. They accepted the Yale IRB determination, and fully supported the quality improvement nature of this project. Patients and their caregivers were receiving
postoperative care instructions prior to project implementation. This project provided an enhanced and web-based format of education with written instructions and a text reminder with the objective of improving clinical outcomes.

**Leadership and Stakeholder Engagement**

As the project lead for this quality improvement initiative, I assumed the primary decision-making role which included content development, design, production, execution, coordination, budget, and dissemination. Patients and families are a key component and essential stakeholder within this project. One of the key priorities of our practice is to ensure that patients and families have a clear understanding of their medical condition and treatment, with efficient easy access to clinicians and supportive information and answers to their questions. Other primary stakeholders for this project include practice clinicians including 3 pediatric otolaryngologists, 2 additional PNPs and a triage nurse. They have supported the project from its inception, agree with the identified clinical problem, and were committed to supporting its implementation. Other stakeholders included staff who interface with patient and families and must be aware of the project to help direct questions that may funnel in regarding its use or implementation; and management and nurses who work in the two surgical facilities where we care for patients as they currently provide some of the postoperative education to our patients. Additionally, community pediatric primary care providers are key in knowing the resources available and how they may benefit their patients. A full stakeholder analysis is provided in Appendix J including a stakeholder engagement plan, interest-influence classification of stakeholders and a stakeholder analysis context diagram.
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**Business and Financial Considerations**

The overall cost of this project was projected to be $3,719.15. However, the actual cost at the completion of project implantation and analysis was $603.80 (See Appendix K). The projected costs were based on the development of educational materials to support families when TT are placed as well as the costs of staff and provider training for implementation of the project. An additional cost was included which pertains to the cost of postoperative education provided by the RN to the family following tube placement. Although a pertinent consideration, postoperative education is a staple component of all patient care provided by nurses and will not add to the care burden of the RN or result in additional time or cost expenditure. In fact, it may ultimately provide a cost savings based on improved utilization of RN time providing postoperative education, as the video will provide consistent complete and comprehensive education to caregivers, with an easily retrievable format. Many of the costs associated with this project were the start-up fees for video and pocket-card production and staff education, yet once the project is implemented, the program will continue with minimal additional maintenance costs. The video itself is retrievable with access to our web-site, YouTube or the associated QR code with no further production costs aside from a small fee to replenish the pocket-cards as needed (also available on the internet). This educational program has the potential to increase our practice referrals from pediatric practices, urgent care facilities and the consumer base due to video access, advertising, and endorsement.

Cost avoidance to the patient and society is also at the crux of this project, although more difficult to measure in actual numbers. There is an overuse of oral antibiotics and sick visits being conducted to treat children with uncomplicated TTO, a condition easily identified by the child’s caregiver who can then initiate treatment with ototopical antibiotics drops without the
need for a sick visit; yet many parents seek medical attention (Badalyan et al, 2013). The foundation of this project is increasing the autonomy of caregivers to identify and treat tympanostomy tube otorrhea independently. This, in turn, will ideally decrease urgent care visits, decrease loss of worktime as well as improve treatment outcomes with more appropriate targeted therapy and elimination of unnecessary systemic antibiotics. This has huge cost avoidance implications for our families and insurance companies.
Chapter 4

Results

This quality improvement project was implemented at a private pediatric otolaryngology practice in New England from September 16th through December 20th, 2021. Demographic data is presented in Figure 4. A total of 58 caregivers of children who had TT placement were enrolled. The children ranged in age from 8 months to 9.9 years (M =2.3 years, SD 1.8). Lower quartile (1.2 years) and upper quartiles (2.8 years) were additionally calculated given the skewed distribution of ages. Gender identification from caregivers was balanced (male n=30, female

Figure 4

Patient Demographics (N=58)

<table>
<thead>
<tr>
<th>Gender</th>
<th>History of tubes</th>
<th>Tube type</th>
<th>Indication</th>
<th>Past experience with TTs</th>
<th>Past experience with ear drainage</th>
<th>Past experience administering ear drops</th>
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</thead>
<tbody>
<tr>
<td>Female</td>
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<tr>
<td>Male</td>
<td>First set of tubes</td>
<td>Short term tubes</td>
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<th>Age in Years</th>
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</tbody>
</table>
Most children \((n=48, 82.8\%)\) were undergoing their first set TTs, whereas 17.2\% had had at least one set of TT placed in the past. Primary indication for TT placement was recurrent or chronic otitis media in 58.6\% \((n=34)\), chronic otitis media with effusion in 8.6\% \((n=5)\), and 32.8\% \((n=19)\) presented with both recurrent or chronic otitis media and chronic otitis media with effusion. 96.6\% of children received short-term tubes versus long term T-tubes \((n=2, 3.4\%)\). In respect to caregiver reported experiences at the time of TT placement, 65.5\% \((n=38)\) had no past-experience with TT, 70\% had no past-experience with TTO, and 50\% had no prior experience administering otic drops. All caregivers reported administering TAD as ordered postoperatively.

Caregivers were surveyed at the postoperative visit regarding their interaction with the educational program. All caregivers viewed the educational TT video at the time of the TT placement. The majority (98.3\%) reported the video was helpful and 41.4\% \((n=24)\) reported referring to the video after tube placement. When caregivers were questioned “Do you feel the video is a helpful resource for the future”, the majority (91.4\%) responded yes, 3.4\% responded no and 5.2\% \((n=3)\) were uncertain of the future value. Regarding the educational pocket-card given, the majority (94.7\%) of caregivers reported receiving it and 96\% of whom felt it was a helpful resource. Approximately half of caregivers (49\%) reported referring to the pocket-card after the procedure and 91.8\% felt it to be a helpful resource for future use. The majority (63.2\%) of caregivers reported receiving a post-operative text from our office with follow-up appointment and educational information - and the majority (70\%) reported it as a helpful resource. Sixteen percent reported not receiving a text and 18\% were uncertain. Caregiver feedback regarding the education program is presented in Table 2 and Figure 5.
Table 2

<table>
<thead>
<tr>
<th>Caregiver Survey Question</th>
<th>Total</th>
<th>Yes %</th>
<th>Yes N</th>
<th>No %</th>
<th>No N</th>
<th>Not Sure %</th>
<th>Not Sure N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Did you watch the video at the time of surgery</td>
<td>58</td>
<td>100%</td>
<td>58</td>
<td>0%</td>
<td>0</td>
<td>0%</td>
<td>0</td>
</tr>
<tr>
<td>Did you find the information in the video helpful</td>
<td>58</td>
<td>98.3%</td>
<td>57</td>
<td>1.7%</td>
<td>1</td>
<td>0%</td>
<td>0</td>
</tr>
<tr>
<td>Did you refer to the video after tube placement</td>
<td>58</td>
<td>41.4%</td>
<td>24</td>
<td>53.4%</td>
<td>31</td>
<td>5.2%</td>
<td>3</td>
</tr>
<tr>
<td>Do you feel the video is a helpful resource in future</td>
<td>58</td>
<td>91.4%</td>
<td>53</td>
<td>3.4%</td>
<td>2</td>
<td>5.2%</td>
<td>3</td>
</tr>
<tr>
<td>Did you receive the pocket card at the time of surgery</td>
<td>57</td>
<td>94.7%</td>
<td>54</td>
<td>1.8%</td>
<td>1</td>
<td>3.5%</td>
<td>2</td>
</tr>
<tr>
<td>Did you find the information on the pocket card helpful</td>
<td>51</td>
<td>96.1%</td>
<td>49</td>
<td>3.9%</td>
<td>2</td>
<td>0%</td>
<td>0</td>
</tr>
<tr>
<td>Did you refer to the pocket card after tube placement</td>
<td>51</td>
<td>51%</td>
<td>26</td>
<td>47%</td>
<td>24</td>
<td>2%</td>
<td>1</td>
</tr>
<tr>
<td>Do you feel the pocket card is a helpful resource for in future</td>
<td>49</td>
<td>91.8%</td>
<td>45</td>
<td>8.2%</td>
<td>4</td>
<td>0%</td>
<td>0</td>
</tr>
<tr>
<td>Did you receive a postop text with tube information</td>
<td>57</td>
<td>63.2%</td>
<td>36</td>
<td>19.3%</td>
<td>11</td>
<td>17.5%</td>
<td>10</td>
</tr>
<tr>
<td>Was the postoperative text helpful</td>
<td>43</td>
<td>69.8%</td>
<td>30</td>
<td>16.2%</td>
<td>7</td>
<td>14%</td>
<td>6</td>
</tr>
</tbody>
</table>

Figure 5

Caregiver Feedback Regarding Educational Program at Postoperative Visit
Caregiver self-efficacy data were analyzed using paired T-test, comparing pre-intervention data and post intervention data as detailed in Figure 6 and Table 3. Self-efficacy mean scores were significantly higher after implementing the education program compared to pre-intervention scores for all seven items. Caregivers reported a significant increase in confidence in identifying ear drainage (Mean difference=14.66 (SD=23.32), \( p<.0001 \)) along with initiating TAD for clear, pus-like, smelly, or bloody ear drainage (Mean difference ranged from 14.57- 19.74 (SD= 20.48- 22.37), \( p<.0001 \)). Total self-efficacy score was significantly improved from pre-intervention (\( M=566.4, \ SD=134.9 \)) to post intervention (\( M=665.7, \ SD=53.5 \)) (\( p<.0001 \)). The Wilcoxon Sign Rank Test was used to determine the differences because of the skewed aged distribution.

**Figure 6**

*Changed Self-Efficacy Pre and Post Intervention*
## Table 3

*Changed Self-Efficacy at Pre- and Post-Intervention*

<table>
<thead>
<tr>
<th>Self-Efficacy Question</th>
<th>Pre-Intervention</th>
<th>Post-Intervention</th>
<th>Changed Score</th>
<th>Paired T-test</th>
<th>Non-Parametric Test</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>Mean (SD)</td>
<td>Mean (SD)</td>
<td>Mean (SD)</td>
<td>t Value</td>
</tr>
<tr>
<td>Overall Care of Child</td>
<td>58</td>
<td>87.9 (14.5)</td>
<td>95.9 (7.7)</td>
<td>7.93 (13.08)</td>
<td>4.62</td>
</tr>
<tr>
<td>Administer TAD when directed by clinician</td>
<td>58</td>
<td>89.3 (17.7)</td>
<td>97.4 (6.1)</td>
<td>8.10 (17.11)</td>
<td>3.61</td>
</tr>
<tr>
<td>Identifying ear drainage</td>
<td>58</td>
<td>79.8 (24.3)</td>
<td>94.5 (9.2)</td>
<td>14.66 (23.32)</td>
<td>4.79</td>
</tr>
<tr>
<td>Initiating TAD for clear ear drainage</td>
<td>58</td>
<td>80.3 (25.2)</td>
<td>94.9 (9.2)</td>
<td>14.57 (20.91)</td>
<td>5.31</td>
</tr>
<tr>
<td>Initiating TAD for pus-like ear drainage</td>
<td>58</td>
<td>77.9 (24.1)</td>
<td>94.9 (8.0)</td>
<td>16.98 (20.48)</td>
<td>6.32</td>
</tr>
<tr>
<td>Initiating TAD for smelly ear drainage</td>
<td>58</td>
<td>76.5 (26.0)</td>
<td>94.9 (8.2)</td>
<td>18.36 (22.31)</td>
<td>6.27</td>
</tr>
<tr>
<td>Initiating TAD for bloody ear drainage</td>
<td>58</td>
<td>74.8 (26.7)</td>
<td>94.6 (8.8)</td>
<td>19.74 (22.37)</td>
<td>6.72</td>
</tr>
<tr>
<td>Total Score of all items measured</td>
<td>58</td>
<td>566.4 (134.9)</td>
<td>665.7 (33.5)</td>
<td>99.31 (114.79)</td>
<td>6.59</td>
</tr>
</tbody>
</table>
The data were analyzed to compare total self-efficacy scores based on caregiver’s past experiences with tympanostomy tubes, ear drainage and administering eardrops. The results showed self-efficacy was significantly improved after implementing the education program regardless of caregiver’s past-experience (p<0.05). However, there was no significant difference in self-efficacy based on caregivers’ past experiences with these items (p>.05). There was no statistically significant association between age of the child and self-efficacy of the caregiver (p>.05). This data is presented in Table 4.

