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Companion Shoppers – An Experiential and Educational Public Health Outreach

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Purpose

The purpose of this manuscript is to discuss the underutilization of public health nutrition educators in the retail market and to suggest possible venues for expanding their role.

Discussion

Previous research has demonstrated consumers with high nutrition knowledge are more likely to purchase products with a higher nutritional value, while consumers with lower nutrition knowledge are more likely to purchase products of lower nutritional value (Burton, 1994). High nutrition knowledge has been found to be related to higher levels of accuracy in identifying products that contained more than the recommended amount of nutrients associated with health problems (Burton, 1994). Yet even knowledgeable food shoppers may misinterpret and overgeneralize when comparing nutrient content claims on labels (Andrews, Netemeyer, & Burton, 1998). Overall, while food labels are an important step in helping to educate and guide the public, consumers may ignore or not understand food labels and claims without training (Burton, 1994). Nutrition knowledge has been positively related with educational achievement (Fusillo, 1977). Nutrition knowledge, food beliefs and reported shopping behavior were found to be positive and linear (Fusillo, 1977; Cluss et al., 2013). Lower socioeconomic and older age groups tend to be the highest risk groups in that they tend to have the poorest nutrition knowledge (Fusillo, 1977; Moynihan et al., 2007; Cluss et al., 2013). Shopper's comprehension and subsequent application of nutrition labels could be enhanced with the use of interpretational aids (Cowburn, 2004). An interpretational aid or educated companion shopper, could help customers evaluate the nutritional make-up of foods, including those without labels, and appraise their role in the overall diet (Cowburn, 2004).

From the marketing perspective research has long recognized the role store employees play in affecting the quality of the shopping experience (Lindsey-Mullikin & Munger, 2011). Store employees have opportunities for building relationships with customers. The interactions between store employees and customers can impact customer perceptions of the organization (Gremler & Gwinner, 2008). The goal of these relationships is to enhance customer satisfaction

and improve loyalty to the store. It has been demonstrated that reference group members' influence purchases (Miller, 1998). Companion shoppers are typically shoppers who are acquainted with the customer such as friends, family members and co-workers. The companion shopper can have pronounced influence on the shopping experience. They have the unique capability to interact with the consumer at the point of purchase thus providing either a "thumbs up" or a "thumbs down" to the consumer's shopping decisions. They can provide the last input before a purchase takes place and can guide the actions of the consumer (Lindsey-Mullikin & Munger, 2011). While First Lady Michelle Obama has made food literacy a top priority on a national level, a 2012 Consumer attitudes survey towards food safety, nutrition and health presented by the International Food Information Council Foundation found that 52 percent of Americans indicate that doing their own income taxes would be easier than knowing how to eat a healthy diet (Foodinsight, 2012). Findings from the 1970's suggest that consumer nutrition education must be improved if consumers are to benefit from the efforts of nutritional labeling. (Fusillo, 1997). While many nutrition label changes have taken effect since the 1970's, research demonstrates the public is still confused.

This leaves a wide open door for the area of Nutrition Education. As Public Health Nutritionists look to the future, there are untapped areas in the retail industry. In light of technology and time constraints that accompany fast-paced lives, many grocery stores are beginning to offer a variety of shopping services including on-line grocery stores and on-line shopping services. High value is placed on convenience shopping when it comes to millennials (AlixPartners, LL. Jefferies & Company Inc., 2012). While most of these services advertise convenience other benefits also exist. For Baby Boomers Nutrition Education is the bridge that spans the gap between the doctor's orders and the grocery store shopping cart, and for millennials it is the missing link between their willingness to pay for fresh and healthy food (Hoffman, 2012) and their expectation of convenience through use of social media and other channels (Peregrin, 2015). Employing Public Health Nutritionists as companion shoppers to engage on-line consumers and fill orders is a unique way stores can separate themselves from the competition. As suggested in previous research, interpretational aids, such as a public health nutritionists, could help consumers evaluate the nutritional content of foods (Cowburn, 2004). The Public Health Nutritionist would complement the roles store employees play in affecting the quality of the shopping experience. They would create an opportunity for building relationships with the customer. Positive relationships impact customer perceptions and enhance customer

satisfaction. While this improves store loyalty with baby boomers this approach also allows stores to tailor products purchased to specific dietary needs and have a general health-focus which is important to millennials (AlixPartners, LLP, Jefferies & Company, Inc. 2014).

Another untapped area in retail industry is as a face to face, in-store companion shopper. As research has already reported, the companion shopper has the unique capability to interact with the consumer at the point of purchase providing the last input before a purchase takes place (Lindsey-Mullikin & Munger, 2011). The educated companion can interpret nutrition facts labels and health claims with shoppers, help identify various healthful options among food groups, explain ingredients and even offer samples of new food items the shopper normally would not try (Ruhs, 2015). Ideally, the Nutrition Educator would pair-up with those with low nutrition knowledge or those whose physicians have given them dietary changes they don't understand. The nutrition educator could be a positive influence at a time when decisions are made. Marketing research suggests a priority for retail stores interested in attracting new patrons should be designing a low-stress shopping atmosphere (Baker, 2002). An educated shopping companion could significantly decrease the stress the general public and consumers feel when trying to decide how to eat healthier.

Another alternative to individual shopping companions is group grocery store tours. Grocery store tours encourage active participation and are cost-effective nutrition interventions facilitated by nutrition educators. Tours provides structure, ensure appropriate nutritional content, and empower customers to realize healthy food selections (Baic & Thompson, 2007). Studies show improved nutrition knowledge and positive behavior changes for grocery store tour participants (Nikolaus, Muzaffar, Nickols-Richardson, 2016; Escaron, Meinen, Nitzke, Martinez-Donate, 2013; Baic & Thompson, 2007; Lafferty, Marquart, Reicks, 2006; Crawford & Kalina, 1993; Silzer, Sheeska, Tomasik, Woolcott, 1994). Tours encourage active sharing and input from participants while providing opportunities to ask questions and sample new food items. Establishments that offer tours can promote themselves in a positive light in the public's eye as they demonstrate their concern for public health by being a reliable source of nutrition information. As such these tours are not only beneficial to customers who desire to make healthier food choices, but also to the supermarket and the food industry. Data show consumers purchase healthier foods especially when product availability and affordability are combined with target marketing and nutrition education such as grocery store tours (Escaron, Meinen, Nitzke, Martinez-Donate, 2013).

Millennial shoppers have been found to be both “vocal consumers,” tending to influence the purchases of others, and more likely than previous generations to seek out desired specialty food items from a range of retail locations (Fromm, 2014, AlixPartners, LL. Jefferies & Company Inc. 2012). As a result, perhaps more grocery stores should accompany the long and growing list of schools, corporations, health insurance companies, food manufacturers and health care companies who employ nutritionists due to the rising demand for help with designing healthy menus, recipe substitution suggestions, helping to manage diets, leading grocery store tours, interpreting food labels, defining ingredients and assisting customers in making healthier choices. Many people indicate they want to eat better, feasibly all they are lacking is a nutrition educator to bridge the gap; a companion to walk beside them show them how to fill their grocery cart with the essential, nutrient dense foods.

In the meantime, offering nutrition students the opportunity to educate shoppers and facilitate tours is a creative way to engage students in real-life, hands-on activities that make a pronounced impact on all involved. Many nutrition students are, after all, millennials themselves and in tune with the food movement and recipe-based shopping currently trending among millennials (AlexPartners, LLP, Jefferies & company, Inc. 2014). They are comfortable using their smart phones, health and shopping apps and are often well versed in the various social media networks. Partnering with local grocery store chains and supporting their efforts to impact public health while increasing retail business in the form of healthy food choices creates a win-win situation. The supermarket can truly be a meaningful learning laboratory. When combined with interesting and active educational strategies that effectively function to overcome the confusion and overwhelmed feelings that plague many shopping for health, the retail food environment – nutrition educator duo can become an additional line of defense in preventing chronic disease and keeping healthy people healthy.

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Epigenetic Modifications Mediate Experience-Induced Neuroplasticity; Relevance to the Etiology and Treatment of Posttraumatic Stress Disorder

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Abstract

Covalent chemical modifications, including the acetylation of core histone proteins and methylation of cytosine in or near promoter regions of DNA, influence the efficiency with which genes are transcribed. Chemical modifications that regulate gene expression within postmitotic differentiated neurons can reflect environmental influences, including exposure to stress. These chemical modifications or “marks” may reflect downstream consequences of the transduction of extracellular chemical messengers, such as neurotransmitters, growth factors and hormones, by receptors located at the surface of the neuron or within the cell itself. The ability to decipher the epigenetic code may serve as a record of early childhood adversity that sensitizes to additional epigenetic changes caused by traumatic exposures in adulthood. Further, epigenetic therapeutic interventions may be possible that would attenuate the severity of adverse consequences associated with traumatic exposures in the child and adult. Ideally, targeted epigenetic therapeutic interventions would address stress-induced dysregulation of the hypothalamic-pituitary-adrenal axis and promote expression of therapeutically beneficial neuroplasticity factors.

Introduction

Ultimately, receptor-mediated, activity-dependent signaling pathways that are initiated at the cell surface influence gene expression within the nucleus. Within post-mitotic, terminally differentiated neurons, enduring experience-dependent changes in gene expression underlie changes in synaptic strength within specific circuits, contributing to the plasticity that is necessary for learning and memory, stress responsivity, and substance abuse and psychiatric disorders (Deutsch et al., 2008b; Malan-Muller et al., 2013; Maze et al., 2013; Sun et al., 2013; Sweatt, 2013; Zhang et al., 2013; Zovkic & Sweatt, 2013). Chromatin remodeling affecting the compaction of chromatin and, thereby, the accessibility of transcriptional complexes to

promoter regions of genes, which influences the efficiency of transcription, has emerged as an important mechanism of experience-dependent neuroplasticity. Importantly, the epigenetically determined enduring changes in gene expression do not result from changes or mutations in the sequence of nucleic acids in DNA, rather they often result from covalent modifications of histone proteins (e.g., changes in the acetylation and methylation states of lysine residues) and cytosine residues within the DNA molecule (e.g., methylation or hydroxymethylation), leading to activating or repressive effects on gene expression. With respect to the brain, the definition of epigenetics has broadened to include “chromatin-regulating molecular mechanisms in nondividing neuronal cells” (Zovkic & Sweatt, 2013). Chromatin is the structure that enables approximately 2 meters of double-stranded DNA to be compacted into a nucleus, whose microscopic diameter can be approximately 5 μM . The nucleosome is the repeating unit of chromatin and consists of approximately 147 base pairs of superhelical DNA wrapped around an octamer of four highly conserved core histone proteins: designated H2A, H2B, H3 and H4. The nucleosomes are linked to a fifth histone protein (i.e., H1), which is important for chromatin compaction and its higher-order structure (Deutsch et al., 2008b; Malan-Muller et al., 2013; Maze et al., 2013; Sun et al., 2013; Sweatt, 2013; Zhang et al., 2013; Zovkic & Sweatt, 2013).

Chromatin Remodeling Enzymes

Transcriptional efficiency can also be affected by ATP-dependent chromatin remodeling enzymes that affect the higher-order structure of chromatin (Maze et al., 2013). These enzymes are oligomeric proteins with distinct functional domains, including domains that “read” or recognize distinct “markers” or covalent modifications of histone proteins and a domain with ATPase activity that uses ATP, the biological energy currency, to change the structure of chromatin. ATP-dependent chromatin remodeling complexes can participate in transcriptional activation or repression at a given locus, which is determined by their association with effector proteins, including transcription factors.

Histone Modifications

A major mechanism of chromatin remodeling involves covalent modifications of core histone proteins, which occur primarily on highly conserved basic amino acid sequences (especially lysine residues) located at the amino and carboxy terminal tails (Deutsch et al., 2008b; Maze et al., 2013; Sun et al., 2013). These posttranslational modifications include acetylation,

methylation, phosphorylation, and ubiquitination, among other types of covalently attached groups. In general, the acetylation of lysine residues in the N-terminal tail region by histone acetyltransferases (HATs), which comprise a large class of “writers,” results in gene activation; the specific acetyl-lysine modifications are referred to as bromodomains and recognized by specific “readers.” Histone acetylation results in a reduction or neutralization of the positive charge of core histone proteins that relaxes the electrostatic affinity between the positively-charged histones and negatively charged DNA. Acetylation is the most studied posttranslational covalent modification of histone proteins.

