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Food allergies birth through age 5 and nutrition

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by

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An Independent Study

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PERMISSION

Food allergies birth through age 5 and nutrition

Department Nursing

Degree Masters of Science

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Karen Semmens

Faculty Advisor

Introduction

Food is a basic need, essential to our survival, and is linked to our social settings. The variety of food choices available to society, it is no surprise that food allergies have increased over the years. According to a study released in 2013 by the Centers for Disease Control and Prevention, food allergies among children increased approximately 50% between 1997 and 2011 (Food Allergy Research & Education, 2013). According to FARE (2013), researchers estimate that up to 15 million Americans have food allergies. A detailed survey of families with at least one child younger than 18 (38,000 children), showed that 8% of children under age 18 are allergic to at least one food (Goodman, 2011). A severe reaction is of concern following consumption of the food allergen in children. This potentially deadly ailment affects 1 in every 13 children (under 18 years of age) in the U.S.; that is roughly two children with a food allergy in every classroom (FARE, 2013).

The study by Goodman (2011) discusses the severe reactions children exhibit with severe food allergies. Goodman estimated that approximately 40% of children with food allergies experience severe symptoms such as wheezing and anaphylaxis, which is characterized by difficulty breathing and a sudden drop in blood pressure. The study also found that food allergies were highest in preschoolers, peaking between three to five years of age. This is an age where they may not be able to communicate their symptoms or how they are feeling.

Food allergies can develop at any age and are non-discriminatory (FARE, 2013). Food allergies may occur after exposure to a food at least once. An allergic reaction can vary from mild to severe. The symptoms may get worse with repeated exposure to the allergen (Burke, 2012). Anaphylaxis is the result of a severe and sudden allergic reaction that can develop in seconds. In order for a food allergy reaction to occur, the body then recognizes it as a foreign

object and begins to attack itself. The allergic response begins; the IgE antibodies react with the food and histamine is released. Once the histamine is released, the person begins to have a reaction. The reaction can be hives, asthma like symptoms, itching in the mouth, trouble breathing, stomach pains, vomiting and/or diarrhea (Children's Hospital of Wisconsin, 2013).

Allergies can develop at any time and research has shown that every three minutes, a food allergy reaction sends someone to the emergency department – that is more than 200,000 emergency department visits per year (FARE, 2013). The cost of children's food allergies alone is nearly $25 billion per year (FARE, 2013). The cost includes medical bills, loss of work time, medications, and special food. A child with food allergies is at risk of dying on a daily basis and parents may live in fear of sending their child out into the world without supervising the child's food choices.

The best treatment for food allergies is avoiding foods that cause the event; however, there is no cure at this time (ACAAI, 2010). Epinephrine is the treatment medication for an anaphylactic reaction. If the person administers epinephrine to themselves, it is important to contact emergency transport or proceed to an emergency department. Because of the high risk of food allergies, everyone should understand how to administer epinephrine; and because of the danger for children, every school should have epinephrine available for emergency uses.

The literature review will attempt to determine what is available today for people and families living with food allergies. The review will include how food allergies can be prevented; and if there is a way to minimize the number of people developing food allergies, treatment options, as well as the psychosocial impact.

Purpose

It is important to diagnose food allergies early to help people safely live with a food allergy as well as helping to prevent the development of any additional allergies or experience an anaphylactic reaction. Nurses need to recognize the signs and symptoms of food allergies and provide education. Providing parents and the patient with allergy tips and tools on how to manage their food allergies and providing available resources is helpful. One of the first educational items is to recognize symptoms. The first time a person with a food allergy is exposed to the food, no symptoms occur; but the first exposure primes the body to respond the next time (NIAID, 2010). Symptoms usually present themselves by the third introduction. Symptoms include some or all of the following: itching in the mouth, swelling of lips and tongue, GI symptoms, such as vomiting, diarrhea, abdominal cramps and pain, hives, worsening of eczema, tightening of the throat or trouble breathing, and a drop in blood pressure (NIAID, 2010). Providing comfort to families and support or at least recognition is reassuring to parents.

After the review of literature, a power point presentation was presented to educate co-workers at a rural public health organization. The participants included two social workers and 23 public health Registered Nurses. The power point included the definition of a food allergy, what causes a reaction, when a reaction can happen, most common allergens, signs and symptoms, impact of breastfeeding and complementary food introduction, nursing implications and treatment options.

Following the power point presentation, the ultimate goal is that co-workers will be knowledgeable and empowered to recognize, provide evidence-based education and support families who are encountering food allergy reactions. The information will allow nurses to assist

in improving and possibly preventing food allergies in infants and children, educate and help guide them through the new diagnosis.

Significance

According to NIAID (2010), almost one in 20 young children under the age of five years are allergic to at least one food while other studies such as FARE (2013), states one in 13 children have a food allergy. In either case, there are a large percentage of children with food allergies. In infants and children, the most common foods that cause allergic reactions are: egg, milk, peanut, tree nuts, soy (primarily in infants), and wheat (NIAID, 2010). Peanut and tree nut allergies are rarely outgrown but children can grow out of milk, soy and egg allergies. When a person in a family has a food allergy, the whole family is affected (NIAID, 2010). All meals have to be thought out, including holidays, birthday parties, play dates, eating out, and preschools snacks or lunches. The allergy may be so severe that they cannot be in the same room as the allergen, especially peanuts. A peanut butter and jelly sandwich, which is a staple food for many kids, can lead to an anaphylactic reaction for the child with an allergy. The oils from peanut butter do not go away with using hand sanitizer, only with handwashing. School playground equipment or preschool toys can become involved.

For babies, health experts recommend that mothers feed their babies only breastmilk for the first 4 months of life because of the health benefits of breastfeeding (NIAID, 2010). Introduction of solids should be avoided until 4-6 months of age. There is no conclusive evidence to suggest that you should delay the introduction of the most common potentially allergenic foods beyond 4 to 6 months (NIAID, 2010).

For those babies who develop a food allergy to milk or soy may have these symptoms: a) colic; b) blood in the child's stool; and c) poor growth (Children's Hospital Wisconsin, 2013).