Table 4

<table>
<thead>
<tr>
<th>Caregiver Experience</th>
<th>Total Self-Efficacy Score</th>
<th>Changed Self-Efficacy Score</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total Score at T1 Mean (SD)</td>
<td>Total Score at T2 Mean (SD)</td>
</tr>
<tr>
<td>Do you have experience with TTs?</td>
<td>Yes (N=20) 34.5%</td>
<td>593.0 (132.2)</td>
</tr>
<tr>
<td></td>
<td>No (N=38) 65.5%</td>
<td>552 (135.8)</td>
</tr>
<tr>
<td>Do you have experience with ear drainage?</td>
<td>Yes (N=18) 30%</td>
<td>588.3 (138.4)</td>
</tr>
<tr>
<td></td>
<td>No (N=40) 70%</td>
<td>556.5 (133.8)</td>
</tr>
<tr>
<td>Do you have experience administer ear drops?</td>
<td>Yes (N=29) 50%</td>
<td>590.3 (125.2)</td>
</tr>
<tr>
<td></td>
<td>No (N=29) 50%</td>
<td>542.4 (141.9)</td>
</tr>
</tbody>
</table>
The post-operative surveys also inquired about the incidence of TTO and caregiver actions if TTO did occur. At the time of the post-operative visit, 20.7% \( (n=12) \) of the children had experienced TTO. All caregivers reported initiating TAD when TTO occurred. Fifty-eight percent \( (n=7/12) \) reported referring to the educational video and/or pocket-card. Those who did not refer to the educational material all had children who had previous TTs. Two caregivers called the ENT or PCP office for guidance (16.7%). Four children were seen in the office for evaluation (respiratory symptoms \( (n=1) \) and ear drainage \( (n=3) \) . No children received oral antibiotics following tube placement related to TTO. This data is documented in Table 5.

Table 5

Postoperative Tympanostomy Tube Otorrhea and Caregiver Actions

<table>
<thead>
<tr>
<th>Caregiver Survey Question</th>
<th>Total responded</th>
<th>Yes</th>
<th>No</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>( N )</td>
<td>%</td>
<td>( N )</td>
<td>%</td>
</tr>
<tr>
<td>Did you administer postop TAD as instructed?</td>
<td>58</td>
<td>100%</td>
<td>58</td>
<td>0</td>
</tr>
<tr>
<td>Has your child had TTO since surgery</td>
<td>58</td>
<td>20.7%</td>
<td>12</td>
<td>79.3%</td>
</tr>
<tr>
<td>If child had TTO postoperatively</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Did you start drops independently</td>
<td>12</td>
<td>100%</td>
<td>12</td>
<td>0</td>
</tr>
<tr>
<td>Did you refer to video or pocket card</td>
<td>12</td>
<td>58.3%</td>
<td>7</td>
<td>41.7%</td>
</tr>
<tr>
<td>Did you call ENT/PCP for direction</td>
<td>12</td>
<td>16.7%</td>
<td>2</td>
<td>83.3%</td>
</tr>
<tr>
<td>Did you seek in person medical care</td>
<td>12</td>
<td>33.3%</td>
<td>4</td>
<td>66.7%</td>
</tr>
</tbody>
</table>
Discussion

Development and Adaptation of the Intervention

This quality improvement initiative included the development and implementation of three educational components for the caregivers of children with TT including a web-based video, an instructional pocket-card, and a postoperative texting reminder to caregivers.

Networking with key stakeholders was an essential aspect of educational product development: the diversity of one’s networking fosters the diversity of ideas. Instrumental to the success and acceptance of the products was input and critique from expert clinicians in the script development and product review processes. Input was also incorporated from patients, caregivers and the public with adjustments made accordingly. One major video modification related to the video voice recording, initially performed by a medical education video recording professional with a British accent. However, reviewers (clinical experts and caregivers) overwhelmingly stated it was difficult to understand and not appropriate for the product - hence it was changed. The creativity, knowledge, and ideas of a technical networking group (consultants in web-based technology and implementation, video development, graphic design, media education, photography, and publishing) was essential in transforming the educational concepts into polished products.

The addition of the pocket-card and postoperative texting reminder with QR code link to the web-based video stemmed from networking groups. Although the video is a valuable educational tool, there was concern that a gap may exist between when the caregiver views the video and when they need it. The addition of the pocket-card and text serve as reminders and strive to keep the product accessible and memorable at the time of need. The various formats of
education products allow the information to be accessible to caregivers for easy access whenever and wherever the need arises with options for different learners.

During the time of product development, the CPG-TT was in the process of being updated (Rosenfeld et al; 2022). To ensure the program was in keeping with the most updated guideline (later published in February of 2022), I served as external reviewer to ensure the education program would be consistent with the most current recommendations.

**Implementation Considerations**

Project implementation occurred at the time of surgery with follow-up during the postoperative visit to allow consistency of education program delivery to all caregivers. However, moving forward I believe the program should be introduced to caregivers when the decision for surgery is made, as part of the preoperative education when the caregiver is consented for surgery. This timing will allow the clinician to prescribe the web-based resource with the hopes of diverting caregivers from accessing potentially inaccurate information from less reliable sites and provides information at a time when caregivers will most likely search for the information. It also endorses our products as reliable and recommended resources. Furthermore, prescribing our own developed web-based education shows a commitment to our families and will hopefully impact patient retention and practice endorsement. The literature cites multiple advantages when providers ‘prescribe’ endorsed internet resources to caregivers, including improvements in clinical outcomes, patient and family satisfaction, compliance with treatment, and reduction in health-related anxiety (Parga-Belinkie & Merchant, 2019).

Additionally, the time of surgery is frequently chaotic and stressful for caregivers. Thus, providing the information at the preoperative visit with reinforcement at the time of surgery and subsequent visits is likely a better alternative for delivery of essential postoperative information.
Postoperative education is a vital and essential component of patient care provided by nurses at the time of surgery. Providing the PACU nurses with an established education program for caregivers including videos and pocket-cards should assist nurses in providing consistent, comprehensive, evidence-based education in a time and cost-effective manner.

This project was implemented during the height of the COVID-19 pandemic from September 16th through December 20th, 2021. Pediatric otolaryngology practices across the country saw a plummet in the incidence of otitis media, middle ear effusions and the needs for tympanostomy tube placement. Additionally, the autumn season is typically a time of lower incidence of middle ear disease. This impacted the total number of caregivers recruited. The pandemic created issues on staffing shortages and additional stress of the nurses within the surgical areas. It also placed barriers on in-person training and networking sessions which were transformed to virtual meetings.

**Discussion of Findings**

A total of 58 caregivers of children with TT placement were enrolled in this project during the three-month implementation period. Of all caregivers invited to participate, only one declined. Patient demographics are consistent with national trends including an expected skewed distribution of ages at tube placement ($R= 8$ months to 9.9 years, $M =2.3$ years, SD 1.8), and just over 80% receiving their initial set of tubes (Rosenfeld et al., 2022, Padia et al., 2018; O’Niel et al., 2015; Goel et al., 2021). Gender distribution was balanced.

All aspects of the education program were well received by caregivers. The value of offering various forms of education such as the video, pocket-card, and texting at different times should improve access and use. All caregivers watched the video as it was provided to all on an iPad at the time of surgery. All but one parent found the video helpful. Staff member and nurses
TTO Educational Program

at the surgery center suggested having the video run continuously for parents in the waiting area when children had tubes placed. Physically providing the video resource ensures the caregivers views it and should be considered moving forward. It is interesting that not all caregivers recalled receiving the pocket-card or the post-operative text even though they did, but most reported it to be helpful if they did recall receiving. One consideration is that caregivers did not understand what was meant by a pocket-card. Recall on whether a text was received may be difficult to remember. Importantly, caregivers overwhelmingly found all resources to be helpful and a valuable future resource.

Adaptation of Bandura’s Self-Efficacy Scale allowed evaluation of caregivers change in self-efficacy in respect to the care of their child with TT and identification and treatment of TTO. All self-efficacy items were significantly improved after implementing the education program. Of note, the standard deviation in the post-intervention group is much smaller than the standard deviation in the pre-intervention group. This occurred because caregivers with initially high self-efficacy scores had little or no chance for improvement due to a ceiling effect, whereas caregivers with low initial self-efficacy had much improvement at post intervention.

Caregiver past-experience with TT, ear drainage, and eardrop administration with impact on self-efficacy was also explored. Although not statistically significant, in general, the caregivers with past experiences had greater total self-efficacy at pre-intervention and post-intervention when compared to the caregivers without prior experience. Statistical insignificance may relate to the low power impacted by the small sample size. Although caregivers with past experiences may have higher self-efficacy at baseline, caregiver self-efficacy was significantly improved after receiving the education regardless of experience. Based on self-efficacy ratings,
feedback from caregivers, and affordability of the program, the data shows the program to be a valuable well-utilized resource for caregivers.

This project was executed with a narrow implementation period to determine impact of a new education program on self-efficacy, caregiver acceptance of education resources and finally actions if TTO did occur. At the time of the post-intervention survey, 20.7% of children had experienced TTO. The goal of this project is to reduce the use of oral antibiotic to treat children with acute uncomplicated TTO. Following implementation of the program, all caregivers identified TTO independently and started drops independently. No child received oral antibiotics for acute uncomplicated TTO. This is an indicator of positive impact on clinical outcomes. There was a subgroup of caregivers whose children experienced TTO who called their otolaryngology specialist or primary care provider for direction (n=2) or sought in-person medical attention (n=4); however, no child was seen in an urgent care or emergency care facility. Of those who experienced TTO, 58% referred to the educational resources- of those who did not- all had past experiences with TT/TTO. Although, the hope is this intervention will additionally decrease urgent care visits, caregivers should feel comfortable contacting their health care provider for reassurance, advice, or a visit if they feel it is indicated. Reassessment of caregivers’ self-efficacy and actions for TTO at the next scheduled TT evaluation (typically six months following their postoperative visit) will provide additional evidence regarding the long-term impact of this educational intervention.

**Scalability and Sustainability**

This quality improvement project has allowed development and implementation of an educational program as a pilot project and provided excellent feedback regarding the resources, with a significant positive impact on caregiver confidence in the care of their child and clinical
TTO Educational Program

outcomes. Using the PDSA model, it’s time to scale up and implement the project to all patients and caregivers in the practice who require TTs. Changing the timing of implementation to the preoperative visit by the treating clinician will extend the program substantially. There are many children within our practice who have existing TTs and TTO who would also benefit from the resources. A poster will be produced and displayed in each out our offices with information regarding the video and program (with QR code access) and reinforced during the visit. The video has also been posted to our practice website for easy access for all and is available on YouTube for the public. Follow-up with the current study group through the longevity of their TTs will elicit further information regarding the long-term impact of this education on TTO, which increases with the time the tubes have been in place. Scaling to additional languages will also improve access for our patients and families. The concept of web-based education can be expanded to other common pediatric otolaryngology diseases and treatment (i.e. treatment for epistaxis, preparing your child for surgery, recovery from tonsillectomy, caring for your child with a tracheostomy) to improve our educational resources.