Because of the strength of carbon-carbon bonds, the turnover kinetics of histone methylation is slow and these “marks” can assume multiple valence states (i.e., mono, di, and trimethylated forms) that can serve as the basis of lifelong “epigenetic memory;” methylation occurs at lysine and arginine residues. However, contrary to the former belief that histone methylation “marks” were stable and lasted indefinitely, it is now known that these marks, including the valence states, can also reflect dynamic interactions between multiple distinct histone methyltransferases (HMTs) and histone demethylases (HDMs). In contrast to acetylation, which is usually associated with promotion of gene expression, histone methylation can be associated with gene activation or repression, which is determined by the specific basic amino acid residues that are methylated, interactions with other histone “marks,” and the valence state of the methylated amino acid. Thus, methylation of lysine residues 4 or 36 on H3 are most often associated with the promotion of gene expression, whereas methylation of lysine residues 9 or 27 are commonly associated with gene silencing. Rapid and transient phosphorylation of serine residues in the core H3 histone protein (e.g., the serine 10 residue) has also been shown to result from stimulation of cultured striatal neurons and the hippocampal dentate gyrus by growth factors and neurotransmitters. Interestingly, the affinity of the chaperone “reader” protein 14-3-3 for the phosphorylated H3 histone in the serine 10 position is increased by the presence of an acetyl group on the neighboring lysine in the 14 position, which leads to transcriptional activation. The data support the importance of “readers” that recognize distinct combinations of histone marks (Maze et al., 2013).

The relaxation of compacted chromatin can promote gene expression by enabling the recruitment of the transcriptional machinery (Deutsch et al., 2008b; Maze et al., 2013; Sun et al.,

2013). As mentioned, the histone modifications or “markers” are “read” by specific proteins, which can lead to activation or repression of transcription and gene expression. Importantly, the readers often have multiple binding domains that recognize and bind to different histone marks simultaneously; thus, deciphering the “histone epigenetic code” and understanding the functional output of modified chromatin requires examination of multivalent modifications both within (i.e., intra) and between (i.e., inter) nucleosomes. The histone modifications act in a combinatorial manner to influence gene expression. In addition to their association with transcription complexes, “readers” may have domains or be associated with enzymes that can affect other histone modifications or ATP-dependent chromatin remodeling. As reviewed, chromatin output in post-mitotic, terminally differentiated neurons is a dynamic process that reflects experience-induced changes in histone modifications or “marks.” The ability of “readers” to integrate and transduce these “marks” into chromatin output reflects, in part, a dynamic relationship between “writers” (e.g., HATs and HMTs), and “erasers” (e.g., histone deacetylases [HDACs] and HDMs); erasers enzymatically remove specific histone modifications. Ultimately, chromatin output reflects reading of the “histone epigenetic code,” whose coordinated components include histone modifications, DNA methylation, noncoding RNAs, and transcription factors.

DNA Methylation

Within intergenic regions, DNA methylation is responsible for the silencing and suppression of expression of transposable and viral elements, which, if expressed, would be harmful (Moore et al., 2013). DNA methylation is also important for the establishment of imprinting, which is a process whereby genes are preferentially expressed from only one of the two parental chromosomes (Moore et al., 2013). Additionally, DNA methylation is a mechanism regulating the differentiation of cells from pluripotent stem cells during development. Finally, DNA methylation represents a mechanism for transducing experiences into long-lasting changes in gene expression, and serves as a major mechanism of epigenetic regulation. Most commonly, DNA methylation in the promoter region of genes enriched in cytosine-guanine (CpG) dinucleotides (so-called CpG islands) leads to transcriptional silencing. About 70% of gene promoters reside within CpG islands and these CpG islands are conserved between mice and humans, consistent with their functional importance. Specifically, DNA methylation involves the catalytic transfer of a methyl group from S-adenosyl methionine (SAM), the universal methyl

donor, to the carbon-5 position on cytosine. Importantly, the epigenetic marks of 5-methylcytosine and 5-hydroxymethylcytosine cannot be differentiated by the current conventional high-throughput methods for mapping patterns of DNA methylation (i.e., bisulfite sequencing and the use of methylation-sensitive restriction enzymes). 5-Hydroxymethylcytosine influences gene expression, similar to 5-methylcytosine, and is also an intermediate in a pathway that leads to DNA demethylation.

The DNA methyltransferases (DNMTs) that are involved in maintenance and perpetuation of patterns of DNA methylation constitute one of the two broad families of DNMTs (Moore et al., 2013). This group of enzymes includes DNMT1, which recognizes the methylated CpG dinucleotide on the hemi-methylated strand and converts unmethylated CpG on its complementary strand into a methylated CpG. The other broad family of DNMTs is the de novo DNMTs, including DNMT3a and DNMT3b, which methylate previously unmethylated cytosines in CpG dinucleotides. In general, the de novo DNMTs create a new methylation pattern of unmodified or naked DNA, whereas DNMT1 functions during DNA replication to assure that the pattern of DNA methylation is preserved in daughter strands. With respect to de novo DNA methylation, transcription factors are thought to play a regulatory role in determining which regions of DNA are to be methylated. Before or after binding to specific DNA sequences, transcription factors may act by recruiting DNMTs or, alternatively, their binding may protect CpG sites from de novo methylation. In addition to its activity during DNA replication, DNMT1 also “repairs” DNA methylation preserving and maintaining a differentiated cell’s pattern of DNA methylation. Recent research on disorders such as schizophrenia and hereditary sensory and autonomic neuropathy type 1 (HSAN1) support an important epigenetic role of DNMT1 in post-mitotic neurons in the adult brain. In fact, because no dramatic changes in DNA methylation patterns in forebrain postmitotic neurons are observed in transgenic knockout mice with absent expression of DNMT1 or DNMT3a, it is thought that these two DNMTs may have overlapping roles in these postmitotic neurons (Moore et al., 2013).

DNA demethylation is an active metabolic process whereby a series of sequential chemical reactions leads to deamination and oxidation of 5-methyl-cytosine to a product that is a substrate for the “base excision repair (BER)” pathway; there is no known enzymatic mechanism for cleaving the strong covalent carbon-carbon bond between cytosine and its methyl group in

the 5-position (Moore et al., 2013). The ultimate product of the processing of 5-methyl-cytosine results in a base-pair mismatch that is subject to BER. As noted, 5-hydroxymethyl-cytosine is an intermediate in one of the DNA demethylation pathways that may also have a role in the epigenetic regulation of gene expression. For example, 5-hydroxymethyl-cytosine interferes with the binding of MeCP2 to methylated DNA; MeCP2 is a methyl-CpG-binding protein that contributes to gene repression. The family of methyl-CpG binding proteins are more highly expressed in brain than other tissues, and may possess a “transcriptional repression domain” that binds to repressor complexes (Moore et al., 2013). In addition to active gene repression, MeCP2 has a probable role in the maintenance of DNA methylation patterns because it binds to DNMT1. MeCP2 is also a substrate for posttranslational phosphorylation induced by neuronal activity, which would release it from promoter regions, making these sequences accessible to active DNA demethylation and, thereby, promoting gene expression. That MeCP2 is a critical methyl-CpG-binding protein is supported by the fact that its mutation results in Rett Syndrome, a neurodevelopmental disorder.

Epigenetic Changes Mediate Contextual Fear Conditioning

Contextual fear conditioning in rodents is a form of hippocampal-dependent associative learning in which an aversive unconditioned stimulus, such as foot shock, becomes associated with the context or place (i.e., conditioned stimulus) in which the aversive stimulus was delivered (Zovkic & Sweatt, 2013). Once the long-term association memories in the fear conditioning paradigm become consolidated, freezing behavior, the unconditioned response to the aversive foot shock, is observed or elicited whenever the animals are placed in the context where the foot shock was originally delivered. (i.e., conditioned response). A variety of epigenetic changes have been described in the hippocampus as a result of this fear conditioning procedure. Some of the observed changes in hippocampus are time-dependent, including reversion to baseline levels within 24 hours, reflecting, perhaps, the processes of memory consolidation in hippocampus and downloading of these memories in the cortex for long-term storage and maintenance. The changes in hippocampus associated with contextual fear conditioning included acetylation of H3 histone protein in the CA1 region; moreover, treatment of adult animals with histone deacetylase (HDAC) inhibitors and, thereby, increasing the acetylation status of H3 led to enhanced memory formation. Complementary changes were also observed in DNA methylation at specific gene loci. For example, contextual fear conditioning was associated with an

upregulation in the hippocampal expression of DNMT 3a and 3b, which led to methylation and transcriptional silencing of a memory suppressor gene (i.e., *protein phosphatase 1*). There was also DNA demethylation and transcriptional activation of the genes coding for reelin and brain-derived neurotrophic factor (BDNF), which are two proteins important for experience-induced neuroplasticity. Interestingly, contextual fear conditioning was associated with increased H3 histone acetylation at BDNF promoter regions, supporting the coordinated activity of DNA methylation and histone acetylation in the regulation of BDNF expression. The changes in levels of DNA methylation for *protein phosphatase 1* and *reelin* in hippocampus returned to baseline within 24 hours (Zovkic & Sweatt, 2013). An inability to extinguish learned fear responses is a major etiological theory of PTSD. The persistence of learned fear responses may ultimately reflect enduring epigenetic changes due to covalent modifications of histone tails and DNA.

Environmental-Induced Epigenetic Modifications Mediate Hypothalamic-Pituitary-Adrenal Axis Dysregulation in Response to Childhood Adversity and Adult Trauma Exposures

A major role of the hypothalamic-pituitary-adrenal (HPA) axis is the maintenance of “allostasis,” which is the maintenance of stability in spite of stressful or unanticipated environment exigencies (McGowan, 2013). Childhood adversity can impact the ability of the HPA axis to maintain allostasis and is a major risk factor for posttraumatic stress disorder (PTSD). Current research on the epigenetic consequences of early life adversity focuses on identifying labile areas of the genome that are sensitive to modifications by environmental factors and the ontological time course of epigenetic changes (i.e., when during development are epigenetic changes most likely to occur in response to specific types of adversity). Animal models of early life adversity have clearly shown that the quality of maternal care influences offspring response to novel and stressful environments, which are mediated, at least in part, by epigenetic changes in the HPA circuitry of the offspring. Thus, the quality of maternal care in rats influences lifelong changes in the DNA methylation pattern in hippocampus of the untranslated 1₇ splice variant of the glucocorticoid receptor (GR) promoter, as well as the acetylation status of the lysine 9 residue of the H3 histone protein in offspring (Daskalakis et al., 2013; Malan-Muller et al., 2013; McGowan, 2013; Sweatt, 2013; Yehuda & LeDoux, 2007; Yehuda & Bierer, 2009; Yehuda et al., 2013). The quality of maternal care has also been shown to affect the epigenetic regulation of a variety of regions in the offspring’s brains, including the GAD₆₇ gene involved in synthesis of GABA, the major inhibitory neurotransmitter, in prefrontal cortex, the gene for arginine

vasopressin in hypothalamus, and the gene for BDNF in prefrontal cortex and hippocampus, among other genes and regions. Translational studies in postmortem human brain have shown that a history of child abuse affects the extent of DNA methylation of the exon 1F promoter region of the gene for the GR in the hippocampus of suicide victims; thus, suicide victims and controls without histories of abuse or severe neglect in childhood had lower levels of DNA methylation of this promoter region, than suicide victims with childhood histories of abuse and neglect.