To identify if a baby who has the above symptoms has a food allergy, it is recommended that the infant have a radioallergosorbent test (RAST) test or skin prick test (SPT) performed to test for common allergens. Recommendations are to eliminate the allergen food from the infant's diet if the testing comes out positive. For those infants allergic to milk or soy there are other milk alternatives such as hypoallergenic formulas and soy-based formulas. Soy formulas are fortified to be nutritionally complete; however, unfortunately, some children with a milk allergy also develop an allergy to soy (Mayo Clinic, 2011). It may depend on the severity of symptoms the infant is experiencing or the family history. The goal of treatment is to avoid the foods that cause the symptoms (Children's Hospital Wisconsin, 2013). Food allergies cannot be prevented but can be delayed by following these recommendations: a) breastfeed the infant for the first 6 months; b) avoid solid foods until the infant is 6 months or older; c) avoid cow's milk, wheat, eggs, peanuts, and fish during the child's first year of life (Children's Hospital Wisconsin, 2013).

Timing of when a food is introduced may be associated with the development of food allergies. Food passes through human milk when breastfeeding but is usually in small amounts. It is the first introductions of foods that trigger an allergic response. According to Motala and Fiocchi (2012), the incidence of cow's milk allergies is lower in exclusively breast-fed infants compared to formula-fed or mixed-fed infants, and clinical reactions in the breast-fed group are mostly mild to moderate. Breastfeeding is found to be beneficial in many ways but with the prevention of allergies, it is still controversial with the majority of researchers saying that breastfeeding has not been found to be involved with the prevention of food allergies. Future changes in how and when complementary foods are introduced can impact the outcome of the development of food allergies.

Psychosocial factors affect the child and family when they suffer from food allergies. Food allergy (FA) has been found to be related to high levels of stress and anxiety, particularly in mothers (Knibb & Semper, 2013). FA accounts for a large number of clinical presentations, having a great impact on the quality of life of the affected individuals: Daily activities of patients and their families become limited, and both experience anxiety about eating, behavioral changes, social restrictions, a poorer perception of healthiness and even post-traumatic stress if they have experienced serious complications of their disease such as anaphylactic shock (Cortes, Castillo, & Schiaraffia, 2013). The emotional impact on families can lead to a limited quality of life. Anxiety and stress on the family and the child or teen plays a role in their socialization. Suspected food allergies impact the lifestyle of the family. Parents need to check food labels, encounter difficulties in eating in restaurants, or taking their child to parties. Food allergies can also impact the parent's place of employment due to taking time off for illness and appointments (Knibb & Semper, 2013). Constant fear of accidental ingestion and anaphylaxis limits everyday activities and imposes stress, uncertainty, and heightened anxiety in patients and their families (Kostadinova, Willemsen, Knippels, & Garssen, 2013). Some studies suggest that stress control (in case of atopic eczema), control of depression/anxiety (in asthma) and social interaction improve control of the underlying allergic pathology, thus preventing exacerbations (Cortes et al., 2013). If a person is not healthy mentally, the immune system is impacted making them vulnerable to developing allergies or having a food allergy reaction.

Theoretical Framework

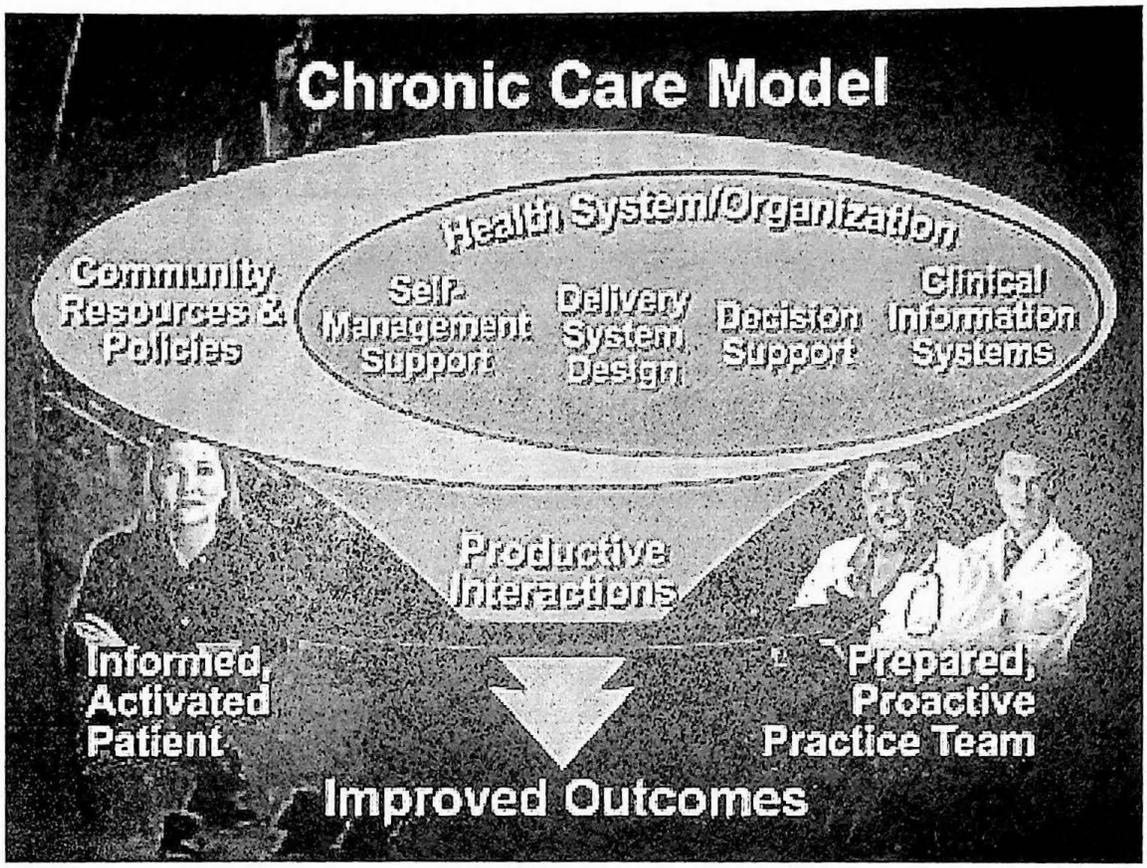

Figure 1: Chronic care Model

The Chronic Care Model (CCM) includes any condition that requires ongoing adjustments by the affected person and interactions with the health care system (Improving Chronic Illness, 2014). The CCM consists of 6 distinct concepts identified as modifiable components of healthcare delivery: organizational support, clinical information systems, delivery system design, decision support, self-management support, and community resources (Fiandt, 2006). Concepts of the model can be used separately or as a whole. A critical component of the CCM model is self-management support, emphasizing the need for patient-centered intervention (Fiandt, 2006).