Sharing the resource with community pediatric providers is also essential. Our practice newsletter to community providers this spring will focus on ear disease with an update of the recently released CPG-TT and information about the TT education program with resources for clinicians to use in their own practice. The TT poster will be shared within the newsletter and be provided to community walk-in clinics and urgent care facilities. The American Academy of Otolaryngology has a website which links educational resources with practice guidelines- the video will be shared with a hopeful link for greater dissemination to the public. Dissemination of this work will also take place through publication, podium and poster presentations and networking with fellow pediatric and otolaryngology colleagues. I fully support the educational
video being prescribed and the principles of the education program to be used or adapted by clinicians and practices across the country, to improve patient care, education and outcomes.

**Broader Healthcare System Implications**

Antibiotic resistance is a global health crisis (WHO, 2021). This project has a deep seeded goal of antibiotic stewardship, which benefits the individual and community with global one health considerations. Tympanostomy tube placement is the most common surgery performed in children; 83% will develop tympanostomy tube otorrhea (Rosenfeld et al, 2022). TADs are the most beneficial treatment for this condition, and do not lead to antibiotic resistance (Roland, 2003). Yet many providers continue to prescribe systemic antibiotics. Antibiotics have the inherent risk of causing patient harm due to possible adverse drug reactions, resulting in additional urgent visits, and accrued medical costs. Cost avoidance to the patient and society is also at the crux of this project, although more difficult to measure in actual numbers. The foundation of this project is increasing the autonomy of caregivers to identify and treat TTO independently. This in turn will ideally decrease urgent care visits, decrease loss of worktime as well as improve treatment outcomes with more appropriate targeted therapy and elimination of unnecessary systemic antibiotics. This has huge cost avoidance implications for our families and insurance companies. The inappropriate prescribing practices for children with TTO directly impact clinical outcomes, have global implications in antibiotic resistance and financial implications resulting from the cost of additional medical encounters and associated missed work and school days. Clinicians have a responsibility to evaluate their practice and implement strategies to reduce antimicrobial misuse.


TTO Educational Program

Conclusion

This quality improvement project focused on the development and implementation of an educational program to educate, empower, and improve the self-efficacy of caregivers of children with TT to initiate treatment for TTO independently when clinically indicated. Development of the web-based video provided caregivers with a valid, reliable, and easily accessible tool endorsed and prescribed by their clinician. The pocket-card and texting system reinforced provided access to the education. Educational resources were utilized by all caregivers and felt to be useful for future reference and significantly increased caregiver confidence in the care of their child with TTs. No child received oral antibiotics for TTO. Expanding implementation to all patients from all practice sites with follow-through for the duration of TTs will provide further endorsement to the value of this program. Implementing strategies to improve caregiver confidence, efficiency in care, and improve patient understanding and execution of care positively impact patient care. The long term goal of this work is to decrease the unnecessary use of oral antibiotic in the treatment of acute uncomplicated TTO, impacting global antibiotic resistance, improving health utilization and cost, and improving clinical outcomes.
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https://doi.org/10.1016/j.ijporl.2020.110027

https://doi.org/10.1177/0003489420902183


https://doi.org/10.1177/0009922819845163


TTO Educational Program


Appendices

Appendix A1

PRISMA Flowchart- Treatment of Tympanostomy Tube Otorrhea

Identification
Records identified through database searching
OVID 1/21/21 (n=753)
Records identified through database searching
Scopus 1/21/21 (n=1,107)
Records identified through database searching
Cochrane 10/27/20 (n=38)

Records after duplicates removed
(n=996)

Screening
Records screened
(n=996)
Records excluded
(n=871)

Eligibility
Full-text articles assessed for relevance
(n=125)

Included
Studies included in ROL
(n=35)
Studies included in matrix
(n=35)

Inclusion Criteria:
Search terms: “tympanostomy tube” OR “myringostomy tube” OR “grommet” AND “otorrhea” OR “infection” OR “otitis media” OR “drainage” AND “child” OR “infant” AND “treatment” OR “antibiotic” OR “management”
Includes articles from all countries and unlimited time range

Exclusion Criteria:
Articles not available in English

YSN 2020


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Appendix A2

PRISMA Flowchart- Web-Based Education in Pediatric Otolaryngology

Inclusion Criteria:
Search terms: "digital health" OR "Internet" AND "health behavior" OR "information seeking" AND "tympanostomy" OR "otolaryngology" OR "grommet" AND "child" OR "parent"
Search dates: 2015-2021

Exclusion criteria:
Articles not published in English
Articles published outside North America
Articles published prior to 2015

For more information, visit www.prisma-statement.org.
## Appendix B1

### Literature Matrix - Tympanostomy Tube Otorrhea

<table>
<thead>
<tr>
<th>Author</th>
<th>Date</th>
<th>Study Purpose</th>
<th>Sample</th>
<th>Design method</th>
<th>TTO treatment options (Includes adverse events)</th>
<th>Data re OM/TT</th>
<th>Miscellaneous outcomes identified</th>
<th>LOE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chee, 2016</td>
<td>evaluate efficacy of topical abx + steroids vs oral abx to tx TTO in children</td>
<td>4 studies – 560 subjects with TTO- 227 received topical abx tx, 283 received oral abx</td>
<td>Meta analysis of RCT</td>
<td>topical better resolution rates at 2–3 weeks over oral (RR = 1.35, 95% CI 1.21–1.50, p &lt; 0.001, NNTB = 4.7)</td>
<td>SE less w topical abx vs oral – Oral abx sig HR risk of diarrhea (pooled RR = 21.5, 95% CI 8.00–58.0, p &lt; 0.001, NNTH = 5.4 and dermatitis (pooled RR = 3.14, 95% CI 1.20–8.20, p = 0.019, NNTH = 32)</td>
<td>1A</td>
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<tr>
<td>Steele 2017</td>
<td>2nd part of study synthesize evidence re effect of drops v watchful waiting and oral abx in ch w to p 2</td>
<td>25 articles included (11 specific to TTO) 10 RCTs +1 NRCS, n=1811 patients analyzed (1405 in RCTs and 406 in NRCSs)</td>
<td>Meta analysis of RCT</td>
<td>Tx w topical abx drops better than oral abx and watchful waiting or placebo. Cure rates higher for drops than oral (p3) Both topical abx+ glucocorticoid and abx-only drops better than watchful waiting - odds of clinical cure 12x(95%, 1.9–82) higher (number needed to treat 2.2, assuming a reference rate of 0.4515) for antibiotic–glucocorticoid drops and 7.3 (95%, 1.2–51)</td>
<td>reviews evidence for need for water precautions- no evidence it is necessary (p2 Table 1 shows probabilities that an Intervention is Among the 1st-4th most effective with clinical resolution of TTO (p4))</td>
<td>1A</td>
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<tr>
<td>Venekamp 2016</td>
<td>assess benefits harms of tx types for ch w tto (p8)</td>
<td>Children (&lt;12y) w AOMT who developed acute drainage &gt;2w po (p8) 9 studies (all RCT) 2132 children (p13)</td>
<td>Cochrane review of RCT</td>
<td>Abx drops +steroids were more effective than oral abx –By 1w- 1 study, 42 ch, ciproflox drops v amox: 77% v 30%; RR: 2.58, 95% CI 1.27-5.22 (mod evid) (p15–17) -By 2w- 1 study, 153 ch, BCH drops v amox-clav: 95% v 56%; RR 1.70, 95% CI 1.38-2.08 (mod evid)(p17-18)Abx drops +steroid v oral -2 studies-, 590 children: 35% versus 20%; RR 1.76, 95% CI 1.33 to 2.31 Duratn discharge- 2 studies, 233 ch, ciproflox drops v amox: median 4d v 7d and BHC drops v amox/clav: 4d v 5d (mod evid)(p 20) - Recurrence- 1 study, 148 ch, BCH drops v (P 20-21) No sig diff -1 study 331 ch -abx drops- 0/111- 0% v steroid drops-1/112- 1% abx+steroid drops 2/108-2% - No complications compared no tx, NS flushes, steroid drops alone and combos of all above (p18-23) Cochrane systemic review -several of the studies used in this review are itemized below, older studies but landmark and minimal published since</td>
<td>1A</td>
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<tr>
<td>Author</td>
<td>Year</td>
<td>Study Design</td>
<td>Population</td>
<td>Intervention</td>
<td>Efficacy</td>
<td>Safety</td>
<td>Notes</td>
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<tr>
<td>Ah-Tye</td>
<td>2001</td>
<td>occurrence of OTT after TT for COME in healthy kids</td>
<td>173 with TT placed bin 6-36m, followed for 18m</td>
<td>long term prospective study, randomly assigned children</td>
<td>TT extrusion 19d-38.5m (mean 13.8m), TTO 1+ during 12m-74.8%, first 18m 83%, mean number of episodes/child 0.79 in the first 6 m, 1.50 (in 12m) 2.17 (in 18m) 2.82 (24m).</td>
<td>SE-Adverse events reported in 53.1% but not study drug related 12.8% adverse events possibly rt study drug (earache, otorrhea, tinnitus, taste distortion, rash, fever, paresthesia) (p543)s (96.3%)</td>
<td>1C</td>
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<tr>
<td>Dohar</td>
<td>1999</td>
<td>determine safety and efficacy of Oflox otic to tx acute TTO</td>
<td>Children 1-12y with acute purulent TTO (&lt;3w) p538</td>
<td>RCT Multicent, 3 arms- prospect oflox, retrospec hisorical, current practice arms;p538</td>
<td>Signif improve character, odor 95%, 98% (p&lt;.001) in flox group, Clinical cure 93.1% by V4, Overall cure 84.6% (flox group), 64.2%(hist grp), 70% (current practice) (p541) More clinical cures (eradication of otorrhea on day 10-14 after therapy) 84.4%;119/141 than historical practice 64.2%;140/218 (p&lt;001) or current practice subjects-70%;33/47 (p&lt;.03). baseline pathogens eradicated in 103/107 micro evaluable oflox subject---</td>
<td>Tx SE- Cipro/dex drops- ear pain 5.1% amox/clav -diarr 19.5%, -dermatitis 7.3% gastro 4.9% (p 567)</td>
<td>1C</td>
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</tr>
<tr>
<td>Dohar</td>
<td>2006</td>
<td>Compare topical cipro/dex drops to amox/clav in ch with AOMT</td>
<td>Children 6m-12y with AOMT &lt;= 3w duration and visible otorrhea (p e562)</td>
<td>RCT observer masked parallel group multicenter p562</td>
<td>median time to cessation of TTO was significantly shorter with cipro/dex vs amox 4 vs 7d; n=79). significantly more clinical cures at the test of-cure visit (85% v 59%, respectively) (p567-567)</td>
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<td>1C</td>
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<tr>
<td>Goldblatt et al, 1998</td>
<td>compares safety and efficacy of oflx v aug to tx TTO</td>
<td>acute TTO in 1-12y, multicenter (36 US+1 chile) randomized parallel group evaluator blind</td>
<td>eradication rates for OFLX and AUG were similar for Strep pneumo, H flu and M cat/ superior with OFLX for Staph aureus and Pseudomonas . OFLX better pathogen eradication rate (96% vs. 67%; PB0.001). Treatment-related adverse event rates were 31% for AUG and 6% for OFLX -No significantly altered hearing acuity.</td>
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<tr>
<td>Goldenblatt 2006</td>
<td>compared safety + efficacy of oflox drops v Aug ) ch w TT + acute purulent otorrhea</td>
<td>Children 1-12y w TT and acute purulent otorrrhea (p92)</td>
<td>RCT multicenter 37 parallel group, evaluator blind p92</td>
<td>cure rate -76% w ofox (n140) + 69% w AUG (n146;p=0.169) (p95) Overall eradication w oflox v aug were similar for strep pneu, H inf +Mcat; superior w oflx for staph aur &amp; pseudomonas (p&lt;0.05 for both- Oflox had greater overall pathogen eradication rate (96% vs. 67%;P&lt;0.001) (p95-97) Treatment-related adverse event rates were 31% for aug and 6% for oflox (p&lt;0.001) (p98)</td>
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<td>Reference</td>
<td>Study Details</td>
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<tr>
<td>Granath 2008</td>
<td>Children (&lt;3y) with otitis media for recurring AOM (n=53)</td>
<td>RCT Open label randomized prospective study</td>
<td>Group 1 – NS irrigation + topical abx drops (hydrocortisone, oxytetracycline and polymyxin B) Group 2 – same with addition of oral abx (amox or amox/clav) No difference between the 2 groups in tx or duration - 88% response rate addition of abx is not better (notes) logrank test, p-value 0.53 (p1230 Stockholm study) Gives breakdown of pathogens for both groups</td>
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<tr>
<td>Heslop 2010</td>
<td>Caucasian ch &lt; 10 y w first episode of otorrhea after TT- (n=68)</td>
<td>RCT dbl-blind</td>
<td>Treatment failure rates 58%-NS, 23%-cipro, 70%-amox Recurrence much less in drops v saline (x2=4.8254, 0.01&lt;P&lt;.05) and amox (x2=9.4502, p&lt;.005) (p2518) 13% had OE after tx (1-drops grp, 4-NS group, 4-amox group) (p2518) Tx failure sim bt n NS and amox x2=1.6857, p&gt;.05. The most frequent bacteria isolated from treatment failures in general were streptococci and M cat (2518) Denmark study,</td>
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<tr>
<td>Roland et al 2003</td>
<td>201 children 6m-12y with acute TTO and visible otorrhea</td>
<td>RCT, pt masked, parallel group, multicenter trial</td>
<td>Mean time to cessation TTO in microbial culture +ve pts was sig shorter w cipro/dex than cipro alone (4.22 vs. 5.31 days; P .004). sig better clinical responses on days 3 and 8 (P&lt;.0001 and P.0499, respectively). no sig differences bt grps in clinical response or microbial eradication rate by day 14. cipro/dex 20% reduction (1.1 day) in time to cessation of TTO</td>
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<tr>
<td>Roland et al 2004</td>
<td>599 children 6m-12y with acute TTO</td>
<td>RCT (39 cites) prospective observer masked parallel group study</td>
<td>Cipro/dex better than oflox re clinical cure (90v 78%), microbiologic success (92 v 81.8%) at test for cure visit, fewer tx failures (4.4 v 14.1%) shorter median time to cessation of TTO (4v6d)</td>
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<tr>
<td>Ruohola 2003</td>
<td>6-72m with TTO</td>
<td>RCT double-blind, placebo-controlled p1062</td>
<td>Amox-clav v placebo for 7d+ daily suction of TT, median duration of TTO was shorter in amox clav than placebo (3v8d) after 7d, TTO resolved in 28/34-amox/clav v 13/32 (tx-control difference 41%; 95% CI, 20%–63%; number needed to treat, 2.4), median duration of bacterial growth</td>
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This used oral vs placebo- no topical drops were used in any of the pts
<table>
<thead>
<tr>
<th>Reference</th>
<th>Methodology</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Van Dongen et al. 2014</td>
<td>Presence of TTO 2w post tx, duration of TTO, otorrhea recurrences during 6m fu, QOL, complications + adverse events</td>
<td>No complications of OM. Drops-16 ch (21%) reported pain or discomfort-2 (3%) local rash. Oral-18 ch GI symptoms (23%), 3 ch (4%) rash.</td>
</tr>
<tr>
<td>Wallace and Newbiggin, 2004</td>
<td>Does ENT review at 1w po Tt reduce comp rate and # of consults w pcp in first month po</td>
<td>Outcomes incidence po TTO reported by parents and id on exam in clinic, no sig difference in tube extrusion, patency, number consultations for TTO.</td>
</tr>
<tr>
<td>Spektor et al. 2017</td>
<td>Eval efficacy and safety of cipro + fluc v cipro</td>
<td>Outcomes incidence po TTO reported by parents and id on exam in clinic, no sig difference in tube extrusion, patency, number consultations for TTO.</td>
</tr>
<tr>
<td>O'Niel et al. 2015</td>
<td>Implement database for kids with om to identify</td>
<td>Great data on numbers.</td>
</tr>
</tbody>
</table>