HPA axis dysregulation, increased glucocorticoid sensitivity, and hypocortisolemia can occur in patients with PTSD, which could reflect epigenetic modifications of the cytosine methylation status in promoter regions of the genes for both the GR and the FK506 binding protein (FKBP5), the latter protein regulates the efficiency of intracellular signaling mediated by the GR (Yehuda et al., 2013). There are also emerging data that the expression of these and, perhaps, other glucocorticoid related genes can be environmentally regulated throughout life. In fact, preliminary data suggest that Prolonged Exposure (PE) therapy, an evidence-based cognitive-behavioral intervention for PTSD, can regulate the epigenetic state of FKBP5, which is associated with a positive therapeutic response to treatment (Yehuda et al., 2013). As discussed, in a rat model, differences in maternal grooming of pups regulated the cytosine methylation status in hippocampus of the exon 1₇ promoter of the GR gene. Translational studies in the human confirmed that childhood adversity is associated with increased methylation of the human ortholog of the rat exon 1₇ promoter of the GR gene (i.e., the exon 1F promoter), resulting in lower expression of GR in hippocampus and a dysregulated HPA axis response to stress. These data are consistent with a literature on premorbid risk factors for PTSD. Altered levels of expression of FKBP5 appear to act as an intracellular feedback loop regulating the signaling consequences of GR activation; FKBP5 is a co-chaperone of the GR that decreases the binding of ligands to the cytosolic GR and impairs translocation of the ligand-bound GR to the nucleus from the cytoplasm. Thus, increased expression of FKBP5 would dampen activation of the GR. Ultimately, the methylation state of *FKBP51*, the gene coding FKBP5, reflects an interaction between genetic variations in the sequence of its nucleotides (i.e., polymorphisms) and childhood adversity, and the interaction of genetic variants of *FKBP51* and childhood adversity contribute to risk for major depression, suicide attempts and PTSD (Yehuda et al., 2013). Importantly, prior sensitization to stress (e.g., due to childhood adversity) can increase the risk

for PTSD after exposures to trauma as an adult. A compelling hypothesis is that epigenetic modifications of glucocorticoid related genes are likely to be responsible for both risk and perpetuation of PTSD, which is associated with low glucocorticoid levels and increased GR sensitivity.

In a small preliminary study, the effects of PE therapy on the methylation state of the promoters of the genes for GR and FKBP5 in peripheral blood mononuclear cells was studied in 16 combat veterans, eight of whom responded and no longer met diagnostic criteria for PTSD after 12 weeks of treatment (Yehuda et al., 2013). Importantly, the methylation status of the exon 1F promoter of the human gene for the GR, the homolog of the exon 1₇ promoter region of the rat gene, is influenced by a childhood history of trauma. Responders to PE therapy showed a greater number of methylated CpG sites in the GR exon 1F promoter at baseline prior to treatment; however, the extent of methylation did not change after treatment or three-month follow-up (Yehuda et al., 2013). Thus, increased methylation of the exon 1F promoter may be a predictor of a good response to PE therapy. With respect to the promoter region of the FKBP5 gene, the data suggest that the number of methylated sites decreases in treatment-responders. Thus, in patients with PTSD, who have increased sensitivity to glucocorticoids, decreased DNA methylation and up-regulated expression of FKBP5 may be a desired therapeutic goal. The upregulated expression of FKBP5 would lead to diminished glucocorticoid activation as a result of diminished GR sensitivity.

In summary, the data suggest that enduring positive effects of “psychotherapeutic” interventions may be mediated by epigenetic modifications of genes implicated in stress responsivity, such as changes in the methylation status of the promoter region of the gene for FKBP5. Conceivably, beneficial effects of nonpharmacological, psychotherapeutic interventions for PTSD and other psychiatric disorders may also be associated with changes in expression of genes implicated in neuroplasticity, such as the genes coding for reelin and BDNF. The pattern of DNA methylation of the promoter region of the GR gene may inform a history of altered stress sensitivity to traumatic exposures, especially exposures in childhood, and also be predictive of a positive response to certain therapeutic interventions. Recent work also supports the potential benefits of strategically timed pharmacological interventions to alter stress-induced changes in the epigenetic landscape (Deutsch et al., 2008a,b). For example,

treating mice with sodium butyrate, a HDAC inhibitor, around the time of their exposure to a profound stressor (i.e., forced swimming in cold water) attenuated the severity of the stressed-induced reduction of dizocilpine's antiseizure efficacy tested 24 hours after the stressful exposure; dizocilpine is a noncompetitive NMDA receptor antagonist. The dose of sodium butyrate was known to increase the acetylation status of histones in the hippocampus. These data support exploration of epigenetic interventions to address stress-induced alterations of glutamatergic neurotransmission (Deutsch et al., 2008a).

Conclusions

The data are converging to show that environmental influences, especially stressful ones, can affect expression of genes in specific brain regions; epigenetic modifications, which are covalent modifications of histone tails and DNA itself near transcription start sites, can result in enduring, even lifelong, modifications of genes mediating the stress response and neuroplasticity. The characterization of these epigenetic modifications will surely contribute to our understanding of the environmental contributions to the etiology of psychiatric disorders, especially PTSD, as well as present new avenues of possible therapeutic interventions. Epigenetic therapeutic interventions are already being explored in cancer, and there may be some translational opportunities to test them in psychiatric disorders, including PTSD.

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University Administrators' Perceptions of Online and Blended Doctoral Degrees

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Abstract

The purpose of this phenomenological study was to examine the perceptions of university administrators regarding prospective faculty candidates with online or blended doctoral degrees from accredited institutions located in Virginia. Administrators in the field of health and education were interviewed to gauge their perceptions and completed a survey adapted from DePriest (2009) who adapted it from Levernier (2005). Data was collected through questionnaires, documents, and individual interviews. Data was analyzed using Creswell's (2007) data analysis spiral. Analyses were conducted using transcription, thematic coding, textural and structural descriptions, and a description of the essence of the experiences. The results indicated that administrators had a positive perception of online and blended education with a preference for faculty candidates with a blended doctoral degree.

Introduction

Distance education has expanded and evolved over the last few decades; each year more students graduate with degrees earned partly or completely online (Allen & Seaman, 2014; Garrett, 2010; Mooney, 2010; Sener, 2010). During 2012, online education exploded and gained greater media attention due to the new education platform termed Massive Open Online Courses (MOOC) (Daniel, 2013; Robinson, 2013). Many colleges that offer online degrees advertise it as a great way to get an education due to the lower cost of courses in comparison to traditional courses, flexible scheduling, convenience, and the advantage of earning a degree while still working full time. This trend has resulted in 11,200 college-level programs offered in 2006-2007 by Title IV degree-granting institutions (US Dept of Ed., 2008). Since 2002, Allen and Seaman (2014) have created an annual report on the state of online learning in U.S. higher education. According to Allen and Seaman's (2014):

The number of students taking at least one online course increased by over 411,000 to a new total of 7.1 million since last year, 2013. The proportion of higher education students at least one online course is at an all-time high of 33.5 % (p.4).

Research indicated by a statistics professor at Babson College stated that in 2003 online learning was nearly unheard of ten years earlier but as of 2003 11% of all students are taking classes online; the rate of students choosing to take online classes is predicated to increase at a rate of 20 % (Roach, 2003, p.44). Based on Allen and Seaman's (2014) the predication was correct.

Online courses are classes delivered over the internet to students who are not located in the same physical location. There are several types of distance education courses such as hybrid

classes, TV broadcasts, and paper modular' s (Tallent-Runnels, Thomas, Lan, & Cooper, 2006, p.93). Distance education has helped meet the intense demand for higher education, cut education costs for both universities and students, and allowed individuals to return to school that otherwise would never have the opportunity to do so. Online education is also helping to meet the growing health professional workforce demand (Mokwena et al, 2007; RHlhub, 2015).

Distance education has not been without growing pains and criticism. "Numerous debates have arisen concerning the credibility, quality, and consequences of these programs in higher education" (Adams & DeFleur, 2006, p.33). However, the educational quality of distance learning and its instruction is not the focus of this research. Instead, the focus of this research is on the perceptions of administrators on hiring faculty members with online and blended doctoral degrees for faculty positions at accredited universities and their general perceptions of online education.

Students graduating with online degrees expect that their degree will help them advance in their career or open doors for a new job. Students spend thousands of dollars on their education and educational cost is rising faster than the cost of health care (Hyman, 2012). As of 2012, student debt passed the one-trillion dollar line (Hyman, 2012). Research, on the other hand, suggests that employers do not think highly of hiring someone with an online degree (Adams & DeFleur, 2006; DePriest, 2009; Redpath, 2012). In fact some "virtual institutions who advertise online education often claim that they are sure routes to employment, career advancement, raises in pay, and other job rewards" (Adams & DeFleur, 2006, p.33). Furthermore, according to the Kelderman (2013) the Obama administration wants to hold schools accountable for student employability and to require states to create more oversight over distance education programs (p.a25). Research is necessary on these claims due to the financial investment students contribute toward their education.

There is a large population of students enrolled in online courses; therefore, research needs to answer the question "how do prospective employers view online degree programs?" In particular, this study examined the perceptions of academic administrators involved in the hiring process of prospective faculty members who have earned online doctoral degrees.

Do administrators perceive online and blended doctoral degrees negatively and have perceptions of these programs improved? According to Allen and Seaman (2008), "...academic leaders do not believe that there is a lack of acceptance of online degrees by potential employers" (p.3). However, previous research by Adams and DeFleur (2005, 2006) and DePriest (2009) show that employers do not have a high acceptance of online degrees and employers prefer to hire applicants with a traditional degree. DePriest (2009) research included academic leaders in the employers surveyed. In his research Fischer (2013), provides research on the types of colleges employers prefer; he found that most institutions preferred anything but online degree programs. Academic leaders give conflicting answers about online and blended doctoral degrees. Perceptions of academic leaders require more research related to online and

blended education. Employer perceptions require exploration due to the lack of in-depth qualitative research on the perceptions of online and blended programs.

Rarely is the decision to hire a prospective faculty member made by one administrator alone. Committees tend to make hiring decisions or by agreement in department level group meetings. For that reason, it is important to discover the perceptions of both deans and chairpersons when possible. "Hiring committees are designed to be objective. They are comprised of individuals who possess unique expertise within their fields" (Simplicio, 2007, p.258). Administrators have the final say in hiring decisions but they tend to follow the choice of department chairpersons who lead committees.

Purpose

The purpose of this phenomenological study was to discover the current perceptions of university administrators regarding prospective faculty candidates with online or blended doctorate degrees from accredited institutions located in Virginia.

Method

This study was conducted using a transcendental phenomenological research method. There have been few quantitative studies on the acceptability of online programs using surveys; however, there has been limited qualitative research on the topic. The transcendental phenomenological approach gave a fresh in-depth perspective on administrators' view of online and blended programs. The study helped discover other factors in addition to the method of degree completion that may influence hiring decisions of administrators. A qualitative method was chosen over a quantitative method to explore the topic deeper and because current perceptions were unknown due to conflicting research. A survey method does not capture the thought process of hiring managers nor does it take into consideration all of the possible factors that influence administrators.

According to Moustakas (1994) phenomenological research requires Epoche, phenomenological reduction, textural description, imaginative variation, structural description, synthesis of meanings and essences of the experience. The purpose of Epoche is to put aside prejudgments and hold interviews with an open mind that encourages the participant to describe the essence fully. By providing the researcher's role in the research and using open ended questions in the interview, the researcher attempt to fully embrace the essence of Epoche. Phenomenological reduction is accomplished by bracketing questions around the topic of online and blended doctorate degrees. The research questions and interview questions are very general and open to discover a fresh perspective on the topic. Imaginative variation was explored by obtaining various perspectives of the phenomenon from different administrators at different types of academic institutions such as private, public, and religious. Possible meanings were grouped together and a list of constructs were created based on experiences. With the comprised

information, structural descriptions will be created. Lastly, information was synthesized through reflection, textual and structural meanings and essences of the experience.

Research Questions

1. What perceptions do academic administrators have of online doctoral degrees?
2. What type of influence does the university from which the prospective faculty member earns their online doctorate degree influence hiring decisions?
3. What type of influence does the university from which the prospective faculty member earns their blended doctorate degree influence hiring decisions?
4. Does the method of doctorate degree completion influence administrative perceptions during the candidate hiring process?

Participants

Using purposive sampling, participants included chairpersons and/or deans at four year accredited institutions from public, private, and private religious institutions within the Commonwealth of Virginia. The sample included different types of institutions, such as private, public, and private religious academic institutions to gain a well-rounded perspective and to determine if the different perceptions over institution type. Participants included at least one dean or chairpersons from both departments/colleges of health sciences and department/college of education. The reason for the purposive sampling was to focus on individuals who had both experience in hiring faculty members and at least a basic knowledge of online and blended doctoral degrees. The schools selected in the sample were based on convenience of location and whether there is a department/college of health sciences and a department/college of education. Due to the nature of qualitative research, pseudonyms were provided for the academic institutions and the individuals interviewed.

The logic behind interviewing chairpersons and/or deans of departments/colleges of health sciences and department/college of education was that in 2008-09 the “greatest number of degrees were conferred at the doctoral level were in the fields of health professions and related clinical sciences (12,100) and education (9,000)” (Aud et al, 2011). Furthermore, according to the US Department of Education National Center for Education Statistics (2011), in 2008-09 9.7% of students were completing their entire post baccalaureate degree online in education and 9.1 in health. Given the popularity of these two fields of study, these areas provided an excellent starting point to understand perceptions of administrators regarding online and blended doctoral degrees. Twenty-four interviews were attempted with eight derived from each type of university, divided between the two departments/colleges of health sciences and education.