The health system/organization concept involves improving the health care of patients while utilizing evidence based practice (EBP) and quality improvements. Prevention within this

component may include incentives for patients to entice them to adhere to their care plan (Glasgow, Orleans, Wagner, Curry & Solberg, 2001).

Delivery system design involves interventions that enhance the team approach and care. A hallmark of effective chronic-care illness care is follow up (Glasgow et al., 2001). The standard care in food allergy is nutritional counseling, elimination diets, and educating patients to self-adminitster epinephrine upon accidental exposure (Kostadinova, Willemsen, Knippels, & Garssen, 2013). Immunotherapy has a positive impact on the treatment of food allergies. Sublingual immunotherapy (SLIT) may offer a safe and effective administration route and has a positive influence on tolerance, compliance, and adherence of patients to treatment (Queiros et al. 2013). SLIT is less invasive as the subcutaneous route of immunotherapy and has little to no reactions. Despite some SCIT clinical efficacy the rate of system adverse reaction to the therapy was unfavorably high (Kostadinova et al., 2013). Allergen-specific immunotherapy (SIT) is the most potential curative approach at the moment, but it is still at an experimental level for food-allergic diseases (Kostadinova et al., 2013). SIT induces tolerance by slowly increasing the dose overtime. Oral immunotherapy (OIT) is gaining research attention due to the side effects from subcutaneous immunotherapy (SCIT). In OIT, patients are given gradually increasing amounts of powdered food protein mixed with a food vehicle (e.g., apple sauce) during the build-up phase until a target dose is achieved (Kostadinova et al., 2013). OIT has shown some success with cow's milk and peanut allergy in developing tolerance, however further research is needed on the permanency of tolerance and maintenance dose. Kosotadinova et al. (2013) study found that SLIT followed by OIT is more effective in desensitizing patients, but was more often associated with multisystem adverse reactions needing treatment than SLIT subjects.

Clinical information systems need to provide timely information about individual patients with chronic conditions in order to be effective (Glasgow et al., 2001). Keeping the patient informed about new prevention measures or treatment options should be priority. User friendly information systems can also aggregate data by provider or clinic relative to others in the system or to quality-improvement goals (Glasgow et al., 2001). The electronic charting can allow streamlined care for patients. It allows the providers to communicate and have access to the chart.

Effective decision support for chronic-illness management programs relies on the knowledge of the providers to provide optimal care for the patient (Glasgow et al., 2001). The care management team should follow chronic care and prevention guidelines and provide collaborative care and support for the patient.

Self-management support looks at how well the patient and family dealing with the chronic illness and the emotional impact it has taken on them. The availability of appropriately tailored education resources, skills, training, and psychosocial support are key CCM elements (Glasgow et al., 2001). Prevention care includes developing lifestyle modifications such as change in diet, avoidance of foods, understanding how to administer the epi pen, allergy signs and symptoms, and allergy awareness. Identification of potential barriers, providing support and strategies are necessary components of self- management prevention.

Community resources component involves determining what is available to the patient and family in the community they live. This may include support groups, food assistance programs, and support from schools or other programs. If the environment they are involved in is supportive, they are more likely to adhere to their treatment plan and prevent unhealthy behaviors. Policies may need to be put in place in order for prevention to be effective.

In order for the model to be effective, the interactions between the patient and family with the collaborative medical team need to be informed, prepared and engaged. Advocating for yourself or your children is necessary. A primary care physician needs to refer the patient to an allergist, dietician and counseling. Knowledge is power, for the patient and practitioner.

Definitions

Allergen- a substance that causes an allergic reaction (Burke, 2012).

Anaphylaxis- a severe reaction that involves more than one organ system, can begin very rapidly, and cause death (NIAID, 2012).

ELISA- enzyme-linked immunosorbent assay- test components of the immune system and chemicals to detect immune responses in the body (MedicineNet.com, 2014).

Epinephrine- a hormone, also called adrenaline that works rapidly to contract blood vessels, preventing them from leaking fluid; relaxes airways, relieves cramping in the gastrointestinal tract, decreases swelling, and blocks itching and hives (NIAID, 2012).

Food allergy- an abnormal response to a food trigger by the body's immune system (NIAID, 2012).

ImmunoCAP- immunoassay capture test to rule out atopy in patients with allergy-like symptoms; accurately identifies specific allergen sensitivities (QuestDiagnostics, 2014).

Oral food challenge (OFC) – professional gives the individual doses of various foods, some of which are suspected of starting an allergic reaction (NIAID, 2012).

Oral immunotherapy (OIT) – an experimental desensitization treatment for food allergy; extremely small amounts of an allergen are gradually given in increasing dosages until a tolerance develops (AllergySafeCommunity.ca, 2010).

Oral tolerance – antigen-specific tolerance induced in the periphery within the gut-associated lymphoid tissues (GALT) (Tang & Martino, 2013).

Skin Prick Test (SPT) - places a drop of solution containing a possible allergen on the forearm or back and a series of scratches or needle pricks allows the solution to enter the skin. >3mm wheal is a positive reaction (Toit et al., 2009).

RAST – radioallergosobent testing; blood test that can measure your immune system's response to a specific allergen by measuring the amount of allergy-causing antibodies in your bloodstream, also known as immunoglobulin E (IgE) antibodies (Mayo Clinic, 2013).

Subcutaneous immunotherapy (SCIT) – series of injections of purified allergen extracts usually given over a period of a few years (Mayo Clinic, 2013).

Sublingual immunotherapy (SLIT)- small amount of concentrated liquid allergen extract administered under the tongue, kept her for a certain time period and then spit or swallowed (Kostadinova et al., 2013).

Process

The first search engine was Google Scholar. The key terms used was "children with food allergies" resulted four articles, "infants with food allergies" resulted four articles, "treatment of food allergies" resulted five articles, "breastfeeding and food allergies" resulted six articles, "delay of infant foods and allergies" resulted five articles, and "sublingual immunotherapy" resulted 11 articles. Abstracts were reviewed and five articles were relevant. Harley E. French Library was used to obtain the full text of the articles. PubMed was searched using key terms: food allergies, allergen immunotherapy, breastfeeding and allergies. Limiters were English only and the past 10 years. There were 15 relevant articles found and after thorough review, five articles pertained to the study.