**TTO Educational Program**

- Shorter in amox/clav than placebo 1 vs 8, p1064
- Van Dongen 2014: Presence of TTO 2w post tx, duration of TTO, otorrhea recurrences during 6m fu, QOL, complications + adverse events (p725)
- Wallace and Newbiggin, 2004: Does ENT review at 1w po Tt reduce comp rate and # of consults w pcp in first month po (66 children, RCT)
- Spektor et al. 2017: Eval efficacy and safety of cipro + fluc v cipro (662 children with acute TTO, RCT double blind)
- O'Niel et al. 2015: Implement database for kids with om to identify (634 children with TT, 1m-17y 544 tubes followed from insert to prospective cohort)

- Abx drops superior to oral and obs for all outcomes (p727) - eval of TTO at 2w post tx: -drops 5% had TTO v 44% w oral abx (risk difference, −39%age points; 95% CI, −51 to −26) and 55% w obs only (risk difference, −49 percentage points; 95% CI, −62 to −37) median duration of the initial episode of TTO 4d drops v 5s oral (P<.001) and 12d observatn only (P<.001) 55% treated with obs -During 6m fu fewer children txed with drops had TTO > 4 w+, v txed with oral abx or observation (p731) Amsterdam/Netherlds
- ES: Does ENT review at 1w po Tt reduce comp rate and # of consults w pcp in first month po (66 children, RCT)
- ES: Eval efficacy and safety of cipro + fluc v cipro (662 children with acute TTO, RCT double blind)
- ES: Implement database for kids with om to identify (634 children with TT, 1m-17y 544 tubes followed from insert to prospective cohort)
<table>
<thead>
<tr>
<th>Study/Clinical Question</th>
<th>Methods</th>
<th>Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pereira et al., 2005</td>
<td>determine incidence TT sequelae/complications in children presenting with ROM and COME undergoing TT</td>
<td>75 children, 11m-10y with fu up to 38m prospective cohort study complications: to - 47.3%; perf - 2.1%; retractions - 39.7%; tympanosclerosis -23.3%. Average LOS: 12.13m. Mean age at TT placement of ch not requiring a 2nd set of tubes = 35.9m mean age at initial tube insertion of children requiring more tubes = 25.6m (P=0.04). TT stayed longer in the ears that had more TTO (P=0.01). TT + adenoidectomy less otorrhea episodes (P=0.02)</td>
</tr>
<tr>
<td>Walker et al, 2017</td>
<td>Determine MIC for ciproflox resistant MRSA isolates from otologic infects compared to expected conc with fluoroquin</td>
<td>30 otologically sourced cipro resistant MRSA isolates collected from adult and pediatric patients MICs ranged from 16 to 1025 mg/ml - not highly resistant MRSA but all others with mono tx In vitro assay with retrospective medical record review During an episode of acute TTO managed with topical drops, about 50% of children recover within 3 to 4 days, 90% within 7 days, and a plateau of 95% after 14 days.</td>
</tr>
<tr>
<td>Roland et al, 2005</td>
<td>investigate incidence of AOM since 13 metascan database AOM cases in the MarketScan database</td>
<td>Incidence rates of healthcare utilization related to the index AOM episode were calculated using the annual number</td>
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TTO Educational Program
<table>
<thead>
<tr>
<th>Study</th>
<th>Objective</th>
<th>Methods</th>
<th>Results</th>
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</thead>
<tbody>
<tr>
<td>Ahmed et al, 2014</td>
<td>Determine incremental health care costs associated with AOM in children</td>
<td>Cross-sectional analysis of a national health-care cost database</td>
<td>8.7 ± 0.4 million children were diagnosed with AOM (10.7 ± 0.4% annually, mean age 5.3 years, 51.3% male) among 81.5 ± 2.3 million children sampled (mean age 8.9 years, 51.3% male). AOM resulted in additional +2.0 office visits, +0.2 ED visits, and +1.6 prescription fills (all P &lt;0.001)/yr vs no om-- AOM additional outpatient health care costs of $314 per child annually (P &lt;0.001) and +$17 in patient medication costs (P &lt;0.001)</td>
</tr>
<tr>
<td>Arason et al, 2005</td>
<td>Investigate links between antibiotic use for AOM and TTP, and parental views and physician antimicrobial prescribing</td>
<td>Cross-sectional community study repeated after five years.</td>
<td>The placement of TT is less in areas where more conservative and narrow spectrum abx are used. Well informed parents predict a restrictive script policy (used for stats only)</td>
</tr>
<tr>
<td>Bhattacarya and Shay, 2020</td>
<td>Assess national prevalence of TT and frequent OM in children</td>
<td>Survey of statistically representative sample of US kids &lt;18 yrs with history of prior TTP and frequent OM</td>
<td>6.26/73.1 million (8.6%) had TTP. Freq OM incidence 3.49 million (4.8%). Males (9.6%) females (7.5%) to undergo TTP (P = .004). Among children under 2 years of age, 9.1% reported FEI, compared to 3.9% of children aged 3 to 17 years. &lt; 2 yrs - 25% with FEI received TTP vs 1.5% without FEI (P &lt;0.001). 3 - 17 years, 31.1% with FEI received TTP vs 8.6% without FEI (P &lt;0.001).</td>
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## TTO Educational Program