Data Collection and Management

Three methods of data collection were used in this study: interviews, documentation, and a survey adapted from DePriest (2009) who adapted it from Levernier (2005). Three methods of data collection were used based on the work of Erlandson, Harris, Skipper, and Allen (1993), who wrote that “the interview provides leads for the researcher’s observations. Observation

suggests probes for interviews. The interaction of the two sources of data not only enriches them both, but also provides a basis for analysis that would be impossible with only one source” (p.99). Furthermore, using three different methods of data collection to create triangulation strengthens any shortcomings that one method alone may have possessed (Guba & Lincoln, 1989; Brewer & Hunter, 1989).

Interviews

Interviewing is an important part of phenomenological study and is typically the primary form of data collection (Moustakas, 1994; Bogdan & Biklen, 2007). Interviews were held in a semi-structured format with the following open-ended questions listed below presented. Interviews were still conversational and flexible based on Moustakas (1994) who writes that “...phenomenological interview involves an informal, interactive process and utilizes open-ended comments and questions (p.114).

To understand the perceptions of degree completion method there must be some understanding of the faculty candidate search and the hiring process hence the questions regarding the hiring process. Questions related to the perceptions of degree completion method were based on the purpose of the study, which was to discover perceptions of administrators regarding online and blended doctorates. Understanding how the participant defined online and blended education could reveal if he or she had a clear understanding of the education model. This information may be helpful when synthesizing data to discover why participants may hold a certain view concerning online doctoral degrees. This was also true of the experiences he or she had dealing with online and blended programs.

It is important to note as well that the interview questions were piloted prior to the formal interviews. A peer reviewed the questions for possible revisions and refinement, and then two pilot interviews were conducted. Afterwards, changes were made, as needed, and one more peer review and pilot were conducted to finalize the questions.

Documentation

Bogdan and Biklen (2007) write that documentation is an important part of qualitative research and can include many different things. Documents that were collected included:

- list of interview questions typically used to ask candidates if available
- forms used to evaluate candidates if available
- profiles for each institution from their website
- professional development/continuing education policy if available
- equal opportunity or diversity statement

Administrators may not have been able to provide all of the documents, depending on their creation or the institution’s policy. However, many of the documents collected were considered public knowledge and were available on the intuitions website.

Surveys/Questionnaires

The purpose of this study was to give in-depth data about participants' perceptions about online and blended doctoral degrees. Surveys provided objective, quantifiable data that could be replicated but did not give in-depth information on participant's feelings and thoughts. However, the survey provided demographic information about the participants', the institution, and the college/school or division/department. Therefore, a modified version of the survey used by DePriest (2009), who adapted it from Levernier (2005), who modified the original survey created by Schmidt, Shelley, Van Wart, Clayton, & Schreck (2000) was used. Survey parts one and three of the survey were used to discover what, if any, online or blended classes and degrees were offered, with the institution, college/school or division/department and demographic information about the participant and institution.

DePreist (2009) validated the instrument using faculty members experienced in research methods and measurement to check both the face and content of the survey.

In addition, the Deans of Arts and Sciences, Education, and Business at a local community college provided assistance in validating the instrument. These administrators reviewed the questions for content and clarity and then completed a pilot survey in order to suggest any needed changes to the survey instrument and to assist in ascertaining instrument validity (DePreist, 2009, p.69).

Data Analysis

Moustakas (1994) transcendental phenomenological research design was used in this study and Moustakas modification of the Stevick-Colaizzi-Keen method of analysis was used to analyze the phenomenological data. A full description of the researcher's experience with the phenomenon were obtained from the audit trail, memoing, and documentation. A verbatim transcript of the experience of each participant was used to fully describe their experience of the phenomenon. All relevant statements were recorded and a list of non-repetitive statements was created from it. That created mean units of the experience of invariant horizons, which was created into themes. These themes were synthesized into a description of the textures of the experience with verbatim examples. Reflecting on the textural description and using imaginative variation, a description of the structures was constructed. Lastly, a textural-structural description of the meanings and essences of each individual was created. This led to a "composite textural-structural description of meanings and essences of the experience integrating all the information to describe the experience representing the group as a whole" (Moustakas, 1994, p.122).

Trustworthiness

To establish trustworthiness the following methods were used: triangulation of data, rich descriptive data, peer review, audit trail, member checking, epoche, and clarification of biases from the outset. Guba (1981) describes four general criteria for establishing trustworthiness: credibility, transferability, dependability, and conformability. Using triangulation and peer

examination both credibility and dependability could be shown. Triangulation also shows conformability. Lastly, rich descriptive data allow for the research to be transferable.

Triangulation

Triangulation is the use of multiple sources of information to establish trustworthiness in research and develop converging lines of inquiry (Yin, 2009). There are four types of triangulation that can be used: triangulation of data sources; investigator triangulation which uses different evaluators, theory triangulation, and methodological triangulation (Yin, 2009, p.116). In this study data triangulation was used by collecting data using interviews, document analysis when available, and survey. Investigator triangulation was used in that interview questions were peer reviewed and the research process monitored by three committee members and a research consultant. Lastly, theory triangulation has been used in that various distance education theories were reviewed until one was found that gives a complete picture of the current state of what has become online education, equivalency theory.

Transferability

Transferability was addressed by using thick descriptive data (Creswell, 2007; Moustakes, 1994; Schwandt, Lincoln & Guba, 2007; Yin, 2009). Both textual and structural descriptions were used to describe the researchers experience, themes, and the underlying dynamics of the experience of the members (Moustakes, 1994). The structural description was based on the textual.

Dependability and Confirmability

Schwandt, Lincoln, and Guba (2007) write that dependability and confirmability need both an audit trail and ongoing external auditing. The audit trail consisted of a chronological narrative of research activities and how the information evolved into the current analysis. Peer review and member checks served as the ongoing external audit, as well as accountability. (Creswell, 2007) In summary, credibility was established by using prolonged engagement through interviews, triangulation of data, peer debriefing, and member checks (Schwandt, Lincoln, & Guba, 2007). Transferability was established using rich and thick descriptions. An audit trail, member checks, and peer review were used for dependability, confirmability, and accountability.

Ethical Considerations

Participants' confidentiality and privacy were protected by keeping all information in locked cabinets within a locked office along with all electronic data being password protected. IRB approval was gained before contacting participants. A pseudonym was used for the participant's institution and for himself or herself that he or she will be able to choose. Participants were asked to sign an informed consent form after reading through the form and asking any questions. Participants were given the opportunity to check assumptions made from the interview and information provided to give feedback on results.

Discussion

Using this study alone it is difficult to make generalizations about the acceptances of online and blended education within the entire state of Virginia or the United States of America. Thirty-one institutions were contacted for permission to interview chairs and deans with only eight college presidents giving permission to approach faculty for interviews. From those eight institutions 25 people were contacted on several occasions from May 2013-October 2013 resulting in ten returned surveys and six interviews. Potential participants were contacted by letter, email, and phone. The interview participation rate was 20%.

Six people were interviewed, three women and three men. Each participant was over the age of forty with over twenty years of experience in education. Participants worked in a department, school, or college of health sciences. Every participant interviewed worked in a health-related discipline. Two participants who worked in a school of education did turn in the survey but did not agree to an interview.

Hiring process

Participants were asked six open ended questions related to their hiring process. The hiring process among the six interviewed participants was consistent. All of the institutions had a standardized application process and equal opportunity statements. One participant from a public institution stated that all government-funded institutions must follow certain guidelines when making hiring decisions. The Human Resources Department played a role in making sure fair hiring practices were followed. One example of the standardization of the application process was that all the applicants had to be asked the same questions. Participants stated that they created open-ended questions so applicants could provide additional information if they wanted to in order to make themselves stand out.

The application process required submission of an application, cover letter, references, original transcripts, teaching philosophy, vita, background check, and a series of interviews if approved. Knowledge of the hiring process was important for this study because applicants are typically vetted well before they reach the stage of background checks and initial interviews. If applicants were sorted based on degree method early in the application process then then separation would have answered the research questions to a degree. Participants also shared typical interview questions they asked which revealed more of a concern about research and teaching experience than degree method. Two participants did state that if the candidate completed an online or blended doctorate degree they would ask why they chose that method. Education is a field that requires public speaking and strong communication skills. If an online doctorate degree were pursued over a residential degree in order to avoid addressing those areas, then the applicant would not be the best candidate for a full-time faculty position.

Defining online and blended education

Online and blended education has change greatly over the last fifty years. Some people do not understand what online and blended education is and how those two areas are currently defined. Understanding how the participant defined online and blended education could reveal if he/she had a clear understanding of that medium of education and what experiences they had with it. According to the latest definitions by the Sloan Consortium online education is a course where 80% or more of the content is delivered online (Allen & Seaman, 2013). Blended, also called hybrid, education was defined as 30-70% of content delivered online (Allen & Seaman, 2013). What was interesting to note was that traditional education was defined as having no online technology used. Based on interviews, none of the participants' institutions had a course that fit the traditional definition. Instead, courses they referred to as "traditional" were web-facilitated, meaning that they used technology to facilitate some information, and used a course management system to post syllabi and grades. A web-facilitated course is any that offers 1-29% of content online (Allen & Seaman, 2013).

The participants used the terms "blended", "hybrid", and "web-facilitated" interchangeably, unaware of the differences between a traditional course and a web-facilitated course. This observation was very significant because it brought up the question "Are there any traditional courses or degrees being offered at the college level today?" For the six participants interviewed, the answer was no.

Influence of degree method and institution

There did not appear to be any automatic removal from the applicant pile based on degree completion method. There was a slight bias toward blended doctoral degrees by one participant, Steve, due to the experience an applicant would have in both learning formats. The fourth research question asked whether the method of doctorate degree completion influenced administrative perceptions during the candidate hiring process. Based on the results of the interviews and the surveys, administrators who were somewhat familiar with online and blended education did not have a bias against it. Some who had blended degrees might even be more likely to hire someone with a familiar degree method. Based on research by Rivera (2012) hiring is more than an issue of skills; people tend to hire employees who are culturally similar to themselves, which would include experiences such as education. As more candidates flood the job market with online and blended doctoral degrees and gain employment in positions of authority, the issue of degree method will fade away. As the participant referred to as David said in his interview, there will come a time when people will wonder why the question of the acceptability of online degrees was ever asked. Online and blended education is quickly becoming the norm with a new method of learning on the horizon: MOOCs.

Some participants stated that where applicants went to school did influence their hiring decision. An institutions academic reputation and for-profit status mattered. Another issue related to the institution was whether it was considered a teaching focused or research-focused

institution. This was only expressed by one participant, David, who was the administrator at a research focused institution. Three participants mentioned that school reputation was an influencing factor. The survey results also showed that when hiring for a faculty position, administrators would choose a candidate with an online doctorate completed at a known traditional school over an online only university. Stenstrom, Curtis, and Iyer (2013) found in their research that university and, in particular, department ranking, was the strongest predictor of employment after completing a doctorate degree. Their research supports the findings here that institution reputation does matter. Between the results from this study and the study by Stenstrom et al (2013) people considering a doctoral program should be more concerned about picking an institution with a positive reputation for their department of study than fearful of pursuing an online or blended degree.

Strengths of online and blended education

The strengths addressed by the participants can be divided into two different categories: benefits for students and benefits for faculty. Benefits for students included, convenience, also referred to as flexible; affordable; superior to lecture courses; holds students more accountable for participation; helps introvert students find a voice; and the consistent format of online content. The strengths of online education from the faculty side were that participants stated they were able to reach more students than they would just teaching in the traditional classroom.

There is quite a bit of research on the benefits of online and blended education from both the student and faculty perspective that support the results from the interviews. Brown (2012) found in survey results given over a four-year period that students preferred online education because it was a way to work their education into their lives while still maintaining time at work and with family. Even instructor's responded to the survey as finding online education more flexible, even though it required daily, reliable internet access to stay connected to students.

Participants stated that online education was more affordable for students. Taking online classes makes the cost of living on campus a nonissue and allows students to make an income while working on a degree. However, research on the topic states that the "optimism about online learning reducing the price of college is premature" (Casement, 2013, p.18). Many universities charge more for online classes or include technology fees for online classes (Casement, 2013; Post, 2010; Parker, 2012; Poulin, 2012). In a survey by the Adult College Completion Network and the Campus Computing Project, the results indicated that 63 % of all institutions charged the same amount for online classes with 29 % charging more for online classes, and only about seven percent charging less (Poulin, 2012). The perception is that online education saves students money, but the reality appears to be different.