Review of Literature

IgE- mediated food allergy in children

The prognosis for food allergies was historically more positive than it is in the past few years. In an article by Longo, Berti, Burks, Kruass, & Barbi (2013), it was identified that food allergies have become more persistent over the years for milk, egg and wheat. Allergies to peanuts and tree nuts are typically associated with fatal episodes of anaphylaxis; as well as shellfish allergies.

Food allergy diagnosis begins with conducting a thorough medical history, physical examination, and antigen specific IgE through skin prick test (SPT) or immunoassay and/or a positive food challenge. Once a food allergy diagnosis has been determined, treating the allergy can be a challenge.

Treatment options vary according to the type of allergy. Some of the treatments available are: 1) antihistamines for non-severe allergic reactions; 2) epinephrine for acute severe systemic allergic reactions such as anaphylaxis; and 3) use of oral immunotherapy to assist in desensitization to egg products. There has been some controversy of delaying the introduction of foods in preventing food allergies; however, the optimal window period of food introduction is between three to four months and six to seven months of age. Breastfeeding beyond four months of age did not prove to be beneficial in the prevention of food allergies (Longo et al. 2013).

Naturally, avoidance of the allergen is the best treatment; however, that is not always possible (Longo et al, 2013). Avoidance of foods can lead to nutritional deficiencies; a dietician consult should be completed. Oral food challenge is the gold standard for diagnosis but it also puts the subject at risk for a reaction so the SPT or IgE-mediated immunoassay is used more frequently. Oral immunotherapy has shown to be effective but remains experimental.

A limitation of the study is the possibility of publication bias. Further research is needed to understand food avoidance and the effect of specific food allergies on rates of remission (Longo et al., 2013). More studies on infant formulas, treatment modalities and impact on families along with patient and family education is needed to determine the effect on the incidence of food allergies.

The diagnosis of IgE-mediated food allergy in childhood

A retrospective study of took place in London, UK which included three cases of children, ages nine months to four years of age. The children were evaluated to determine family history, dietary history, risk factors, diagnosis, and risk of future reactions. Specific factors assessed in the allergy history was suspected food that caused a reaction, timing of complementary food introduction, symptoms, route, severity, prior history to the suspected food, cross-reactions, associated factors such as asthma, eczema, and exercise.

IgE-mediated food allergies are most common during early childhood (Toit et al., 2009). One allergy often leads to another or there can be a cross-reaction. Cross-reactivity is when the body recognizes the food as the allergen due to its similarity in IgE antibodies such as apples and birch trees. Eczema may be the first sign of a FA and is strongly associated with the development of food allergy (Toit et al., 2009). Eczema is due to the rise in the total IgE levels which can limit the diagnosis or overestimate the diagnosis. Confirmation of an allergy is important in order for treatment and management to be incorporated into their life. The diagnosis of food allergy relies on a combination of clinical history, physical examination, use of validated allergy tests SPT and/or serum-specific IgE (sIgE) – and oral food challenges (OFC) (Toit et al., 2009).

Oral food challenges (OFC) remain the gold standard for the diagnosis of food allergy, they are time consuming and without risk (Toit et al., 2009). Determination of what the child can

tolerate and how much is important in the history. Also, asking if any type of foods in the air bother them such as odors or vapor fumes from cooking fish. Family history of food allergies increases the child's risk of developing food allergies.

A definitive diagnosis is not always reached which leads to an oral food challenge (OFC). OFC has to be conducted in a medical facility under the supervision of an allergist. During the OFC, the allergist feeds the person the suspect food in measured doses, starting with very small amounts and increased over a period of time while watching for signs of a reaction (FARE, 2013).

Allergy testing needs to be repeated to determine if they are improving, this can be done by sIgE or SPT, or both. If the child is tolerating the food, it is important to keep that food in their diet. The severity of future reactions will be worse each time the child is in contact with the food. Some allergies children can outgrow. It has been found that allergies to cow's milk and eggs carry the best prognosis (Toit et al., 2009).

Diagnosis of FA can be difficult. Other predictor's of an allergy that may help in the diagnosis is IgE epitope mapping which was not included in the study. Future studies are needed to validate this hypothesis. It is important to have an awareness of co-existing diseases such as family history, siblings, eczema and/or asthma.

Probiotics in primary prevention of allergic disease-follow-up at 8-9 years of age

Probiotics are bacteria that help maintain the natural balance of organisms (microflora) in the intestines and promote a healthy digestive system (WebMD, 2014). Lactobacillus paracasei F19 is an emerging probiotic strain that shows considerable promise for use in functional foods for intestinal health (Crittenden et al., 2002). Probiotic *Lactobacillus paracasei* ssp *paracasei* F19 (LF19) use during weaning with eczema, prevention of asthma, and food hypersensitivity

did not show to be a successful prevention intervention for allergic disease. A baby's gut is sterile until born so what is introduced postnatal is important. The gut-associated lymphoid tissues (GALT) accounts for about 70% of the immune system (West, Hammarstrom, and Hernell, 2013). The gut immune system microbiota is related to the optimum time of when to introduce foods to infants.

In Umea, Sweden in 2000-2003 with 179 healthy, term infants with no prior allergic manifestations were randomized to daily intake of infant cereals with (n-89) or without (n-90) addition of LF19 1 x 10 to the 8^{th} power CFU per serving from 4-13 months of age. Assessments were completed on the children including inspection, SPT, and spirometry. Diagnoses were based on information from clinical assessment, questionnaires, and medical records. To determine the LF19 in the body, stool samples were evaluated. A follow-up was conducted during 2009-2011 when the children were eight to nine years old using the same assessments indicated above (West et al., 2013).

The preventative effect of LF19 on infant eczema was not sustained at school age, and there was no long-term benefit on any diagnosed allergic or IgE-associated allergic disease nor was there any effect on respiratory allergic disease or lung function measures.
A limitation was a loss to follow-up with reassessment of 70% of the original study population due to participant withdrawal for various reasons, which may have biased the results (West et al., 2013).