<table>
<thead>
<tr>
<th>Reference</th>
<th>Study Details</th>
<th>Findings</th>
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</thead>
<tbody>
<tr>
<td>Cullen et al, 2009</td>
<td>National health stats reports national estimates of surgical and nonsurgical procedures performed in amb US centers in 2006</td>
<td>53.3 million surgical and nonsurgical procedures were performed during 34.7 million ambulatory surgery visits.</td>
</tr>
<tr>
<td>Shaffer and Dohar, 2020</td>
<td>Impact of telephone triage program on management of TTO in accordance with AAO guidelines</td>
<td>82 patients whose parents called nurses line with TTO. RCR TAD prescribed by an APP in 96.3% of cases - 2.5% had drops at home and advised to use. 1.2% referred to PCP. 24.4% received another antibiotic prescription and 17.1% had a subsequent clinic or urgent care visit for otorrhea. This obviated clinic visits in 82.9% of patients with a 75.6% treatment cure.</td>
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<tr>
<td>van Dongen, 2013</td>
<td>Determine incidence of TTO and its predictors</td>
<td>1184 children &lt;10y (Dutch study); cohort study, parental web based survey. Young age, recurrent acute otitis media being the indication for tube placement, a recent history of recurrent upper respiratory tract infections and the presence of older siblings were independently associated with the future occurrence of TTO. 67% with TTO, 4% with chronic TTO (&gt;4w), 12% w recurrent tto, 12% with early TTO, within 1m. 597 (50%) 1+ or more acute TTO episodes (duration &gt;4 weeks)- 4%, one or more chronic TTO episodes (duration &gt;4 weeks).(12%) recurrent TTO 67% of children developed one or more TTO.</td>
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<tr>
<td>Wang et al, 2021</td>
<td>Identify risk factors assoc with early po complic of TT</td>
<td>311 children median age 3.86 years; case control study in tertiary hospital (Australia). 8.7% of patients developed TTO in 6w po – use of IO or PO drops significantly less TTO (IO: Odds Ratio [OR] = 0.15, 95%CI 0.04 to 0.57, p = 0.005; PO: OR = 0.21, 95%CI 0.58 to 0.76, p = 0.017). TTO higher in colder months (OR = 3.17, 95%CI 1.14 to 8.84, p = 0.028), and pts&lt; 3 years (OR = 2.66, 95%CI 1.01 to 7.03, p = 0.049). Topical abx exposure was inversely associated with TTO.</td>
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</table>
TTO Educational Program

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<thead>
<tr>
<th>Rosenfeld, 2000</th>
<th>impact tubes on child QOL, and compare variability in QOL before surgery to after surgery</th>
<th>determine the subjective impact of it on child QOL, and compare the variability in QOL pre and post surgery</th>
<th>prospective observation before and after trial</th>
<th>3</th>
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<tbody>
<tr>
<td>Patel et al, 2019</td>
<td>Ed tool effect on parent TTO id</td>
<td>57 pt undergoing TT (27 retro 30 prospective)</td>
<td>prospective data compared to retrospective control</td>
<td>developed a 3.5x2 in card showing TTO and describe to institute approp tx- phone calls decreased 59.3% pre intervention, 16.7% post intervention</td>
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<tr>
<td>Aarts 2012</td>
<td>awareness, opinions, and adherence to EBG in ENT</td>
<td>440 ENTs Dutch society of oto</td>
<td>Survey using self report measures (quant approach)</td>
<td>Impact of EBG on clinical practice, 70% influenced by, 62% supported practice, 32% directed practice, mean % of nonadherence is 45%,</td>
</tr>
<tr>
<td>Badalan, 2013</td>
<td>Compares tx of TTO ENT v ED</td>
<td>175 ED Docs 174 Pedi ENTs</td>
<td>Survey w self report measures</td>
<td>significantly higher proportion ED would use oral abx -54% vs 9% (p205) Use of topical ENT-99% and ED- 87%(p205)</td>
</tr>
<tr>
<td>Ma 2019</td>
<td>five deliver high quality effective care</td>
<td>Survey of Canadian OHNS otology/neurotology subspec grp of Canadian</td>
<td>Expert Consensus</td>
<td>“(4) Don’t prescribe oral antibiotics as first line treatment for patients with painless otorrhea associated with tympanic membrane perforation or tympanostomy tube”(p2)</td>
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<tr>
<td>Rosenfeld, 2020</td>
<td>Review current issues and controversies RT TT-7 issues identified</td>
<td>literature review</td>
<td>based on research evidence and expert opinion</td>
<td>Controversies - Does acute TTO caused by MRSA require oral abx when culture shows resistance to fluoros- data on Mic levels and irradiation of mrsa with quin drops. What is the best way to manage a child with recurrent or persistent TTO? table on reasons for</td>
</tr>
<tr>
<td>Carr et al, 2017</td>
<td>decisional regret following TT insertion</td>
<td>210 children &lt;18y with TT</td>
<td>70.5% regret score 0, mean 6.98 (95%CI 5.11e8.85)- scores higher for parents when child had TTO at time of survey - DR higher with reflux (3.33 versus 7.89, p ¼</td>
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### TTO Educational Program

<table>
<thead>
<tr>
<th>Study Authors, Year</th>
<th>Methodology</th>
<th>Study Population</th>
<th>Findings</th>
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</thead>
<tbody>
<tr>
<td>Padia et al, 2018</td>
<td>Review incidence of long term issues after TT</td>
<td>14,058 children &lt;3y with TT with 5 year fu</td>
<td>Case series and chart review. Mean age TT placed 1.4 years 2nd set- 14.4% (in 5y), 4.6% required 3+ sets. 3% require tube removal (34.2 +/-17.6 m postplacement. 5.1% had a resulting perforation after either tube extrusion or tube removal requiring closure.</td>
</tr>
<tr>
<td>Hughes et al, 2017</td>
<td>Are AAO guideline re TT being followed re TT placement criteria</td>
<td>88 children &lt;9y undergoing TT</td>
<td>RCR. 75% met guidelines for TT. 22 not meeting guidelines, 11(50%) had abnormal exams, but were 1 to 2 infections short of meeting guidelines; 7 (33%) had normal exams but met criteria for number of infections. only 5% substantial departure from guideline.</td>
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### Appendix B2

**Literature Matrix- Web-Based Education in Pediatric Otolaryngology**

<table>
<thead>
<tr>
<th>Author</th>
<th>Study Purpose</th>
<th>Sample Description</th>
<th>Design Method</th>
<th>Web-based ed stats, accuracy, comprehensive health literacy, patient centered, advocacy</th>
<th>Health literacy, patient centered, advocacy</th>
<th>Misc outcomes Impact</th>
<th>LOE</th>
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<tbody>
<tr>
<td>Goggin et al, 2020</td>
<td>assess impact of 90 second animated video on parents interest in receiving an abx for child</td>
<td>1051 children 1-5 y with acute URI</td>
<td>pre/post test</td>
<td>After watching the video, parents’ average antibiotic interest ratings decreased by 10 points (mean, 57.0 +/- 20 to M +/- 21; P &lt; .0001) with highest ratings in those who wanted anti prior to video (83.0 +/- 12.0 to 63.4 +/- 22; P &lt; .0001) with more than one-half (52%) rating their interest in the low or neutral ranges after watching the video.</td>
<td>Impact of parents wanting abx after watching 90sec ed video</td>
<td>Internet resources about TT placement vary in quality pertaining to health literacy, principles of shared decision making, and consistency with practice guidelines EXCELLENT BREAKDOWN OF cpg VARIATION AND REPRESENTATIVE TEXT</td>
<td>3</td>
</tr>
<tr>
<td>Harris et al, 2018</td>
<td>evaluate the quality of leading internet resources describing TT placement</td>
<td>10 websites (most frequently encountered)</td>
<td>cross sectional descriptive design</td>
<td>1/10 met national health literacy standards (mean 10th-grade level reading, median 9th, range 6–15th). All sites were understandable (mean understandability 81.9%, range 73%–92%). Most had low actionability scores (7 of 10, median 47%, mean 44.6%, range 0–80). Shared decision-making centrality was high (mean 5, range 4–6), but most did not list alternative treatment options. Although CPG compatibility was high (mean 3.4, range 1–4), many websites contained inconsistent recommendations about tube duration, follow-up, and water precautions.</td>
<td>Internet resources about TT placement vary in quality pertaining to health literacy, principles of shared decision making, and consistency with practice guidelines EXCELLENT BREAKDOWN OF cpg VARIATION AND REPRESENTATIVE TEXT</td>
<td>Internet resources about TT placement vary in quality pertaining to health literacy, principles of shared decision making, and consistency with practice guidelines EXCELLENT BREAKDOWN OF cpg VARIATION AND REPRESENTATIVE TEXT</td>
<td>3</td>
</tr>
<tr>
<td>Shetty et al, 2020</td>
<td>determine quality content, readability of patient ed re OM across popular online platforms</td>
<td>website review (aafp, ent health on AAO, healthychildren.org on AAP, kidshelath)</td>
<td>analyzed material for quality and readability DISCERN</td>
<td>Material balanced, AAFO and kids health &gt; focused on medical management. Average DISCERN score all sources good quality, min short comings, some readability scores around the 8th grade, some above this level “Pt ed materials RT OM on academic and certain popular internet sites are good sources to obtain high-quality info on topic. Pt ed background, prior knowledge and understanding of OM, and physician-patient partnership goals should be considered when refer</td>
<td>Good quality info on prof and academic websites in print, but many above recommended 6-8th grade reading level (excluded multimedia info)</td>
<td>Good quality info on prof and academic websites in print, but many above recommended 6-8th grade reading level (excluded multimedia info)</td>
<td>3</td>
</tr>
</tbody>
</table>
**TTO Educational Program**

<table>
<thead>
<tr>
<th>Study</th>
<th>Research Question</th>
<th>Sample Size</th>
<th>Methodology</th>
<th>Findings</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sood et al, 2019</td>
<td>Impact of internet sources on parental trust of physician dx and getting a second opinion</td>
<td>1374 parents</td>
<td>Online survey, experimental and control group</td>
<td>Video with misinfo compared to control group with no misinfo noted. Video participants less likely to trust the Dx (P &lt; .001) and more likely to seek a SO than the control (P &lt; .001). Participants who viewed supporting results were more likely to trust the Dx (P &lt; .001) and less likely to seek a SO than the control (P &lt; .001).</td>
<td>Impact of misinfo on trust in dx and healthcare</td>
</tr>
<tr>
<td>Sorenson et al, 2013</td>
<td>Assess overall quality of info on TA and PET surgery on YouTube (<a href="http://www.youtube.com">www.youtube.com</a>) from parent perspective searching for surgery info</td>
<td>102 videos – 55 videos TA, 47 TT</td>
<td>Cross sectional study</td>
<td>Educational (65.3%) /testimonial (28.4%) / news program (9.8%). Testimonials were more common for TA than TT= significantly lower mean accuracy (2.23 vs. 2.62, p = 0.02), 79ssessing79-siveness (1.71 vs. 2.22, p = 0.007), and TA specific content (0.64 vs. 1.69, p = 0.001) score than educational type videos. (5.9%) no significant association between the accuracy and comprehensive score and views, posted “likes”, posted “dislikes”, and likes/dislikes ratio.</td>
<td>Quality of content on web- Only six (5.9%) Test poorer general quality. Likes don’t equate to quality</td>
</tr>
<tr>
<td>Wong and Levi, 2017</td>
<td>Evaluate the readability of pedi ENT ed from leading online sources.</td>
<td>502 articles</td>
<td>Cross sectional analysis</td>
<td>Poor health literacy- The average readability grade exceeded the reading ability of the average American adult. 28.3% written at or below the reading ability 71.7% were written above</td>
<td>Online pedi ent written info too difficult</td>
</tr>
<tr>
<td>Joury et al, 2018</td>
<td>Discern content/quality of health info in parent/pt focused website-OM</td>
<td>35 websites</td>
<td>Cross sectional study</td>
<td>Low to med quality info, average 9-10th grade reading level</td>
<td>Readability and quality of sites for OM</td>
</tr>
<tr>
<td>Wozny et al, 2017</td>
<td>Evaluated readability comprehensiveness and consistency around</td>
<td>30 internet sites</td>
<td>Cross sectional study design</td>
<td>Less than half readability, info incomplete, lacks psychosocial support and skills training recs</td>
<td>Readability and quality of sites for ta</td>
</tr>
</tbody>
</table>
## TTO Educational Program