There have been numerous research studies comparing online and blended education to traditional courses. An entire book series could be dedicated to the topic. Some of the research was addressed in chapter two herein. Based on the results of the current research, it can be

concluded that online students perform modestly better or equal to their traditional student counterparts (Allen & Seaman, 2010; Brown, 2012; Means et al, 2010; Mgutshini, 2013; Redpath, 2012). Mgutshini (2013) found, “a multifactorial comparison shows online students to have comparable educational success and that, in terms of student satisfaction, online learners reported more satisfaction with their learning experience than their campus-based counterparts” (p.1). All of the participants have years of experience teaching online and in the classroom. Their conclusions that online courses are superior to lecture courses fit with the results of current research. They also bring a new element to the table by pointing out how the online environment makes it easier to hold students accountable for participation and helps introverted students find a voice.

Last, faculty found being able to reach more students globally as beneficial to online education. Traditional courses require students to be physically present for long periods of time in a classroom. These classrooms tend to be located within universities or at satellite locations. Online education can reach any student who has access to the internet. Colleges, such as Pennsylvania State University and Liberty University connected outreach programs with their online education programs, reaching thousands of students worldwide.

Concerns of online and blended education

Concerns about online and blended education are well documented in the research literature. It is significant to note that some of the original concerns about online and blended education when it was in its infancy were not mentioned as a concern during the interviews. Such concerns included whether or not students learned equally well online as their residential counterparts. Another issue used to be the quality of online degrees versus residential degrees. These concerns are still present in research but the question is being asked less frequently. Instead, participants were concerned about accreditation, lack of career advice, replication of residential learning outcomes, development of social and professional development skills, and consumption of faculty time. Participants also voiced concerns about the amount of time faculty spend teaching online courses.

In the annual Sloan Consortium online education report, 2,800 colleges and university chief academic officers were surveyed (Allen & Seaman, 2013). In the report, some of the concerns about online education were addressed such as “does it take more faculty time and effort to teach online and are learning outcomes in online comparable to face-to-face?” (Allen & Seaman, 2013, p.5). According to the current concerns cited “academic leaders believe it takes more faculty time and effort to teach online” a concern that has increased from 41.4 % in 2006 to 44.6 % in 2013 (Allen & Seaman, 2013, p.5). As supported by the interviews there is concern that online teaching is taking more time. This leads to the need for faculty to have strong time management skills and know when to let the steady stream of student requests wait until the following day.

The second area the Sloan Consortium report addressed was the question of online instruction being comparable to face-to-face instruction. The participants interviewed stated that they had no doubt those online students learned and earned their degrees, which were comparable to residential degrees. Their concerns were that learning outcomes were replicated in the online and blended courses. Allen and Seaman (2013) found that an overwhelming number, 77 % thought “learning outcomes in online education are the same or superior to those in face-to-face” settings (p.5). That is a 20 % jump over the last ten years.

The concerns over the lack of career advice students receive and the development of social and professional skills through graduate professional development were concerns that did not appear in other research. The Distance Education Advising Commission of NACADA is committed to helping people learn how to respond to learner needs as it relates to academic advising. Accrediting bodies such as the Council of Education for Public Health and the Southern Association of Colleges and Schools ask the question how and who advises students. However, there does appear to be a concern on how and if this advising is reaching the online students.

Last, there was a concern of how faculty candidates with online degrees have pursued professional development in their field. This appears to be a new concern with no research on the topic. In the academic field where conference presentations, publication, and new discoveries are highly prized activities, the results of this research would suggest all faculty candidates pursue these activities whether or not they are encouraged in the online learning environment. Administrators of online and blended programs should also consider how to encourage the same professional development of their online students that they do with their residential students.

Future role of online and blended education

The future of online and blended education appears bright with more room for growth. Joyce said it well when she stated that the traditional degree would never be the same. Online education is here to stay. Allen and Seaman (2014) found that out of 2,800 colleges surveyed only one percent stated it was not likely that a student would be taking at least one online course in the next five years (p.20).

One participant, David, brought up the topic of MOOC’s. The effect MOOC’s will have on education remains to be seen. Long (2013) reviewed how MOOC’s were changing education and throughout the article, referred to MOOCs as simply online education. There is a fear that MOOC’s will put higher education programs out of business along with how to make it self-sustaining. Five years ago, the world did not know what a MOOC was but now it is hard to talk about online education without addressing the new delivery method. MOOC’s have the potential to change education the same way that online, blended, hybrid, and WebEx has changed education. Since the fall of 2013 there have been almost weekly articles in the Chronicle of Higher Education related to MOOC’s and if it is here to stay.

Summary

The results of the present study revealed implications that might be useful to future doctoral students, faculty pursuing tenure or promotion, and administrators deciding on doctoral degree offering methods. The most profound implication from this study is that administrator's perception of online and blended degrees do appear to be improving. Previous research has shown employers to have negative attitudes toward online degrees and an overwhelming preference for traditional degrees (Adams, 2008; Adams & Defleur, 2005, 2006; Adams, Lee, Cortese, 2012; Kinneer, 2013; Richardson, McLeod, Dikekers, 2011; Kohlmeyer, Seese, & Sincich, 2011). Yet, according to recent research, employer perceptions of online degrees are growing more positive (Chant, 2013; Linardopoulos, 2012; Wecker, 2012; Wellen, 2006). But as Chant (2013) pointed out the perception of online programs has not kept pace with its prevalence. However, the continued growth of online education makes it difficult for employers to dismiss candidates with online degrees.

The second implication is that participants appear to have a slight preference for faculty candidates with a blended or hybrid degree. The blended degree gives candidates experience in both online educational methods and residential educational methods. In Public Agenda's (2013) survey of attitudes of students and employer toward online education 82% of employers felt "hybrid programs gave students a better education than online-only programs" (p.5). Given the choice, administrators who are considering offering a program online, should consider requiring a residential component or at least providing the option of a residential component.

The third implication circles back to equivalency theory. As stated in the literature review, equivalency theory is the concept that online education should strive for equivalency with residential education to the point that regardless of how information is presented or in what format or location the learning outcomes and experiences are equivalent. Research has shown that students are learning just as well in the online environment as the residential environment (Allen & Seaman, 2010; Brown, 2012; LaMeres & Plumb, 2013; Means, Toyama, Murphy, Bakia, & Jones, 2010). If this is the case then employment opportunities should also be the equivalent no matter the degree method. Attitudes and perceptions should also be equivalent regarding online, blended, and residential education. If there is not equivalency then there is a bias that doctoral seeking students should be aware of before choosing a format of study.

Conclusion

Many of the findings in this study were consistent with and confirmed previous quantitative and qualitative research, such as the growth of online and blended education and the growing acceptances of online and blended doctorate degrees (Allen, Seaman, & Sloan, 2006, 2007, 2008, 2010, 2011, 2013, 2014; Garrett, 2010; Mooney, 2010; Sener, 2010). Despite the small sample size there was consistency among the participants regarding their perceptions of online and blended education. There was even a slight preference of candidates with a blended

doctorate degree due to their experience with both online education and residential course work. However, there were still lingering concerns about candidates with online-only doctoral degrees.

Existing research was used to validate the need for this study and to compare the findings of this phenomenological study to those within the review of literature. The textural and structural descriptions of the perceptions of university administrators were unique. These descriptions gave this researcher a complete view of the participants' understanding of online and blended education, along with how it affects their hiring decisions for full time doctorate level faculty positions. Specifically, the current research differs from others in the methods and procedures, allowing for understanding of the essences that described the administrators' perceptions and experience with online and blended education. The current study did not merely use a survey to judge opinions of online and blended education. Instead, the phenomenological method allowed for understanding of why participants would hire a candidate with a blended degree over an online or traditional degree. It gave a picture of educational administrators past and current thoughts regarding online and blended education as well as their predictions for the future.

The results of this research can help guide students who are considering which method of educational study pursue. If an individual has career goals that include a full time faculty position it may be beneficial to seek out a blended doctoral program. Despite overwhelming research, that shows online students have comparable educational success to their traditional counterparts there are still concerns. These concerns could result in candidates with a blended or traditional degree having better chances of achieving full time faculty employment. Furthermore, participants in this study preferred someone from a blended degree because it gave the candidate experience in both worlds. Educators are reaching a point in education where new professors are required to be a skilled classroom professor as well as a skilled online professor. Educators still value other skills, such as ongoing professional development, research, and publications.

Colleges that are considering expanding their current educational programs should consider the advantages and disadvantages that various degree methods would have on student employment. The conveniences of a completely online degree are great for students however, long-term negative career impacts should be considered. The more graduates who find successful employment the more attractive a college will appear to degree seeking students.

Recommendations

The current study should be expanded to include other academic areas to see if the findings are consistent across disciplines. Further studies could also benefit from tracking people seeking faculty employment who have completed doctorate degrees online or in a blended format. Due

to the lack of generalization to the whole population, future research should expand to a national or regional level.

Due to the low number of participants in this study, this study can be used as a pilot study to create a survey based on the themes revealed. That survey could then be sent out to a variety of academic administrators that could provide a sample large enough to make generalizations related to the whole population. It would also provide quantitative data on the topic.

Technology changes quickly and it has been changing and influencing education for generations. Some of the participants mentioned Massive Open Online Courses (MOOC's) as the wave of the future. Others stated that online and blended education would become the norm. It would be beneficial research to see if other administrators shared these views and what they see for the future of education.

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Using family-based experiential learning to improve nutrition knowledge, dietary intake, physical activity, and food purchasing behaviors among Northern Virginia Latina WIC participants and their children: A pilot study.

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ABSTRACT

Objective: To examine the impact of a family-based nutrition education program on nutrition knowledge, diet, physical activity, and food purchasing behaviors of Latina mothers and children participating in Northern Virginia Women, Infant, Children (WIC) programs.

Methods: Surveys were administered to mothers (n=15) using a pre-test/post-test design. The family-based nutrition intervention included 1) Discussion and lecture on food labels, food purchasing, portion sizes, and healthy meals, 2) Experiential learning focused on preparation and storage of low-cost, healthy meals incorporating WIC foods, and 3) A Zumba class and discussion on physical activity.

Results: The data revealed improved diet such that mothers reported increased fruit and vegetable consumption, decreased juice consumption among their children. Mothers reported their children were more physically active. Further, mothers prepared more meals at home using raw ingredients.

Conclusions: The findings are significant in that they support growing literature of the success of family based interventions. Further, these data show the importance of integrating experiential learning activities such as cooking and physical activity with the more traditional didactic methods.

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PURPOSE:

Causes related to childhood obesity involve interactions among multiple factors that can shape daily diet and physical activity behaviors. Such factors include personal (e.g., beliefs, attitudes, cultural experiences, taste preferences, and dietary composition), environmental (e.g., schools, community, healthcare, food access and availability), societal (e.g., cultural norms, foodways, social networks, economics, public policy) and as well as physiological (e.g. genetics and epigenetics) " (Schonfeld-Warden & Warden, 1997).

Childhood obesity has become a serious public health problem in the United States. The most recent data show that 31.7% of youth are overweight (Ogden, Carroll, Kit, & Flegal, 2014). Further, obesity rates have climbed in many states in the south including, the Commonwealth of Virginia, where childhood obesity 15.5% of children are overweight (National Conference of State Legislators, 2014). Those of particular risk include immigrant families and those of low socioeconomic status (Singh, Yu, & Kogan, 2013).

Researchers on childhood obesity suggest that prevention of overweight in the pre-school years should focus on parents, because parental beliefs, attitudes, perceptions and behaviors appear to contribute to children's development of excessive weight gain, (*Polfus and Fern, 2012*).

There is significant evidence that parental variables are instrumental in the development of obesity (Holland et al., 2014) and family-based behavioral interventions are the most widely studied type of intervention, with evidence of long-term success among 2 to 12 year- old children (Holland et al., 2014) (Davis et al., 2013). As such interventions have shown to be successful, this study aims to examine the effects of a family-based experiential learning on nutrition knowledge, dietary intake, physical activity, and food purchasing behaviors among Latina WIC participants and their children in the Fairfax Health District, Fairfax, County, Virginia.