Developmental pathways in food allergy: a new theoretical framework

Younger children are dependent on their parents to make decisions for them and are more accepting to their FA. As the child grows, so does their independence. DunnGalvin, Gaffney, & Hourihane (2009) identified that once the child turned eight, the children often did not share their

FA with peers due to embarrassment; this may lead the older child to be more specific when choosing friends. Although most children had friends who were supportive, 40% of children described incidences where they were teased, and 20% related incidents of bullying. Lack of education regarding food allergies played a role in how people reacted. Food allergies impact children's emotions, behaviors, and cognition in various stages of their life. A chronic condition may affect and/or interact with already existing normative demands and changes in socialization Parents are a safety net for the young but as they gain autonomy and the parents attempt to let go, stress, anxiety, and fear affects the children with FA (DunnGalvin et al., 2009).

A prospective study conducted by Dunn Lavin et al, 2009) involved children, ages six to fifteen, all suffered from a FA and had an epicene. Vignettes of hypothetical stories were developed from focused groups of parents and members of the Irish Anaphylaxis Campaign, and used when they interviewed the children/teenagers. All transcripts from the vignettes were audio taped, transcribed and then coded using grounded theory, a qualitative data analysis methodology particularly suited to exploratory research (DunnGalvin et al., 2009). Six key themes emerged from the analysis: 'meanings of food'; 'autonomy'; 'control and self efficacy'; peer relationships'; 'risk and safety'; self/identity'; and 'coping strategies' (DunnGalvin et al., 2009, pp. 560).

Each milestone or transition in a child's life can be positive or negative depending on their environment and how their parents react. Coping is more than simply a strategy it is a cumulative history of interactive processes (both age- and disease-specific) that are embedded in a child's developmental organization (DunnGalvin et al., 2009). Coping strategies found to be used by the children and teens were: avoidant strategies 40%, minimization strategies 30%, and

adaptive strategies 30% of the time. The plan of care should recognize the psychosocial aspects, build off of their strengths and include their struggles to help them develop new strategies.

DunnGalvin et al. (2009) study was the first attempt to provide an integrated developmental framework to explain the onset, development and maintenance of FA related to cognitions, emotions, and behavior. Further studies need to be done with the framework developed to determine if the results can be verified.

Impact of suspected food allergy on emotional distress and family life of parent prior to allergy diagnosis

The quality of life can diminish with children and families living with food allergies. One hundred and twenty parents visited an allergy clinic for the first time to have their child assessed for possible food allergies. The study conducted by Knibb & Semper (2013) was to determine the anxiety and depression level associated with food allergies. The Hospital Anxiety and Depression Scale (HADS) was the assessment tool utilized in this study. The HADS is in questionnaire format; the first questionnaire was completed in the clinic and again at four to six weeks in the participant's home. The HADS is measured on a Liker scale 0-21. Data analysis was done using SPSS version 18 (SPSS Inc. Chicago, IL, USA) (Knibb & Semper, 2013). Majority of respondents were mothers at 80%. The ages of the children ranged from five months to 16 years of age with a mean age of five and a half years. The knowledge level increased after the clinic visit. Anxiety and depression levels were evident before and after the clinic visit (Knibb & Semper, 2013).

There were no significant relationships between anxiety and depression levels and self-reported knowledge levels, number of dietary or lifestyle changes, age of child, time to referral or length of time parent suspected a food allergy in their child (all $p>0.05$) (Knibb & Semper,

2013). Due to the majority of parents putting their child on an elimination diet, with or without the advice or test results, could have impacted the tests along with anxiety levels. Diet elimination can impact the nutritional intake for a child so choosing this type of diet can cause nutritional deficits for the child in the future. Only a third of parents talked to a dietician in this sample. Knowledge and vigilance were not related to greater anxiety. Over a third of parents suffered from some level of anxiety prior to the clinic visit and almost a fifth suffered from depression. Even after the clinic visit and diagnosis, the levels did not significantly decrease (Knibb & Semper, 2013).

One of the limitations of the study was the response rate for the follow-up was smaller and the follow-up period may have been too short. It may have been beneficial for double-blind food challenges to have taken place to confirm food allergy. Longitudinal studies are needed to follow parents over time to ascertain whether food allergy causes anxiety and depression or possibly exacerbates levels of anxiety and depression already present in the parent (Knibb & Semper, 2013). Education on the psychological effects food allergies versus just the confirmation of food allergies would be beneficial for families along with studies to determine if it was helpful or not.

Development of the scale of psychosocial factors in food allergy (SPS-FA)

Food allergies (FA) affect a person's psychological well-being and possibly decrease immune system even further. Management of anxiety, stress, and depression can help decrease the amount of exacerbations and illnesses. A prospective study was completed in Chile to determine the impact psychosocial factors on patients and their caregivers living with FA. A preliminary 28-item scale was generated (Cortes et al., 2013). The 99 participants had a

confirmed FA diagnosis. The allergies included were the four most commonly found in our population: milk, egg, nuts and soy (Cortes et al., 2013).

The Psychosocial Factors in Food Allergies Scale (SPS-FA) is proposed as a tool capable of providing the clinician and the researcher with key information to estimate the interaction between psychosocial factors and the progress of FA in the patient-caregiver dyad (Cortes et al., 2013). The final version of the SPS-FA consists of nine items distributed into three factors: quality of life, crisis and social impact (Cortes et al., 2013). Results showed that allergy symptoms correlated with psychosocial factors. Depression, anxiety and decreased quality of life were higher in those who suffer from FA.

SPS-FA was the first scale developed that focuses on the dyad care-child (Cortes et al., 2013). This is an easy tool to incorporate into the clinical care of patients with FA. Several studies suggest that stress control in case of atopic eczema, control of depression/anxiety (in asthma and social interaction improve control of underlying allergic pathology, thus preventing exacerbations (Cortes et al., 2013). Again, this goes to show that stress can elevate the immune system and cause further damage and disease for patients.

Food allergy and anaphylaxis in pediatrics

Family history is known and proven risk factor for developing food allergies. Determining why and if any prevention measures can be done would be beneficial. According to Santos & Lack (2012) risk factors for a child to develop allergies were family history, low birth order (boys and first born), season of birth (autumn and winter) and severe atopic eczema. Children with one food allergy are more likely to develop more allergies.