<table>
<thead>
<tr>
<th>Study</th>
<th>Methodology</th>
<th>Findings</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chi et al, 2017</td>
<td>Cross-sectional</td>
<td>Average DISCERN quality websites 55.1 (SD-12.3, Median-60.5). Mean score for FRES was 42.3 (SD-15.9, Median-45.5), which falls in the range defined as difficult. Only 4(27%) websites were in the optimal range of 6e8. Weak correlation between FRES and DISCERN (r = 0.07) and FKGL and DISCERN (r = 0.21).</td>
<td>Poor 80ssessing 80s and quality for tonsils and sleep apnea in children</td>
</tr>
<tr>
<td>Kubb and Foran, 2020</td>
<td>Lit review</td>
<td>Parents worldwide are heavy users, 6 studies found high anxiety in parents (14-52%), parents report desire for more guidance on internet sources but rarely discuss info found with provider</td>
<td>Extensive lit review spanning 24 years—many changes in that time, all parents and disease, high incidence anxiety and low discuss with provider</td>
</tr>
<tr>
<td>Kulasegarah et al, 2018</td>
<td>Lit review</td>
<td>Webpages gave on average 50.6% of the critical information a patient should know prior to undergoing surgery. This is a drop from 2007 (65.5%). Over 96.8% were found to have no inaccuracies identified on the available information provided on the websites. This was slightly higher than in 2007 (94.7%). YouTube (10%) and hospital webpages (10%) were among the new subcategories that were not present in the 2007 study.</td>
<td>Drop in completeness and improved accuracy from 10 years ago—YouTube and hosp based sites now avail</td>
</tr>
<tr>
<td>Lupton 2021</td>
<td>Lit review</td>
<td>General discussion re use of dig tech in youth, enjoy connection with peers, rely on adults to help them understand, still want face to face</td>
<td>Web based benefits to consumer-</td>
</tr>
</tbody>
</table>

80
<table>
<thead>
<tr>
<th>Author(s)</th>
<th>Title</th>
<th>Year</th>
<th>Methodology</th>
<th>Key Points</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nichols et al, 2020</td>
<td>What are the factors that influence the decision making of parents seeking unscheduled pediatric healthcare?</td>
<td>56 articles-narrative approach to different categories</td>
<td>lit review</td>
<td>Key point in paper- Unscheduled healthcare use was often initiated by the parent’s perception that the child’s condition was urgent and their need for reassurance. Conclusion: Policy and planning initiatives do not always reflect how patients negotiate the health system as a single entity with numerous entry points. Altering patients’ behavior through public health initiatives that seek to improve speaks to why parents seek urgent care and the need to improve health literacy and preventative measures through education to address these overuses</td>
<td>4</td>
</tr>
<tr>
<td>Pehora et al, 2015</td>
<td>Current use and perceptions on reliable websites for children’s health info by parents</td>
<td>149 parents</td>
<td>survey</td>
<td>97.8% parents reported using internet to search for 81ssess info, most familiar with public search engines 80%, least fami with child specific websites run by health professional (26.7%), 43% reported searched frequently more than one a month and some daily, used laptop 62%, desktop 53%, mobile phone 46%, tablet 43%</td>
<td>a</td>
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<tr>
<td>Yardi et al, 2018</td>
<td>Determine parents online medical info seeking behaviors about their child’s health</td>
<td>331 parents</td>
<td>survey</td>
<td>96% searched the internet prior to visit, 63% used their smartphone, most common reason for searching was to prepared questions and what to know more, 57% asked if info was reliable, 69% wanted guidance on searching, 77% and 81ssessing reliability</td>
<td>great stats on why searching and what they do with it</td>
</tr>
<tr>
<td>Abreu, 2008</td>
<td>Discusses creation of podcasts for parents of kids ent procedures</td>
<td>NA</td>
<td>how to on create a web-based educationa l tool</td>
<td>feasibility of creating web based ed without tech background</td>
<td>5</td>
</tr>
<tr>
<td>Glynn 2013</td>
<td>Assess internet use influence of iphones on health info seeking by parents/ch</td>
<td>Paper based questionn aire at ENT practice</td>
<td>501 (351 outpt, 150 day surgery)</td>
<td>29.9%consulted for ENT info- Increased online activity younger age, univ education, access to iphone p0.001). Info understandable 65.7% and helpful 57.7% , 25.5% said influenced medical decisions they made for their child. 50.3% will discuss information found online with surgeon. 9.2% doc search – 19.6% factor in choosing that surgeon. 45.2% said they would use an iPhone app regarding their child’s condition if one was available. 36.1% reported they would use the Internet in the future.</td>
<td>specific to pedi ent, but data old and changed quite a bit, not sure it’s helpful to include but impor points are inequities in internet access, also those who perused info did not always discuss with provider</td>
</tr>
</tbody>
</table>
# Appendix C

## Efficacy of TTO Treatment Options with Statistical Outcomes

<table>
<thead>
<tr>
<th>Reference</th>
<th>Study type</th>
<th>Results with statistics</th>
</tr>
</thead>
</table>
| Chee et al., 2016 | Meta-analysis (4 RCT) | - Resolution rates TAD-A vs oral abx (RR=1.35, 95% CI 1.21–1.50, p<0.001, NNTB = 4.7)  
-TAD+S vs oral abx (pooled RR = 1.59, 95% CI 1.34–1.89, p<0.001, NNTB = 3.0)  
-Microbiological eradication TAD+S vs oral abx (NNTB = 3.5, pooled RR = 1.47, p < 0.001) |
| Dohar et al., 2006 | RCT (multi-ctr) | - Cessation of TTO: TAD+S vs oral abx – median days 4 vs 7 days (P=.0006)  
- Clinical cures – TAD+S 85% vs oral abx 59% (P=0.0100) |
| Goldenblatt et al., 2006 | RCT (multi-ctr) | - Treatment failure rates- TAD(23%), NS (58%), oral antibiotic (70%)  
- Recurrence much less with TAD versus normal saline (x2=4.8254, 0.01<P<.05)  
- TAD versus oral antibiotic (x2=9.4502, p<0.001)  
- Treatment failure similar between normal saline and oral antibiotic (x2=1.6857, p>.05) |
| Heslop et al., 2006 | RCT | - Cure rate- TAD 76% vs oral abx 69%  
- TAD had greater overall eradication of pathogens vs oral abx (96% vs. 67%; P<0.001) |
| Goldenblatt et al., 2006 | RCT (prosp) | - Cessation of TTO- TAD+S vs oral abx  
- Median days 4 vs 7 days (P < .0006)  
- Clinical cures – TAD+S 85% vs oral abx 59% (P=0.0100) |
| Roland et al., 2003 | RCT (multi-ctr) | - Cessation of TTO- TAD+S vs TAD-A (mean - 4.22 vs. 5.31 days; P=0.004)  
- Better response with TAD+S on day 3 (P<.0001) and day 8 (P=.0499) |
| Roland et al., 2004 | RCT (multi-ctr) | TAD+S vs TAD-A  
- Clinical cure (90v 78%)  
- Microbiologic eradication (92 v 81.8%)  
- Treatment failures (4.4% v 14.1%)  
- Shorter median time to cessation of TTO (4v6d) |
| Ruohola et al., 2003 | RCT | Oral abx versus treatment placebo + daily suction  
- Median duration of TTO (3 vs 8days)  
- Resolution of TTO (tx-control diff 41%; 95% CI, 20%–63%; NNTT, 2.4)  
- Median duration of bacterial growth - 1 vs 8 days |
| Spektor et al., 2017 | RCT | TAD+S versus TAD alone versus Steroid drop alone  
- Median time to cessation of otorhoea  
- TAD+S-4.23 days (95% CI, 3.65–4.95 days) vs  
- TAD alone 6.95 days (95% CI, 5.66-8.20 days)  
- Steroid drop alone- not estimable findings (P < .001).  
- Clinical cure rate at the test-of-cure visit  
- TAD+S-80.6%, TAD alone-67.4%(difference,13.2%; 95%CI, 5.0%-21.4%; P = .002)  
- Steroid drop alone- 47.6% difference, 33.0% 95%CI, 24.0%-42.0%; P<.001  
- Microbiological cure rate  
- TAD+S -79.7% TAD alone-67.7% (difference,12.0%; 95%CI, 0.8%-23.0%; P=.04)  
- Steroid drop alone - 7.6% (difference, 42.1%; 95%CI, 29.3%-54.8%; P < .001) |
| Steele et al., 2017 | Meta-analysis | TAD+S are more effective than oral antibiotics - OR 5.3 (95% CI, 1.2–27)  
TAD alone is more effective than oral antibiotics - OR 3.3 (95% CI, 0.74–16)  
Probabilities that an intervention is most effective for clinical cure of TTO - TAD+S 77%, TAOD22%, oral antibiotic 1%, watchful waiting or placebo 0% |
| Van Dongen et al., 2014 | RCT | - Presence of TTO 2 weeks post treatment : TAD 5%, oral abx 44% (risk difference, -39%age points; 95% CI, -51 to -26); no treatment 55% (risk difference, -49 percentage points; 95% CI, -62 to -37)  
- Median duration of the initial episode of TTO: TAD vs oral abx- 4d v 5d (P<0.001) and observation 12d (P<0.001)  
- During 6m fu fewer children bled with drops had TTO > 4 w vs oral and observation |
| Venekamp et al., 2016 | Cochran e review (9 RCT) | TAD+S more effective than oral abx  
- By 1week- TAD 77% vs oral abx 30%; (RR- 2.58, 95% CI 1.27-5.22)  
- By 2weeks- TAD 95% vs oral abx 56%; (RR 1.70, 95% CI 1.38-2.08)  
- TAD+S (35%) vs oral abx-20%; (RR 1.76, 95% CI 1.33 to 2.31)  
- Duration of discharge- TAD +S vs oral abx- median 4 days vs 5-7days  
- Recurrence- TAD vs oral abx: 0 vs 1 episode at 6m (low-quality evidence) |

Note: TAD-A=TAD (antibiotics alone); TAD+S= TAD with antibiotics and steroids TAD= TAD antibiotics + steroids
## Appendix D

### SWOT

<table>
<thead>
<tr>
<th><strong>STRENGTHS</strong></th>
<th><strong>WEAKNESSES</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Highly respected Pediatric ENT practice for 2 decades</td>
<td>Some Caregivers will have limited access to the internet</td>
</tr>
<tr>
<td>Cohesive, experienced clinical provider group focused on EBP with excellent intercommunication</td>
<td>Diversity of languages spoken by patients - concern for non-English speakers</td>
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<tr>
<td>Strong support for PNP role within practice</td>
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<td>Regularly scheduled meetings for practice clinicians</td>
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<tr>
<td>Low turnover in support staff</td>
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<tr>
<td>Private practice with autonomy for QI projects</td>
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<tr>
<td>Clinicians take all clinical calls within the practice</td>
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<tr>
<td>Clinicians support project and agree with need</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>OPPORTUNITIES</strong></th>
<th><strong>THREATS</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>SOHN- organization invested in this work and its dissemination</td>
<td>COVID-19 impact - potential office/ OR closures</td>
</tr>
<tr>
<td>Clinical Practice Guideline for Children with TT</td>
<td>COVID-19 impact - caregiver concern for medical encounter</td>
</tr>
<tr>
<td>Wide referral base and close relationship with pediatric primary care and specialty practices throughout the state</td>
<td>Primary care providers may recommend visit versus verbal reinforcement of topical treatment due to financial gain of visit</td>
</tr>
<tr>
<td>Pedi Antibiotic Stewardship team at Yale focused on decreasing systemic antibiotic use in community - support project</td>
<td>Technical production of high-quality educational video</td>
</tr>
<tr>
<td>University IT department resources to help with video production</td>
<td></td>
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<tr>
<td>Exceptional nursing staff at Surgical facilities</td>
<td></td>
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<tr>
<td>Pediatric Community Clinician liaison for communication regarding educational resources provided in this project</td>
<td></td>
</tr>
</tbody>
</table>
Appendix E