Women Infants and Children (WIC) program in Fairfax Health District

The Fairfax County Health Department cares for the residents of Fairfax County, Fairfax City and the City of Falls Church with a total population of approximately 1.2 million people distributed over 395 square miles. There are nine Women Infants and Children (WIC) service delivery sites in The Fairfax Health District serving over 19,000 women infant and children, (54% children, 21% infants, 12% pregnant women, 9% breast feeding women, 4% postpartum women.). Fairfax County is one of the most diverse counties in the Commonwealth of Virginia and among the all the Fairfax County WIC clients, 50% speak Spanish, 43% speak English and 7% speak other languages such as Arabic, Urdu, Vietnamese, Farsi, Korean, and Amharic.

The prevalence of obese children (95th percentile) among the WIC population in Fairfax is 22%. The percent of children who are at risk for becoming overweight (85th to 95th percentile) is 11%, which is second highest in the state. Dietary assessments of WIC children suggest that the large consumption of sweetened fruit juices by 25% children between two to five years of age and inadequate intake of fruits and vegetables by 30 % of the children (U S D A , n . d .) contribute to the above obesity statistics.

In 1998, the U.S. Department of Agriculture (USDA) funded a childhood obesity prevention initiative called **Fit WIC**. The purpose of this initiative was to examine how the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) could better respond to the issue of childhood obesity. The Fairfax Health District was selected as a pilot site for this study. Lessons learned from this study are as follows:

- Parents did not perceive being overweight as problem for their preschool children. Parents were knowledgeable about WIC's health messages, but they struggled with how to put that knowledge into practice.
- WIC families receive conflicting health messages from health care providers related to children's weight.
- Parents lacked information about desirable activity levels for their families.
- WIC staff had concerns about addressing childhood obesity with their participants.
- Staff expressed a need for additional training on topics related to childhood obesity.

The FitWIC program spurred the need to develop a program which involved family and parents and was targeted at pre-school children. The findings described here are based on a pilot project nutrition intervention which addresses such a need.

METHODS

Participants:

The target population included Latina WIC mothers and their children between two years to five years of age.

A total of 93 WIC clients were invited to participate in the study and given preliminary interviews. The pilot study used pre-test/post-test design. A total of 13 participants responded to the pre-tests and post-tests, and attended both interventions from eight WIC delivery sites of Fairfax County WIC Program. Human Subjects approval was given by George Mason University.

Nutrition Intervention Program:

The family-based nutrition interventions included 1) Discussion and lecture on food labels, food purchasing, portion sizes, and healthy meals, 2) Experiential learning focused on preparation and storage of low-cost, healthy meals incorporating WIC foods, and 3) A Zumba class and discussion on physical activity. Two day-long nutrition intervention programs were held at the George Mason University Department of Nutrition & Food Studies Nutrition Kitchen located in Fairfax City, Virginia. The educational materials were developed and implemented by WIC nutrition staff and Faculty and students from the Department of Nutrition and Food Studies at George Mason University. Study participants continued to receive their WIC benefits as scheduled.

Data Collected:

Questionnaires were developed to assess nutrition knowledge and behaviors concerning dietary intake, food preparation, and physical activity. As part of the knowledge assessment, parents were asked to identify (i) general recommended intake levels (consume more, same or less) across food choices, (ii) added sugar content levels (high or low) across food choices, (iii) fiber content levels (high or low) across food choices and healthy food options across food choices provided. Parents were also asked to identify how strongly they agreed or disagreed with statements aimed at identifying perceived barriers to fruit and vegetable consumption among children. Pre-intervention questionnaires were administered between February and March 2013 while the post-intervention questionnaires were administered between May and July 2013.

Program Intervention Activities:

- Distribute pre-test questionnaires in the first intervention to establish baseline data.
- Provide education on food labels, food purchasing, food safety and preparation, portion sizes, and making healthy, culturally appropriate meals using WIC foods for the WIC families.
- Distribute a "Ready to Get Healthy" mini-kit. The kit included a cookbook using WIC foods, a CD for physical activity, and fresh fruits and vegetables.
- Conduct experiential learning and hands-on cooking activities to prepare WIC food-based recipes using the cookbook.

- Team up with Fairfax Parks and Recreation Department to highlight existing discount opportunities at the Fairfax REC centers and encourage program participant enrollment to the Fairfax Parks and Recreation facilities.
- Distribute post-test questionnaires to determine effectiveness of the program.

RESULTS

Study participants were predominantly of Hispanic White ethnicity and 73% of the interviews were conducted in the Spanish language. Over 90% of the parents who attended the education sessions were female (Table 1).

Table 1 Study participants' socio-demographic and health characteristics at pre-intervention¹

| | Parents | Children |
|-----------------------------|--------------|-------------|
| Age, years | 34.31 ± 6.20 | 3.10 ± 0.71 |
| Sex (%) | | |
| Male | 7 | 60 |
| Female | 93 | 40 |
| Race/Ethnicity (%) | | |
| Non-Hispanic White | 0 | 0 |
| Hispanic White | 87 | 87 |
| Black/African-American | 13 | 13 |
| Asian | 0 | 0 |
| Body weight categories* (%) | | |
| Healthy | 20 | 0 |
| Overweight | 27 | 27 |
| Obese | 53 | 73 |
| Perceived body size# (%) | | |
| Thin | 0 | 0 |
| Normal | 40 | 67 |
| Overweight | 47 | 33 |
| Extremely overweight | 13 | 0 |

¹n=15 at pre-intervention

*Body weight categories based on BMI for the parents and BMI-for-age percentiles for the children.

#Parents' perception of own body size and parents' perception of their child's body size

Forty percent of the target children were female. Approximately 80% of the parents were either overweight or obese based on their BMI while 73% of the children were obese. However only 50% of the parents perceived themselves as being overweight or extremely overweight and only 33% of the children were perceived as being overweight by their parents. All study participants had received WIC benefits for at least 2 years. Parents' knowledge of the general recommended food intake levels, added sugar content and fiber content increased over time (Table 2).

Table 2 Parent's knowledge levels at pre- and post-intervention^{1,2}

| | Pre-intervention | | Post-intervention | |
|--|------------------|--------|-------------------|--------|
| | Mean \pm SD | Median | Mean \pm SD | Median |
| Recommended intake: more, same vs less | 68 \pm 34 | 83 | 84 \pm 15 | 83 |
| Added sugar content: low vs high | 53 \pm 36 | 50 | 71 \pm 13 | 66 |
| Fiber content: high vs low | 49 \pm 22 | 63 | 61 \pm 14 | 63 |
| Healthy food choices | 54 \pm 22 | 58 | 51 \pm 12 | 50 |

¹n=15 at pre-intervention, n=13 at post-intervention

²Reported values presented are percent of correctly answered questions

Percent of children who consumed fruits at least 3 times per day increased from 47% at pre-intervention to 77% at post-baseline (Table 3).

Table 3 Dietary and physical activity-related practices among children¹

| | Children | | Parents | |
|-------------------------------|------------------|-------------------|------------------|-------------------|
| | Pre-intervention | Post-intervention | Pre-intervention | Post-intervention |
| Daily fruit intake (%): | | | | |
| At least 3 times | 47 | 77 | 33 | 31 |
| At least 2 times | 93 | 100 | 80 | 77 |
| Daily vegetable intake (%): | | | | |
| At least 3 times | 20 | 23 | 13 | 15 |
| At least 2 times | 60 | 77 | 40 | 62 |
| Daily fruit juice intake (%): | | | | |
| At least 16 fl. oz. | 20 | 8 | 7 | 0 |
| At least 8 fl. oz. | 60 | 46 | 53 | 62 |
| Daily water intake (%): | | | | |
| At least 16 fl. oz. | 53 | 46 | 73 | 62 |
| At least 8 fl. oz. | 100 | 92 | 93 | 85 |
| Daily milk intake (%): | | | | |
| At least 16 fl. oz. | 47 | 31 | - | - |
| At least 8 fl. oz. | 100 | 100 | - | - |
| Type of milk consumed (%): | | | | |
| Whole milk | 0 | 0 | 7 | 0 |
| 2% fat or whole milk | 87 | 54 | 80 | 62 |
| 1% milk or other milk | 20 | 38 | 20 | 39 |
| Restaurant food intake (%) | | | | |
| At least 3 times per week | 13 | 8 | - | - |

| | | | | |
|-----------------------------------|----|-----|----|----|
| At least 1 time per week | 73 | 77 | - | - |
| None | 27 | 23 | - | - |
| Home-cooked meals (%) | | | | |
| At least 7 times per week | 80 | 85 | - | - |
| At least 3 times per week | 86 | 92 | - | - |
| None | 7 | 8 | - | - |
| Screen time (%): | | | | |
| At most 2 hours per day | 87 | 85 | 67 | 77 |
| None | 7 | 0 | 7 | 15 |
| Play time (%) | | | | |
| At least 5 hours per week | 53 | 69 | 7 | 8 |
| At least 4 hours per week | 53 | 85 | 27 | 46 |
| None | 0 | 0 | 13 | 15 |
| Enrolled in Fairfax Partakes# (%) | 0 | 31* | - | - |

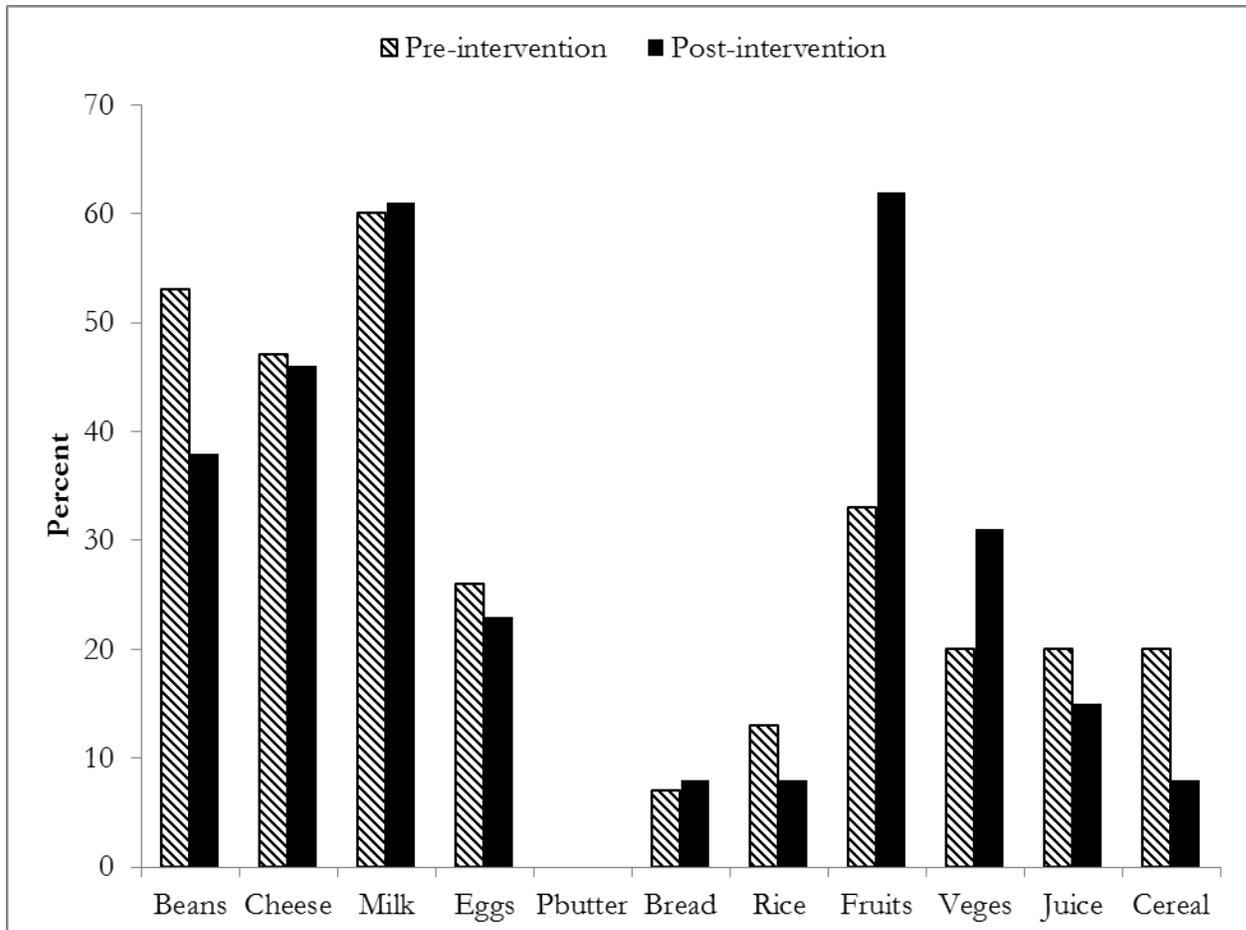
¹n=15 at pre-intervention, n=13 at post-intervention

#Fairfax Department of Parks and Recreation classes/activities

*Post-intervention estimate significantly different from pre-intervention estimate ($p < 0.05$)

Percent of children who consumed fruits at least 2 times per day increased from 60% at pre-intervention to 77% at post-baseline. Percent of children who consumed at least 8 fluid ounces of fruit juice decreased from 60% at pre-intervention to 46% at post-intervention. Percent of children who consumed 2-percent milk decreased from 87% to 54% while those that consumed 1-percent milk or plant-source milk (soy or almond milk) increased from 20 to 38%. Percent of children who consumed home-cooked meals at least 3 times a week increased from 36% to 92%. Prior to the intervention, a majority of parents had identified milk, beans and cheese as the three most frequently consumed foods by their children (Figure 1). Fruits, milk and cheese were identified as the most frequently consumed foods at post-intervention. The largest increase was noted in fruit and vegetables at post-baseline. About 30% and 20% of the parents had identified fruits and vegetables, respectively, as being most frequently consumed by the children at pre-intervention. These percentages increased to over 60% and 30% for fruits and vegetables respectively (Figure 1).