As found in Toit et al. (2009) study, OFC is the most accurate way to diagnosis a food allergy. However, OFC is stressful for the patient and family as it involves the risk of developing

an allergic reaction that can potentially be severe (Santos & Lack, 2012). Skin prick test (SPT) and serum sIgE cutoff levels need to be determined to limit the amount of false positives. Elimination diets leave children at risk for nutritional deficits. Nutritional assessment is essential in the follow-up of these children (Santos & Lack, 2012).

Further training needs to be done due to lack of reporting allergy episodes, recognition of symptoms, and action plans/treatment. Anaphylaxis education and training is needed to public health staff as well as school nurses.

Breastfeeding, asthma, and allergy

Breastfeeding has substantial benefits for the infant, especially with asthma, but prevention of allergies may not be one of them. The longer duration of breastfeeding has protective effects against asthma and may have adverse effects on the risk of food sensitization (Brew et al., 2012).

A historical cohort, retrospective study was completed with children from Sydney, Australia and Stockholm, Sweden. Childhood Asthma Prevention Study (CAPS) was a randomized controlled trial completed with children whose parent(s) or sibling had wheezing or asthma prior to the child's birth (Brew et al., 2012). Barn Allergy Milo Stockhom Epidemiology (BAMSE) was an observational cohort study that found the longer duration of breastfeeding was protective against the development of asthma and allergen sensitization at four and eight years of age (Brew et al., 2012). Exclusively breastfeeding duration was longer in the BAMSE at 81.2% and lower in the CAPS at 33.9%. The CAPS group had higher rates of wheezing, asthma, and sensitization to local inhaled allergens, whereas the BAMSE subjects had significantly higher rates of sensitization to ingested allergens (Brew et al., 2012). No significant impact on breastfeeding and the outcome of asthma between the two groups at age four or five.

Breastfeeding greater than or equal to three months did lessen the risk for asthma at age 8 in the CAPS study. Fully breastfeeding less than three months and risk of sensitization to ingested allergens results contradicted each other, CAPS had an increased risk and BAMSE had a decreased risk. Allergen symptoms decreased the time the mother breastfed.

Maternal diet during pregnancy and allergic sensitization in the offspring by age 5

Mother's diet may affect the infant's likelihood of developing food or inhalant allergies up to age five. Total fruit and citrus foods while pregnant increased the likelihood of inhalant allergies whereas Vitamin D intake during pregnancy decreased the sensitization to food allergens. Citrus foods and fruit consumption increased the risk of developing inhalant allergies but was not significant whereas the Vitamin D intake was significant in decreasing the sensitivity to food allergens (Nwaru et al., 2010).

A population-based prospective cohort study was completed on 931 children and their parents. A Food Frequency Questionnaire (FFQ) and the child's IgE were taken and analyzed. The measurement was set at a specific level and tested for the common food allergies and inhalant allergies. The sensitization to any allergen was found in 30% of these children (Nwaru et al., 2010).

Previous studies show that the maternal intake of Vitamin D is associated with a decrease risk of developing allergies. Polyunsaturated fatty acids (PUFA: fish oils) have not shown a positive effect and remains controversial. Other variables can be associated with the development of wheezing, eczema, and allergic rhinitis that were not accounted for. Lack of statistical power based on the small number of children having asthma, atopic eczema, and allergic rhinitis at the age of five yrs, assessment of the association of maternal diet with these outcomes in the present subject series was not included in the study (Nwaru et al., 2010).

Further studies need to be completed on maternal intake, especially citrus foods due to it not being significant. Vitamin D intake was significant but the amount that the women took would be beneficial to know in order to provide the proper dosage to women.

Factors associated with maternal dietary intake, feeding and weaning practices, and the development of food hypersensitivity in the infant

An observational, prospective cohort study was completed on 969 pregnant women. A validated food frequency questionnaire (FFQ) was completed by the pregnant women at 36 weeks gestation (Venter et al., 2013). Telephone questionnaires, which were based on the International Studies of Asthma and Allergies in Childhood, (ISAAC), were completed when the infant was three, six, and nine months, and again when the children were ages one, two and three. All children had a SPT at ages one, two, and three years. Introduction of foods were started when the infant turned six months but peanuts and sesame was not introduced until the child turned three. Analysis of data was completed using four separate tests: 1) Fisher's Exact test; 2) odds ratios; 3) Kaplan-Meier; and 4) Logrank test.

Findings from the food sensitivity test related to the nutritional intake of the pregnant women did not impact the food allergy hypersensitivity in the infant. A history of the mother's dermatitis, also did not impact the outcome or the infant's food hypersensitivity. Breast feeding was also examined. The median duration of breastfeeding of the participants was 42 days (Venter et al., 2013). Breastfeeding duration did not significantly improve the outcome and lessen the chance of developing food allergies by age one or three. Infants who started solids before 16 weeks of age reduced their rate of food hypersensitivity (FHS) and sensitization to foods.

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Exposing children to allergen foods prior to six months of age had an increased risk of developing FHS by age one and three. If the infant was given allergen foods between three to six months of age, they were more likely to develop hypersensitivity to foods at age one and three. What and when the infant ate foods had an impact on the development of hypersensitivity to foods versus the duration of breastfeeding or maternal diet. Breastfeeding the first 12 weeks was found to be beneficial but beyond 16 weeks it tended to increase the sensitization to foods. Prior studies found that solid food introduction before 16 weeks increased the development of FHS whereas this study concluded the opposite.

Due to contradicting prior research on when to introduce solid foods, it is difficult to use the information gained to apply it in clinical practice with patients. Breastfeeding is best for babies and telling breastfeeding mothers to stop breastfeeding at 16 weeks in order to possibly decrease food sensitivities is not adhering to evidence based practice.

Oral immunotherapy and tolerance induction in childhood

Treatment with oral immunotherapy (OIT) or oral tolerance is an effective treatment option for desensitizing food allergies however, long-term tolerance is still uncertain. OIT has been shown to modulate allergen-specific immune responses, directing them toward responses typically associated with tolerance (Tang and Martino, 2013). OIT has been found to cause allergic reactions in almost half of the sample, especially when the dose was increased among other factors such as illness, environmental allergies flared up, empty stomach, and so forth. If avoided during these times, the reactions would diminish. SLIT used with OIT improved the results of tolerance.

Efforts to improve the safety and tolerogenic capacity of OIT are warranted to support the feasibility and effectiveness of OIT as a future treatment for food allergy in the clinical setting (Tang & Martino, 2013). Safety is a concern due to respiratory and gut reactions with OIT.