Video Development and Script: Caring for your Child with Ear Tubes and Drainage

<table>
<thead>
<tr>
<th>Script (length- 3 minutes)</th>
<th>Graphics and Animation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ear tubes are placed in children who are getting too many ear infections, or who have fluid behind their ear drum that has not gone away on its own, and to treat associated hearing problems.</td>
<td>Enter one ear tube by itself (LARGE)</td>
</tr>
<tr>
<td></td>
<td>Ear tube with ear next to it, to scale</td>
</tr>
<tr>
<td></td>
<td>Ear infection - show ear with blinking red circle or yellow squiggles to show pain / discomfort</td>
</tr>
<tr>
<td></td>
<td>Hearing problems do three straight lines shooting out at the same time (like audio sound wave)</td>
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<tr>
<td>However, it is still possible to get an ear infection with tubes in place.</td>
<td>Show ear tube place inside of eardrum with the same animation done for ear pain</td>
</tr>
<tr>
<td>(blinking pink circle or yellow shock waves of pain)</td>
<td>NEW SCREEN</td>
</tr>
<tr>
<td>Although this may seem concerning, there is no need to worry. If the tubes are working the child usually does not experience pain or fever because the tubes are doing their job by allowing the infection to drain through the tube.</td>
<td>Exclamation points in red (use text for now??) I will illustrate</td>
</tr>
<tr>
<td></td>
<td>Just repeat animation from if the tubes are working: liquid filling middle ear - ear tube placed in, liquid draining through tube into ear canal</td>
</tr>
<tr>
<td>If it does occur, you will notice drainage or a foul odor coming from the ear canal. The drainage may appear clear, cloudy, mucousy or even bloody.</td>
<td>NEW SCREEN</td>
</tr>
<tr>
<td></td>
<td>Show drainage coming out of ear (not the full diagram) and stink clouds</td>
</tr>
<tr>
<td></td>
<td>Show 4 appearances one after the other next to each other (clear, cloudy, mucousy, bloody)</td>
</tr>
<tr>
<td>The best treatment for this kind of infection is the antibiotic ear drops that were prescribed at the time of surgery. Oral antibiotics are not recommended to treat the infection.</td>
<td>NEW SCREEN</td>
</tr>
<tr>
<td></td>
<td>Slide in ear drop bottle</td>
</tr>
<tr>
<td></td>
<td>Fade in oral antibiotic bottle then show red circle w an X in it to show antibiotics are not recommended to treat infection</td>
</tr>
<tr>
<td></td>
<td>Text: Treat with ear drops - fade away---Fade in: no oral antibiotics</td>
</tr>
<tr>
<td>YOU can identify the problem on your own and treat it with the antibiotic ear drops you have at home. Give the office a call if you need a refill.</td>
<td>NEW SCREEN</td>
</tr>
<tr>
<td></td>
<td>Magnifying glass slide in</td>
</tr>
<tr>
<td></td>
<td>Ear drop bottle slide in next to it, enlarges then shrinks back to normal size</td>
</tr>
<tr>
<td></td>
<td>NEW SCREEN</td>
</tr>
<tr>
<td></td>
<td>Show phone vibrating and straight lines coming out like it is making noise</td>
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<tr>
<td></td>
<td>Have ear drop bottle slide in again</td>
</tr>
<tr>
<td>Simply have your child lie with the draining ear facing up</td>
<td>NEW SCREEN</td>
</tr>
<tr>
<td></td>
<td>text: How to use the ear drops</td>
</tr>
<tr>
<td></td>
<td>Slide up from bottom “child head” with ear and drainage(similar placement to the table scene with ear drop bottle)</td>
</tr>
<tr>
<td>Wipe away any drainage from the ear opening. If it’s thick, tissue spear to mop it up. Simply………...</td>
<td>From top of screen, slide in “tissue” and on top of ear move tissue back and forth</td>
</tr>
<tr>
<td></td>
<td>then drainage disappears</td>
</tr>
<tr>
<td></td>
<td>Replace tissue with cotton ball and do same motion and drainage disappearing</td>
</tr>
<tr>
<td>Place 4 drops into the ear that is draining</td>
<td>Have ear drop bottle come from top, tilt toward ear, then 4 blue drops come out and</td>
</tr>
<tr>
<td></td>
<td>disappear into the ear</td>
</tr>
<tr>
<td>Then pump the magic button- the flap in front of the ear. This pushes the drops through the tube into the middle ear where the infection is coming from. Repeat in the other ear if draining too.</td>
<td>Label tragus and in parenthesis magic button</td>
</tr>
<tr>
<td></td>
<td>Have finger pushing on tragus as it moves up and down</td>
</tr>
<tr>
<td></td>
<td>Show blue liquid moving through ear canal and through the ear tube into middle ear</td>
</tr>
<tr>
<td>You will do this twice a day for 7 days.</td>
<td>NEW SCREEN</td>
</tr>
<tr>
<td></td>
<td>Text that says x2 a day and calendar image that highlights one week</td>
</tr>
<tr>
<td>Keep the ears dry until the drainage stops When the infection is gone- it is safe to get water in the ears- this includes swimming and hair washing</td>
<td>NEW SCREEN</td>
</tr>
<tr>
<td></td>
<td>Show ear with pain waves flashing (yellow) (no diagram) and water droplets next to ear with the red no sign on top of water drops</td>
</tr>
<tr>
<td></td>
<td>Show infection gone as pain bolts and no water sign stop appearing and show swim gear and bubbles next to each other representing swimming and hair washing</td>
</tr>
<tr>
<td>Action</td>
<td>Description</td>
</tr>
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</tr>
<tr>
<td>Notify your ENT specialist IF</td>
<td>- the drainage does not clear up after using the drops for 7 days&lt;br&gt;- the drainage keeps coming back after treatment&lt;br&gt;- there is significant ear pain or fever</td>
</tr>
<tr>
<td>Follow-up care with your ENT specialist is important after tube placement</td>
<td>Text: Notify ENT specialist if: Show 3 images next to each other with label&lt;br&gt;Calendar with one week highlighted and drops next to it&lt;br&gt;Drainage falling from front of ear&lt;br&gt;Ear with ear pain waves (yellow)</td>
</tr>
<tr>
<td>The first appointment should take place a few weeks after surgery, and then every 4 to 6 months until the tubes are out, and the ears are healthy.</td>
<td>Text: Follow up Care with a phone with ENT showing and a set of tubes&lt;br&gt;Picture of ear with tubes going in canal, And a calendar with days marked off, 2 other months pop out on either side and a happy face appears.</td>
</tr>
<tr>
<td>The ear tubes typically remain in place 6 to 14 months, and then fall out on their own. Many children will outgrow their ear problems during that time, although some children need them placed more than once.</td>
<td>Text: Follow up Care with a phone with ENT showing and a set of tubes&lt;br&gt;A stack of months on calendars moving through the months with an ear and tubes coming out of the canal</td>
</tr>
<tr>
<td>Tubes increase the quality of life of our patients and families. Please call if you have any questions</td>
<td>Telephone showing a call, Phone number and Website information&lt;br&gt;Credits on final screen</td>
</tr>
</tbody>
</table>

**Video Timeline and Style Board**

**Project Plan V1**

<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>Hand board&lt;br&gt;Style board&lt;br&gt;Plan time line</td>
<td></td>
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</tr>
<tr>
<td>Visual assets (drawings / images)&lt;br&gt;Edit script / audio recording&lt;br&gt;Identify keywords / phrases</td>
<td></td>
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<tr>
<td>Animations: text, transitions, frame by frame&lt;br&gt;Animation&lt;br&gt;REVISE ANIMATION&lt;br&gt;INFO CARD</td>
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</tr>
<tr>
<td>Animators use case&lt;br&gt;Define Concepts&lt;br&gt;Design idea and flow in business card</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Sample Fonts**

This video provides information about how to care for your child with ear tubes.

This video provides information about how to care for your child with ear tubes.

**Colors**

[Color swatches]
Appendix F

Text Message Script

This message is from Connecticut Pediatric Otolaryngology. We are checking in with you since your child’s ear tube placement. We look forward to seeing you at your postoperative visit on _____ in the ____ office. Reminder, if your child experiences any ear drainage (pus, blood, or mucus), start the prescribed ear drops. The following link provides directions-

https://www.youtube.com/watch?v=oWeVu5tLbEE.
Appendix G1

Pre-Intervention Survey for Caregivers of Children with Ear Tubes

Our practice is implementing new educational resources for caregivers of children with ear tubes. Please help us evaluate this process by answering the following questions. You will be asked to complete another short follow-up questionnaire on a follow-up visit.

1. Do you have any past experiences with tympanostomy tubes?   Yes___  No ___
   If yes, explain:_____________________________________________________________________

2. Do you have any past experiences with ear drainage?                 Yes ___ No ___
   If yes, explain:_____________________________________________________________________

3. Do you have experience administering ear drops?      Yes ___ No ___
   If yes, explain:_____________________________________________________________________

4. Please rate how certain you are that you can perform in the situations described below.

   *Rate your degree of confidence by recording a number from 0 to 100 using the scale given below:*

<table>
<thead>
<tr>
<th>Cannot do at all</th>
<th>Moderately can do</th>
<th>Highly certain can do</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>10</td>
<td>20</td>
</tr>
<tr>
<td>30</td>
<td>40</td>
<td>50</td>
</tr>
<tr>
<td>60</td>
<td>70</td>
<td>80</td>
</tr>
<tr>
<td>90</td>
<td>100</td>
<td>0-100</td>
</tr>
</tbody>
</table>

   a. Overall care of your child with ear tubes........................................... ______
   b. Administering antibiotic ear drops when directed by my clinician............ ______
   c. Identifying ear drainage ................................................................. ______
   d. Initiating antibiotic ear drops independently for clear ear drainage ...... ______
   e. Initiating antibiotic ear drops independently for pus-like ear drainage .... ______
   f. Initiating antibiotic ear drops independently for smelly ear drainage ...... ______
   g. Initiating antibiotic ear drops independently for bloody ear drainage ..... ______
Appendix G2

Post Intervention Survey for Caregivers of Children with Ear Tubes

Thank you for your participation in this quality improvement project; providing feedback on the resources we offer our patients- with the goal of maximizing clinical outcomes and quality care.