Figure 1 Most commonly-consumed WIC foods by the children enrolled in the Fairfax County WIC program



In terms of physical activity, there was no decrease in screen time. However, the percent of parents who reported at least 5 hours per week of children's play time increased from 53% to 69%. Additionally, the percent of children who were enrolled for the Fairfax County Parks and Recreation activities increased from 0% to 31% at post intervention (Table 3). Amongst the parents, there was an increase in consumption of vegetables, decreased consumption of 2-percent or full-fat milk accompanied by an increased consumption of 1-percent or plant-source milk (soy, almond). In terms of physical activity, there was an increase in percent of parents who reported zero hours or at most 2 hours of screen. And, percent of parents who reported at least 4 hours per week of physical activity time increased from 27% to 46% (Table 3). The percentage of parents who identified financial cost and short shelf-life as barriers to fruit and vegetable consumption among children was lower at post-intervention (Table 4).

Table 4 Perceived barriers to fruit and vegetable consumption among children^{1,2,3}

| | Pre-intervention | Post-intervention |
|---------------------------------------|------------------|-------------------|
| Cost too much (%): | | |
| Agree | 36 | 27 |
| Disagree | 36 | 60 |
| Spoil Easily (%): | | |
| Agree | 55 | 20 |
| Disagree | 27 | 33 |
| Too much time to prepare (%): | | |
| Agree | 9 | 27 |
| Disagree | 64 | 60 |
| They are too messy (%): | | |
| Agree | 0 | 13 |
| Disagree | 80 | 73 |
| Not filling enough (%): | | |
| Agree | 10 | 13 |
| Disagree | 60 | 47 |
| Child does not like them (%): | | |
| Agree | 10 | 40 |
| Disagree | 70 | 47 |
| Child has trouble digesting them (%): | | |
| Agree | 0 | 20 |
| Disagree | 70 | 73 |
| Restaurants do not serve them (%): | | |

| | | |
|----------|----|----|
| Agree | 10 | 33 |
| Disagree | 60 | 40 |

¹n=15 at pre-intervention, n=13 at post-intervention

²Reported values presented are percent of correctly answered questions

³Percentages do not add up to 100 because some participants selected “neutral” option in their responses

However, the percentage of parents who identified long preparation time, “messy handling”, child’s dislike of fruits and vegetables and “unavailability of fruits and vegetables at frequently-visited restaurants” increased at post-intervention.

DISCUSSION/CONCLUSION

Overall the WIC clients and children who participated in the WIC interventions improved their diets, shopping behaviors, cooking home-prepared foods, and physical activity. Mothers appeared to understand that eating and preparing foods at home is a healthier and less expensive option.

The interventions stressed nutrition knowledge particularly focused on obesity prevention and shopping tips which incorporated purchasing healthy, low-cost, WIC foods. The experiential component also allowed participants to prepare and taste foods which were consisted of WIC foods, were low cost, and high in nutrient density.

The findings are significant in that they support growing literature of the potential success of family-based interventions. Further, these data show the importance of integrating experiential learning activities such as cooking and physical activity with the more traditional didactic methods. We believe this program has great implications for continued interventions within the WIC program and other such communities with high rates of obesity and few resources. As cooking and preparing foods are not a typical part of the WIC nutrition education programs, such an intervention might provide a beneficial model for additional educational components.

This study also revealed that there might be a need within immigrant populations to provide education on how to purchase and prepare foods. For example, one anecdotal report involved a discussion on the purchasing and consumption of frozen vegetables. In this discussion, participants noted that in their home countries, frozen vegetables were very expensive and were never purchased. The intervention stressed the unit costs and showed that these kinds of vegetables can be cheaper in many cases and just as nutritious as fresh.

Limitations:

While, the findings suggested that the intervention program was effective, there were two major limitations to this pilot study. The first limitation concerned a low participation rate. Only 13 participants came to both interventions and completed the pre-tests and post-tests questionnaires. Participants were provided transportation and childcare, but the location of the interventions required many of the participants to spend an hour traveling to the site each way. Further, many participants worked on the weekends so were unable to attend. We also learned that there were some clients who were fearful to participate due to their immigration status.

The second limitation concerned language barriers. Most of the participants spoke Spanish and we were able to translate forms and interpret the information sessions into Spanish, however, with these extra steps, there may have been some fear or misunderstanding about the program.

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The Youth Risk Behavior Survey (YRBS): Evolution of the Survey and Development of Customized Forms

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Abstract

The Youth Risk Behavior Survey is an effective tool in surveillance of youth risk behaviors. Since 1991, Centers for Disease Control and Prevention have been a rich source of support for implementing the YRBS. CDC provides sample surveys, nation-wide data for comparison purposes, and many other resources designed for successful implementation of a YRBS. CDC YRBS have some limitations and implementing their versions of the surveys might be problematic for some communities so it is common to see customization of the CDC YRBS. This paper highlights a brief history of the YRBS, mobilizing the community for input into the YRBS and examples of questions for customizing YRBS.

Purpose

The leading causes of death in the United States have a strong relationship to health behaviors. Approximately 20% to 40% of the top five leading causes of death in the United States could be prevented through healthy lifestyles (Yoon, 2014).

As a result, it is important at regular intervals, to identify a population's health behaviors in order to better understand morbidity and mortality in a given community. Utilizing sound surveillance tools will help to understand the extent to which risk factors are present in the community but also a framework for allocating resources to deal with the factors.

A good example of a sound surveillance system is the Centers for Disease Control (CDC) Youth Risk Behavior Surveillance System (YRBSS). 1991 – 2015 almost 4 million high school students completed the high school YRBS.

The purpose of this paper is to provide a brief history of CDC YRBS, present questions that have been successfully used in a customized version and involving a coalition consisting of all sectors of the community in developing a customized version.

According to CDC The YRBSS was developed in 1990 *to monitor priority health risk behaviors that contribute markedly to the leading causes of death, disability, and social problems among youth and adults in the United States. These behaviors, often established during childhood and early adolescence, include: behaviors that contribute to unintentional injuries and violence; sexual behaviors related to unintended pregnancy and sexually transmitted infections, including HIV infection; alcohol and other drug use; tobacco use; unhealthy dietary behaviors; and inadequate physical activity*

(<http://www.cdc.gov/healthyyouth/data/yrbs/overview> htm)

The YRBSS was designed to: *determine the prevalence of health behaviors; assess whether health behaviors increase, decrease, or stay the same over time; examine the co-occurrence of health behaviors; provide comparable national, state, territorial, tribal, and local data; provide comparable data among subpopulations of youth; and monitor progress toward achieving the Healthy People objectives and other program indicators activity* (<http://www.cdc.gov/healthyyouth/data/yrbs/overview> htm)

The first CDC YRBS survey was designed for high school students only. In 1995 a middle school survey was made available. The original high school survey contained 75 questions. The breakdown of questions can be seen in Table 1.

Table 1: Distribution of Questions on the 1991 High School YRBS

| Topic | Number of Questions |
|-----------------------------|---------------------|
| | |
| Demographics | 5 |
| Safety | 8 |
| Weapons (carrying a weapon) | 2 |
| Violence | 3 |
| Suicide Ideation | 4 |
| Tobacco Use | 8 |
| Alcohol Use | 4 |
| Marijuana Use | 3 |
| Cocaine Use | 4 |
| Illegal Drug Use | 1 |
| Steroid Use | 1 |
| Injected Illegal Drug | 1 |
| Taught about AIDS/HIV | 2 |
| Sexuality | 8 |
| Told they had an STD | 1 |
| Weight | 4 |
| Diet | 7 |
| Physical Activity | 8 |

The most current (2017) High School YRBS includes 89 questions, eleven more than the original survey. The distribution of the 2015 YRBS can be seen in Table 2.

Table 2: Distribution of Questions on the 2017 High School YRBS

| Topic | Number of Questions |
|---|---------------------|
| Demographics | 5 |
| Height/Weight | 2 |
| Safety | 4 |
| Violence-Related Behaviors | 11 |
| Bullying | 2 |
| Depression and Suicide Ideation | 5 |
| Tobacco Use | 8 |
| Electronic Vapor Produce Use | 3 |
| Alcohol Use | 6 |
| Marijuana | 3 |
| Cocaine | 1 |
| Inhalant Use | 1 |
| Heroin Use | 1 |
| Methamphetamine Use | 1 |
| Ecstasy Use | 1 |
| Synthetic Marijuana Use | 1 |
| Steroid Use | 1 |
| Prescription Pain Medications | 1 |
| Injecting Illegal Drug | 1 |
| Injecting Illegal Drug on School Property | 1 |
| Sexual Behavior | 9 |
| Body Weight (Self-Perception) | 2 |
| Diet | 9 |
| Physical Activity | 5 |
| Concussions | 1 |
| Tested for HIV | 1 |
| Visiting a Dentist | 1 |
| Told by a Doctor or Nurse They had Asthma | 1 |
| Hours of Sleep per Night on School Nights | 1 |
| Grades in School (Self-Report) | 1 |

Customized Version

The CDC YRBS, while good, contains questions to which the answers may not be needed (e.g. During the past 7 days how many times did you eat carrots?) or does include important questions such as domestic violence, gang activities and prescription drug use. Further, the current CDC version does not include all the necessary questions to report on the CORE measures as required for many Drug-Free Communities grants. The CORE measures are 30-day use, perception of harm, perception of peer disapproval, and perception of parental disapproval for alcohol, tobacco, marijuana and prescription drugs. To that end, in cooperation with the Prevention Council of Roanoke County questions have been added that have both

met the CORE measure reporting requirements and well as collecting data on area/issues/behaviors deemed important by members of the data committee. These questions are related to violence, prescription drug use, physical activity, technology, bullying, parental disapproval and an expansion of questions related to substance abuse behaviors.

Violence-Related Questions

Have you ever been physically harmed (that caused a scar, black and blue marks, welts, bleeding or a broken bone) by someone in your family or someone living with you?

- A. Never
- B. Once
- C. 2 – 3 times
- D. 4 – 10 times
- E. More than 10 times

Have you ever seen or heard someone in your home being physically harmed (that caused a scar, black and blue marks, welts, bleeding or a broken bone)?

- A. Never
- B. Once
- C. 2 – 3 times
- D. 4 – 10 times
- E. More than 10 times

Are you aware of any gang activities in your school?

- A. Yes
- B. No

Have you ever been approached to join in gang activities?

- A. Yes
- B. No

Do you find yourself getting impatient immediately when things don't go your way?

- A. Yes
- B. No

Prescription Drug Questions

How much do you think people risk harming themselves (physically or in other ways) if they use prescription drugs to get high?

- A. Great risk
- B. Moderate risk
- C. Slight risk
- D. No risk

How wrong do your parents feel it would be for you to use prescription drugs to get high?

- A. Very wrong
- B. Wrong
- C. A little bit wrong
- D. Not wrong at all

How wrong do your friends feel it would be for you to use prescription drugs to get high?

- A. Very wrong
- B. Wrong
- C. A little bit wrong
- D. Not at all wrong

My family has clear rules about drug use.