Tolerance to allergen foods long-term needs to be further evaluated. OIT may be enhanced with cooking the egg and milk products. Use of immune modifying adjuvants may pave the way to enhance the tolerogenic capacity of OIT, and trials are currently underway to explore this (Tang & Martino, 2013). Omalizumab, a subcutaneous injectable prescription medicine to reduce the number of asthma attacks in people with allergic asthma, may modulate the allergic response to promote tolerance (Tang & Martino, 2013).

Immunotherapy – risk/benefit in food allergy

There are three different types of immunotherapy available for treatment of allergies: 1) allergen-specific immunotherapy (SIT), 2) sublingual immunotherapy, 3) oral immunotherapy. Allergen-specific immunotherapy (also known as allergy shots) is an effective treatment used by allergists and immunologists for common allergic conditions, particularly allergic rhinitis/conjunctivitis, allergic asthma and stinging insect hypersensitivity (Moote & Kim, 2011). The goal of SIT is inducing tolerance to an antigen by activating cellular and molecular mechanisms by the repeated administration of increasing doses of antigen extracts (Kostadinova, Willemsen, Knippels, and Garssen, 2013). Subcutaneous immunotherapy had a 67-100% efficacy but has high adverse effects for subjects and the potential to be fatal. Oral immunotherapy (OIT) was successful in treatment of milk and peanut allergies. OIT produces long-term tolerance (1-2 years) whereas SLIT is still unknown. SLIT alone may not be significant in desensitization but used with OIT produces greater effects. SLIT appears to improve the safety of the therapy; however, many uncertainties about its efficacy in inducing a

temporary tolerant state to food allergens still exist (Kostadinova et al., 2013). Diet elimination is not the recommended treatment option due to decreasing their nutritional intake.

It is very difficult to make any conclusions about the permanence of the tolerant state achieved with OIT due to the transient nature of CMA in early childhood (Kastadinova et al., 2013). One study failed to continue due to an error and one subject died from the SCIT of peanuts.

Epicutaneous immunotherapy needs to be studied to determine if it will be the new and safe treatment option of the future. More research is needed to define the optimal doses, role of tolerogenic peptides and administration protocol in order to accelerate its approval for implementation in clinical practice (Kostadinova et al., 2013).

Development of natural tolerance and induced desensitization in cow's milk allergy

Specific oral immunotherapy to cow's milk has successfully desensitized the majority of patients in a number of studies (Savilahti &Savilahti, 2013). IgE and IgG4 are indicators for the development of tolerance. IgE should decrease whereas IgG4 would increase. IgG, especially IgG4, is related to developing tolerance and block IgE binding. Serum IgA antibodies may also play a role in developing tolerance as they increase. As an infant, the IgA antibody levels are low and are found in the mucosal surfaces such as saliva and the gut. CM-specific IgA levels in serum at the time of diagnosis were lower in children whose CMA persisted beyond the age of eight years compared with those that recovered earlier (Savilahti & Savilahti, 2013). The unknown remains as to what is the root cause of developing tolerance to allergens.

Development of tolerance to an allergen can happen at any time. The study was unable to determine if OIT played a role in developing tolerance or was it natural development of tolerance, along with what factors affected the natural development of allergens were not listed.

Controversy remains on decreased levels of IgE levels with desensitization with CM through OIT. Specific IgG4 and possibly IgA antibodies and increase in numbers and/or activity of Tregs promote tolerance to allergens (Savilahti & Savilahti, 2013).

Predictive factors for the persistence of cow's milk allergy

Fromm 1991-2006, there were 139 Portuguese children selected from the Pediatric Allergy Clinic who had a cow's milk allergy (CMA). Multivariate logistic regression analysis was used to investigate independent predictive factors for the persistence of CMA beyond age of two (Santos, Dias, and Pinheiro, 2010). Children were tested for CMA twice a year with oral food challenge, skin prick test (SPT), and/or serum-specific IgE to CMA. Medical records were used for demographic and clinical data.

The average age of CMA development of symptoms was 2.8 months. The allergic symptoms developed within 1 hour after exposure to cow's milk in the majority of cases (Santos, Dias & Pinheiro, 2010). Most common reaction was GI symptoms. The age in which most children developed tolerance to cow's milk is between 12-18 months (14.3%) with 18-24 months not far behind (10.8%). After re-evaluation by multivariate analysis, only asthma, immediate allergic symptoms and other food allergies were identified as independent predictive factors for the persistence of CMA beyond the age of two (Santos, Dias & Pinheiro, 2010).

A child with a larger wheal diameter and a high serum IgE immunoassay, they were less likely to develop tolerance to cow's milk. Ig-E mediated CMA versus delayed or non-Ig-E mediated CMA does not have as good of a prognosis of developing tolerance to CM. Immediate

reactions or symptoms suggest Ig-E mediated allergies versus delayed symptoms from 1 hour to days later.

The retrospective observational study lost follow-up after tolerance to CM was achieved in the majority of cases (Santos, Dias & Pinheiro, 2010). Due to participant withdrawal questions remain whether tolerance continued or decreased with time, if they developed new allergies or other atopic conditions. The duration of breastfeeding and introduction of solids was not included as a variable in this study.

Prospective and interventional studies are needed in the general pediatric population and in population of children with CMA in different countries to improve our knowledge about the epidemiology and naturally history of this universally common food allergy (Santos, Dias & Pinheiro, 2010). CMA is the most common food allergy throughout the world and further understanding as to why is needed.

How to reintroduce cow's milk

The required duration of the strict elimination diet and, hence, the schedule of the reintroduction of cow's milk protein into the diet cannot be clearly established for a given individual (Dupont, 2013). Heating the milk destroys the proteins and majority of children can tolerate it. Milk challenges are performed once they discontinue the elimination diet, usually in the hospital for safety, and the amount tolerated is determined. The challenge may start with baked food and then move to raw. It was shown that casein and milk sIgE level, milk-specific basophil reactivity, and milk SPT wheal diameter are all significantly greater among patients with cow's milk protein allergy (CMPA) who react to baked milk than among those who tolerate it (Dupont, 2013). Reactions may take anywhere from immediate, one to two hours, or delayed up to four hours.