**Ear Tube Video**

1. Did you watch the ear tube video at the time surgery?  
   Yes___  No ___  Don’t know ___
2. Did you find the information provided in the video helpful?  
   Yes___  No ___  Somewhat ___
3. Did you refer to the video after tube placement?  
   Yes___  No ___  Don’t know ___  
   If yes, explain ______________________________________________________________
4. Do you feel the video is a helpful resource in the future?  
   Yes___  No ___  
   Please explain _____________________________________________________________

**Ear tube Instructional Pocket-card**

5. Did you receive the pocket-card at the time surgery?  
   Yes___  No ___  Don’t know ___
6. Did you find the information provided on the card helpful?  
   Yes___  No ___  Somewhat ___
7. Did you refer to the pocket-card after tube placement?  
   Yes___  No ___  Don’t know ___  
   If yes, explain ______________________________________________________________
8. Do you feel the pocket-card is a helpful resource in the future?  
   Yes___  No ___  
   Please explain _____________________________________________________________

**Post-operative text from our office**

9. Did you receive a text from our office with tube info?  
   Yes___  No ___  Don’t know ___
10. Did you find the postoperative text helpful?  
    Yes___  No ___  Don’t know ___  
    If yes, explain ______________________________________________________________
Confidence in Care

11. Please rate how certain you are that you can perform in the situations described below.

Rate your degree of confidence by recording a number from 0 to 100 using the scale given below:

<table>
<thead>
<tr>
<th></th>
<th>0</th>
<th>10</th>
<th>20</th>
<th>30</th>
<th>40</th>
<th>50</th>
<th>60</th>
<th>70</th>
<th>80</th>
<th>90</th>
<th>100</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Cannot do at all</td>
<td>Moderately can do</td>
<td>Highly certain can do</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Confidence (0-100)

a. Overall care of your child with ear tubes................................................. ____
b. Administering antibiotic ear drops when directed by my clinician ............. ____
c. Identifying ear drainage ............................................................................. ____
d. Initiating antibiotic ear drops independently for clear ear drainage ........... ____
e. Initiating antibiotic ear drops independently for pus-like ear drainage ......... ____
f. Initiating antibiotic ear drops independently for smelly ear drainage .......... ____
g. Initiating antibiotic ear drops independently for bloody ear drainage ........... ____

Clinical Questions

12. Did you administer ear drops to your child immediately following the surgery?
   Yes___ No ___ Other ______

13. Has your child had any ear drainage since the tubes were placed? Yes___ No____

If yes, answer the following questions...

14. What action did you take when you saw the ear drainage (check all that apply)
   __ Started antibiotic ear drops
   __ Referred to the tube video or pocket-card
   __ Called the ENT or pediatric office to get directions for what to do
   __ None of the above

15. Did you seek in person medical attention? Yes___ No ___
   If yes, where? (check all that apply)
   __ Pediatric office for treatment
   __ ENT office visit for treatment
   __ Walk-in/Urgent care clinic or emergency room

16. Has your child received oral antibiotics since the tubes were placed? Yes__ No___
   If yes explain______________________________________________________________
Appendix H

Chart Review Data Collection

The following information will be collected following TT placement to ensure accuracy of data. .

- Indication for tubes
- Type of tube placed
- History of tubes with clinicals
- Condition of ears at time of tube placement
- Were TAD prescribed postoperatively
- Child’s age
**Appendix I**

**Project Timeline Gantt Chart**

<table>
<thead>
<tr>
<th>TASK</th>
<th>START DATE</th>
<th>END DATE</th>
<th>PROGRESS</th>
<th>COMPLETION STATUS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Creation of TTO laminated pocket card</td>
<td>6/12/2021</td>
<td>7/12/2021</td>
<td>S</td>
<td>C</td>
</tr>
<tr>
<td>Peer review and revision of TTO laminated pocket-card</td>
<td>8/12/2021</td>
<td>9/12/2021</td>
<td>S</td>
<td>C</td>
</tr>
<tr>
<td>Plan TTO video content with expert review</td>
<td>6/12/2021</td>
<td>7/12/2021</td>
<td>S</td>
<td>C</td>
</tr>
<tr>
<td>Creation of TTO caregiver education video</td>
<td>7/12/2021</td>
<td>8/12/2021</td>
<td>S</td>
<td>C</td>
</tr>
<tr>
<td>Peer review and revision of TTO video</td>
<td>9/12/2021</td>
<td>10/12/2021</td>
<td>S</td>
<td>C</td>
</tr>
<tr>
<td>Develop Pre-intervention Survey</td>
<td>11/12/2021</td>
<td>12/12/2021</td>
<td>S</td>
<td>C</td>
</tr>
<tr>
<td>Develop Post-intervention Survey</td>
<td>12/12/2021</td>
<td>13/12/2021</td>
<td>S</td>
<td>C</td>
</tr>
<tr>
<td>Develop texting mechanism for all TT gon patients</td>
<td>1/12/2022</td>
<td>2/12/2022</td>
<td>S</td>
<td>C</td>
</tr>
<tr>
<td>Introduce and train staff at ENT practice</td>
<td>9/12/2021</td>
<td>10/12/2021</td>
<td>S-C</td>
<td>S-C</td>
</tr>
<tr>
<td>Train ENT clinicians regarding the program</td>
<td>9/12/2021</td>
<td>10/12/2021</td>
<td>S-C</td>
<td>S-C</td>
</tr>
<tr>
<td>Educate Surgical Nurses re pocket card and video</td>
<td>9/12/2021</td>
<td>10/12/2021</td>
<td>S-C</td>
<td>S-C</td>
</tr>
<tr>
<td>Train staff on sending info text with education links</td>
<td>9/12/2021</td>
<td>10/12/2021</td>
<td>S-C</td>
<td>S-C</td>
</tr>
<tr>
<td>Upload tools to practice website and internet</td>
<td>11/12/2021</td>
<td>12/12/2021</td>
<td>S-C</td>
<td>S-C</td>
</tr>
<tr>
<td>IRB approval: deemed QI project: waived</td>
<td>6/12/2021</td>
<td>7/12/2021</td>
<td>S-C</td>
<td>S-C</td>
</tr>
<tr>
<td>Implement educational video, pocket</td>
<td>9/12/2021</td>
<td>10/12/2021</td>
<td>S</td>
<td>C</td>
</tr>
<tr>
<td>Send text to TT patients within 1 week of TT placement</td>
<td>9/12/2021</td>
<td>10/12/2021</td>
<td>S</td>
<td>C</td>
</tr>
<tr>
<td>Data Collection (Pre-Intervention survey)</td>
<td>11/12/2021</td>
<td>12/12/2021</td>
<td>S</td>
<td>C</td>
</tr>
<tr>
<td>Data Collection (Post-Intervention survey)</td>
<td>11/12/2021</td>
<td>12/12/2021</td>
<td>S</td>
<td>C</td>
</tr>
<tr>
<td>Data Analysis</td>
<td>1/12/2022</td>
<td>2/12/2022</td>
<td>S</td>
<td></td>
</tr>
</tbody>
</table>
Appendix J

Stakeholder Analysis

Stakeholder Engagement Plan

<table>
<thead>
<tr>
<th>Title</th>
<th>Power/Interest</th>
<th>Project Engagement</th>
<th>Involvement and Strategies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consumer</td>
<td>2/1</td>
<td>AD</td>
<td>Continual feedback from patients and families- Communication with Caregivers at every patient encounter, sharing of resources and eliciting feedback</td>
</tr>
<tr>
<td>Project Lead Practice APRN</td>
<td>1/1</td>
<td>ABC</td>
<td>Project Lead</td>
</tr>
<tr>
<td>Sponsor Practice owner Pedi ENT</td>
<td>1/1</td>
<td>ABD</td>
<td>Very supportive of the project, serves as clinical expert, Bi-monthly meetings in planning phase, involvement in review of tools, consultation for dissemination, scalability, and sustainability</td>
</tr>
<tr>
<td>PNP Practice Clinician</td>
<td>2/1</td>
<td>AB</td>
<td>Instrumental in implementation with families, highly supportive of project, great feedback-Monthly updates on project development &amp; progress during academic meetings. Involvement in review of tools.</td>
</tr>
<tr>
<td>Pedi ENT Practice Clinician</td>
<td>2/1</td>
<td>AB</td>
<td>Instrumental in implementation with families, highly supportive of project, great feedback-Monthly updates on project development &amp; progress during academic meetings. Involved in tool review. Interest in antibiotic profiles for community- key to the project.</td>
</tr>
<tr>
<td>Office Manager</td>
<td>3/3</td>
<td>D</td>
<td>Manages staff overall which is vital role to clearly communicate expectations with staff. Weekly check-ins regarding project prior to and during implementation to ensure staff competence. Managed staff appointment and monitoring of text reminder.</td>
</tr>
<tr>
<td>Telephone triage Nurse</td>
<td>2/2</td>
<td>A</td>
<td>Instrumental in directing families to resources as she manages all clinical calls and post op calls. Excellent communicator and educator with families, happy to reference resources. Weekly check in regarding the calls she has had re TTO. Involvement in tool reviews</td>
</tr>
<tr>
<td>Nurse Manager Surgery Centers</td>
<td>2/2</td>
<td>D</td>
<td>Manages PACU RNs- Initial training regarding new educational resources, then bimonthly check-ins</td>
</tr>
<tr>
<td>Community Pedi Liaison</td>
<td>3/2</td>
<td>D</td>
<td>Communication regarding the new educational resources- disseminate to community providers</td>
</tr>
<tr>
<td>SOHN liaison</td>
<td>3/1</td>
<td>AB</td>
<td>Involvement in peer review of educational resources, presentation of outcomes</td>
</tr>
</tbody>
</table>

*Note: 1-High; 2- Intermediate; 3- Low, a-Supportive, b-Expert, c-Leading, d-Administrative, e-Dependent*
Stakeholder Analysis Context Diagram (The Bigger Picture)

# Appendix K

## Budget

<table>
<thead>
<tr>
<th>PROGRAM EXPENSES</th>
<th>PROJECTED COST</th>
<th>ACTUAL COST</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phase 1: TT Educational Program development</td>
<td>$4,000</td>
<td>$594.80</td>
</tr>
<tr>
<td>Video, animation and graphic design</td>
<td>$3,000</td>
<td>$500</td>
</tr>
<tr>
<td>Voice recording of script</td>
<td>$100</td>
<td>$0</td>
</tr>
<tr>
<td>Sound booth for recording video script</td>
<td>$800</td>
<td>in Kind</td>
</tr>
<tr>
<td>Printing of TT otorhea pocket card</td>
<td>$100</td>
<td>$94.80</td>
</tr>
<tr>
<td>Phase 2: Project Implementation Training</td>
<td>$1,812.15</td>
<td>$0</td>
</tr>
<tr>
<td>Staff training</td>
<td>$281</td>
<td>in Kind</td>
</tr>
<tr>
<td>Provider training</td>
<td>$950</td>
<td>in Kind</td>
</tr>
<tr>
<td>Surgery Center RN training</td>
<td>$216.70</td>
<td>in Kind</td>
</tr>
<tr>
<td>Children’s Hospital RN training</td>
<td>$364.45</td>
<td>in Kind</td>
</tr>
<tr>
<td>Phase 3: Project Implementation</td>
<td>$1,907</td>
<td>$9</td>
</tr>
<tr>
<td>Postoperative education (video/pocketcard)</td>
<td>$1,100</td>
<td>in Kind</td>
</tr>
<tr>
<td>iPad access</td>
<td>$35</td>
<td>Available</td>
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<tr>
<td>Printing surveys</td>
<td>$9</td>
<td>$9</td>
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<tr>
<td>Staff time with surveys and text</td>
<td>$170</td>
<td>Job Role</td>
</tr>
<tr>
<td>Data Analysis Statistician</td>
<td>$120</td>
<td>in Kind</td>
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<tr>
<td>Reinforcement of project with staff</td>
<td>$85</td>
<td>in Kind</td>
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<tr>
<td>Reinforcement of project with providers</td>
<td>$388</td>
<td>in Kind</td>
</tr>
<tr>
<td>Building utilization (3 practice sites and 2 surgical sites)</td>
<td>$0</td>
<td>$0</td>
</tr>
<tr>
<td><strong>TOTAL EXPENSE</strong></td>
<td><strong>$3,719.15</strong></td>
<td><strong>$603.80</strong></td>
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