The first oral challenge is done in the hospital and then it is maintained at home with a gradual increase of milk in their diet. Several recent studies indicate that the continued presence of cow's milk protein (CMP) in the diet at a tolerated does facilitates the acquisition of a long-term tolerance (Dupont, 2013). Children who do not develop tolerance may be at risk for not getting the recommended amounts of calcium. Milk oral immunotherapy can lead to desensitization in the majority of individuals with IgE-mediated cow's milk protein allergy (Dupont, 2013). Oral immunotherapy showed to be more effective than SLIT but has more side effects. Development of tolerance to cow's milk may be achievable in children with CMPA through oral immunotherapy which is promising for those that suffer.

Timing of infant feeding in relation to childhood asthma and allergic diseases

Multidisciplinary, population-based prospective cohort study was completed on 3,781 children. Dietary assessment was done by using age-specific dietary questionnaires at the ages of three, six, twelve months and a follow-up "age at introduction of new foods-form" for recording the age at introduction of complementary foods (Nwaru et al., 2012). At age five they assessed for asthma and atopic eczema using the International Study of Asthma and Allergies in Childhood questionnaire and serum IgE levels.

Median age for when complementary root foods were given was three and a half months and then other foods were introduced in the following order: fruits and berries, oats, wheat, rye, barley, meat, fish and egg (Nwaru et al., 2012). Boys are more likely to have allergies and asthma along with children of parents who suffered from asthma and allergic rhinitis. Introduction of cow's milk at or before four months was positively associated with atopic eczema (Nwaru et al., 2012).

Early introduction of complementary foods might protect the infant from the development of asthma and allergic rhinitis up until age five. Breastfeeding during introduction of complementary foods may be beneficial in preventing allergies. Introduction of wheat, rye, oats, and barley cereals at five and a half months or less; fish at nine months or less; and egg at 11 months or less might decrease the risk of asthma, allergic rhinitis, and atopic sensitization in childhood (Nwaru et al., 2012). The foods introduced were common for the UK but typically in the U.S. rice or multigrain is often the first food. Eggs are not recommended in the U.S. until one year of age.

Further research is needed on breastfeeding while introducing complementary foods to determine its benefits. Educating patients/clients on how and when is a good time to introduce foods is important and encouraging them to breastfeed, even some, while doing so to help diminish their chance of developing allergies.

Discussion

Change is difficult, especially if staff is resistive. The key seems to lie in creating a context and support system under which EBP efforts can be sustained (Wallis, 2012). If the information is presented well, is factual, saves money in the end, and has more positive outcomes for patients, the stake holders are more open to jumping on board.

Through this project an educational practice recommendation was suggested to Public Health nurses on food allergies such as signs, symptoms, allergist referral, and support. The recommendation is to introduce solid foods to an infant between four to six months of age to prevent, delay, or help manage food allergies and breastfeed for at least for four months to prevent or delay food allergies.

A PowerPoint presentation was developed and presented to Public Health staff which included two social workers and 23 Public Health nurses. The staff was engaged, receptive and asked many questions. Public Health staff can incorporate the knowledge obtained regarding food allergies into their nutrition education in WIC and on their home visits with clients.

The cost to implement the EBP food allergy education is staff development time. The outcome is education. The patient outcomes would be improved due to providing evidence based practice. Staff would gain knowledge and understanding of how to recognize food allergy symptoms, when to introduce solid foods to an infant, benefits of waiting, breastfeeding timeline, and discuss diet and referral options. The goal would be to decrease the likelihood of an infant and/or child developing a food allergy and increase their quality of care along with reducing health care costs. The cost would be decreased for the families, insurance and tax payers.

Further research needed is three fold: 1) continue looking at timing of solid food introduction and the length breastfeeding; 2) probiotics benefits, 3) future reactions becoming more severe.

Summary

The number of infants and children that suffer from food allergies continues to grow. Allergic rhinitis and asthma often co-exist with food allergies. If allergy sufferers are aware of the signs and symptoms, understand and know how to deal with food allergies when presented, it can optimize their care. The goal would be to prevent further allergies and complications and seek proper medical attention, such as an allergist.

Children are resilient but as they grow, they become aware of their surroundings and impact their allergies have on their day to day life. The age of emotional and psychosocial impact is around eight. Allowing them counseling and a dietician will help them learn how to

grow up with allergies and incorporate them into their lives. Prevention of food allergies continues to be skeptical and undetermined on what is the best plan to achieve it. Breastfeeding was found to be best even if it helps prevent allergies or not; it does help prevent asthma and many other illnesses. The timing of introducing solids foods can impact the development of food allergies. However, it remains controversial on the exact timing but it is recommended between four to six months of age. There may be a specific way to introduce foods such as fruits first, then cereal but that has yet to be fully determined.

Diagnosis of food allergies is not always accurate. The gold standard is the oral food challenge which is not always the easiest or most pleasant due to reactions. SPT and immunoassay's can give good results, but are not always the most accurate. It is still worth being tested and finding out your results. Avoiding foods has been found to lead to nutritional intake deficiency. SLIT and OIT together are beneficial in diminishing food allergies. There are still no studies that show documentation of long-term benefits.

There are a few choices of immunotherapy and determining which one is best may depend on finances and personal preference. SLIT is a good treatment option; however it is more beneficial when performed with OIT. SCIT has been shown to prove good results in diminishing allergies but also carries a high risk of reactions. OIT has to be done in the hospital until the maintenance dose is reached then it can resume at home; this however may be inconvenient or scary for patients. Avoidance diets are not recommended due to being detrimental to their overall nutritional status.

Continued research needs to be done on prevention, treatment, diagnosis and the psychosocial aspects that play a role in food allergies. Future studies need to focus on the

continuum of care for patients who suffer from food allergies. Lastly, further research on best practices to diagnosis food allergies with minimal risk to the patients is needed.

The PowerPoint was presented to the Public Health staff. The staff responded with questions and seemed intrigued with the information. The staff felt it will benefit their interactions with babies/children during home visits as well as assisting in the WIC clinic. One of the staff nurses also operated a summer camp and she was curious on the peanut free tables and causing further isolation to the campers. The response given was, according to the "DunnGalvin et al. (2009) study- I read, this was an addressed and the children did feel isolated". This led to a discussion regarding elementary schools being peanut aware versus peanut free. Discussion was held that the information from the independent project was going to be presented to school nurses and/or the Communities for Health committee.

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