- A. Yes
- B. No

Physical Activity Questions

During the past 12 months, on how many sports teams did you play? (Include any teams run by your school or community groups.)

- A. 0 teams
- B. 1 team
- C. 2 teams
- D. 3 or more teams

In the past 7 days, on how many days were you physically active for a total of at least 60 minutes per day? (Add up all the time you spent in any kind of physical activity that increased your heart rate and made you breathe hard some of the time.)

- A. 0 days
- B. 1 day
- C. 2 days
- D. 3 days
- E. 4 days
- F. 5 days
- G. 6 days
- H. 7 days

On an average school day, how many hours do you watch TV?

- A. I do not watch TV on an average school day
- B. Less than 1 hour per day
- C. 1 hour per day
- D. 2 hours per day
- E. 3 hours per day
- F. 4 hours per day
- G. 5 or more hours per day

On an average school day, how many hours do you play video or computer games or use a computer for something that is not school work? (Count time spent on things such as Xbox, PlayStation, an iPod, an iPad or other tablet, a Smartphone, or the Web.)

- A. I do not play video or computer games or use a computer for something that is not school work
- B. Less than 1 hour per day
- C. 1 hour per day
- D. 2 hours per day
- E. 3 hours per day
- F. 4 hours per day
- G. 5 or more hours per day

Technology Use Related Questions

I have a Facebook, twitter or other web based technology account that I use personally.

- A. Yes B. No

On an average weekday, how many hours do you spend texting, blogging, chatting, etc.?

- A. I do not text, blog, or chat with others on an average weekday.
- B. Less than 1 hour per day
- C. 1 hour per day
- D. 2 hours per day
- E. 3 hours per day
- F. 4 hours per day
- G. 5 or more hours per day

Have you ever received any threatening or intimidating communication online or through texting?

- A. I do not use either a computer or cell phone.
- B. I have never received threatening or intimidating communication online or through cell phones.
- C. Yes, Fewer than 5 times
- D. Yes, 5 times or more

Have you ever sent any threatening or intimidating communication online or through texting?

- A. I do not use either a computer or cell phone.
- B. I have never sent any communication online or through cell phones.
- C. Yes, Fewer than five times
- D. Yes, More than five times

Have you ever sent sexually inappropriate pictures or messages using a cell phone or computer?

- A. Yes B. No

Family and Community Risk and Protective Factors

Would your parents be nervous or upset if they knew what you do on the internet or via cell phone?

A. Yes B. No

In the past 30 days, have you texted while driving?

A. Yes

B. No

C. I do not drive

I feel very informed about using the internet safely.

A. Yes B. No

How wrong do your parents feel it would be for you to break the law (steal, property damage, vandalism, picking a fight)?

A. Very wrong

B. Wrong

C. A little bit wrong

D. Not wrong at all

There are many chances for students in my school to get involved in sports, clubs, and other school activities outside of class.

A. Yes B. No

The school (teachers, coaches, counselors, or principal) lets me and/or my parents know when I have done something well.

A. Yes B. No

I have one or more adults in my life (who are not my parents) who encourage and listen to me.

A. Yes B. No

Do you volunteer (help without getting paid) in your community (such as helping out at a hospital, day care center, food pantry, youth program, community service agency, or faith based program)?

A. No, I do not volunteer

B. Yes, Up to 1 hour per week

C. Yes, 2-10 hours per week

D. Yes, 11 or more hours per week

When I am not at home, one of my parents knows where I am and whom I am with.

A. Yes B. No

Would your parents know if you did not come home on time?

A. Yes B. No

Eating and Drinking Behavior Questions

During the past 7 days, how many times did all, or most, of your family living in your house eat a meal together?

- A. Never
- B. 1-2 times
- C. 3-4 times
- D. 5-6 times
- E. 7 times
- F. More than 7 times

During the past 7 days, how many times did you eat fruit or vegetables (fresh or frozen)? (Do not count fruit or vegetable juice.)

- A. I did not eat fruit or vegetables during the past 7 days
- B. 1 to 3 times during the past 7 days
- C. 4 to 6 times during the past 7 days
- D. 1 time per day
- E. 2 times per day
- F. 3 times per day
- G. 4 or more times per day

During the past 7 days, how many times did you drink a sugar sweetened beverage, such as regular soda, sweet tea, sweetened juice drinks, energy (such as Monster, Red Bull, RockStar) or sports drinks (such as PowerAde, Gatorade)?

- A. I did not drink any sugar sweetened drinks during the past 7 days
- B. 1 to 3 times during the past 7 days
- C. 4 to 6 times during the past 7 days
- D. 1 time per day
- E. 2 times per day
- F. 3 times per day
- G. 4 or more times per day

Discussion

The customized version of the YRBS provides for a number of things. First, the effort to customize the YRBS involves all stakeholders – school, community, and parents. Representatives from each of the sectors of the Coalition populate the Data Committee and help to revise the instrument. Second, the questions on the YRBS are up to date in that they are providing a data source for community-specific, important issues.

The way the data is reported can greatly increase the accessibility and usability for community partners. The creation of tables designed to compare national percentages and or previous data collections is relatively simple. The authors have found that comparison tables that include the number of participants responding to the specific question variable (e.g. those that indicated drug use) and percentages values are effective and give community partners talking points for presentations. From our experience, simple

comparisons are best for distribution to community members with cross tabulation tables by grade and gender included as appendices. This combination provided for easily consumable results for those who have less sophistication reading technical reports and enough data for those who need more information for projects such as grant applications.

Survey customization may add some issues of concern as to the validity and reliability of the altered or improvised content of the survey. Modified or added questions may lack compassion data so interpreting the results can be more difficult. The data provided by questions that are developed in community collations has consistently been timely and highly valued in the creation of intervention programs. From our experience, the concerns that may arise are offset by the valuable and timely result achieved by this process.

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Arsenic Contaminated Groundwater Has Serious Global Health Consequences

A Case Study from Bolivian Altiplano.

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Abstract

There are many countries throughout the world where the local population's water supply is exclusively obtained from groundwater and river discharge that is contaminated with arsenic. The Bolivian Altiplano which is a drainage basin within the Andes Mountains is an area of major concern; the arsenic levels are frequently well above The Environmental Protection Agency's and The World Health Organizations minimum guidelines. Consumption of arsenic contaminated water can lead to a variety of minor to major health concerns. Mountainous areas are prime locations for identifying significantly high concentrations of arsenic in groundwater due to mountain building processes within their geologic past. Within the mountainous areas, drainage basins where contaminated water coverages, aquifers that are composed of arsenic rich minerals and hydrothermal springs seem to be the locations of the greatest aquatic arsenic concentrations. There is a strong need for public and private opinion to move toward working together so that global and regional challenges can be met with the proper skillsets. It is important for scientist of all disciplines, health professionals, educators and public servants to combat the issue of contaminated well water so that prolonged risky exposure can be mitigated to prevent serious health implications.

Introduction

This case study was constructed with the purpose to examine a locality that suffers from arsenic (As) contaminated freshwater sources to develop site identification principles. These principles can be applied to under surveyed areas around the world so that resources can be effectively utilized. Additionally, within the United States the Environmental Protection Agency (EPA) and individual researchers have found that As is commonly found in groundwater throughout the country that exceed the EPA maximum guidelines ($10\mu\text{gL}^{-1}$) (Sorg et al, 2014). A potential problem area that has exceptionally limited data and is geologically conducive to extremely high As levels are the southern Appalachian Mountains that includes Western and Southwestern Virginia.

Arsenic (As) is a major health concern when it is found in drinking water because of its ability to cause havoc on the human body. Early signs of over exposure include a metallic taste and mild gastrointestinal symptoms. Prolonged consumption of arsenic at levels above the World Health Organization (WHO) guidelines ($10\mu\text{gL}^{-1}$) can result in neurotoxicity, cardiovascular disease, gastrointestinal disorders and cancer. Leukemia is the most common type of cancer that occurs from consumption of As contaminated water (Hall, 2002).

Global Scale

Throughout the world the amount of people that are currently affected by dangerous levels of As are totaled at 150 million and this is increased as new affected locations are discovered (Ormachea et al, 2016). Affected areas are found globally; noteworthy regions include Bangladesh, Cambodia, India, Nepal, Viet Nam, Argentina, Bolivia, Chile, Mexico and the United States (<http://www.who.int/bulletin/volumes/92/8/13-128496/en/>). For a global example of the seriousness of contaminated groundwater, Bangladesh has been an area of active research due to its tremendously high As levels found in groundwater that result in 24,000 adult fatalities yearly when concentrations are greater than $50\mu\text{gL}^{-1}$ (Flanagan et al, 2012). Groundwater contaminated with As is also an American problem. The EPA has sampled groundwater in the Northeast, Midwest and Western United States for As. The vast majority of wells sampled have returned As values above the EPA's guidelines (Sorg et al, 2014). One area of the United States that has been studied by researchers for over 15 years is the Northern Appalachian Mountains; the sample sites frequently fall between Northern Maine and Northern Pennsylvania. The majority of samples taken displayed elevated As levels that were over the EPA's guidelines and could possibly be hazardous to consume over long time periods. The highest As values found were located in the Newark Basin that measured $215\mu\text{gL}^{-1}$; The Newark Basin was the most southern sampled area recorded and it extends from New Jersey to Pennsylvania (Peters, 2008).

Arsenic in the Bolivia Altiplano:

More recently apprehensions have grown for populations in South America due to research that has found that affected areas are more wide spread than previously thought and that the As concentrations exceed the WHO guidelines ($10\mu\text{gL}^{-1}$) excessively (Ormachea et al, 2016).

This report has been constructed for the purpose of synthesizing more than a decade of geological and hydrological research to better understand the Bolivian Altiplano's water supply and its relationship to natural arsenic found in the ground and surface waters. This will be achieved by describing the regional geology, local climate and hydrological connections to naturally occurring As. The hydrological system will be analyzed in two parts. Water that is found in the hydrothermal environments and rivers, and groundwater used for human consumption and irrigation.

Regional Geology

The Andes Mountains stretch the length of South America; Bolivia is one of many countries that is home to a portion of the mountain range located in South America. Within Bolivia there are two separate portions of the range. These two ranges are differentiated by being named West and East Cordilleras. In the middle of the two parallel mountain ranges is the Altiplano or "high lands". The Altiplano is a depositional area that consists of lakes, rivers and salt flats that reach 3600 to 3900 meters above sea-level. The surface water is comprised of an endorheic system made up of mainly many small rivers that discharge into the Titicaca and Poopo Lakes. The Poopo Lake system is the site of interest for many hydrogeologist and geochemist due to its high level of As that have surface and subsurface sources (Ramos et al, 2014).

The geology surrounding the Altiplano is very complex because of a rich geological history. The two mentioned cordilleras formed under different geological conditions (Ormachea et al, 2013). The Western Cordillera is a young volcanic mountain range that is still very active and is comprised of metamorphic and igneous rock (Ormachea et al, 2016). The Western Cordillera's lithology formed from high pressure and heat caused by the active margin located on the western side of South America. Common minerals found along the western range formed by the orogeny and that reached Lake Poopo are sphalerite and galena. The Eastern Cordillera is comprised of sedimentary rock that has been folded and faulted throughout the thrust belt that reach 5000 meters above sea-level (Ramos et al, 2014). The Eastern Cordillera lithology includes Silurian and Ordovician sandstone, siltstones and quartzite. There are also Paleocene mudstones, limestones and sandstones located in the eastern range. Within the Altiplano lake, Pleistocene fluvial sediments are common. During periods of cyclical glaciation coarsening upward sequences that range from lake clays to large gravels were deposited and are now used as

modern aquifers inside the Altiplano. Most recently during the Holocene, unconsolidated alluvial and colluvial deposits transported from the mountain tops fill in the basin (Ormachea, et al, 2016).

Regional Climate

The area surrounding Lake Poopoo is categorized as a semi-arid climate that receives 300-400mm of rainfall per year. Maximum rainfall values are found to occur closer to the Eastern Cordillera. The majority of the precipitation transpires during the wet summer period that start in November and end usually in March. The wet period can accumulate up to 500mm of precipitation. The winters can be rather dry that extends from April to October that will produce only 250mm of rain. The average temperature for the Altiplano near Lake Poopo is 6-8 degrees Celsius; however, daily temperatures can vary greatly. During the time frame from 1990-2010 the evapotranspiration values have been calculated to be 1241mm per year and 103mm averaged monthly (Ramos, et al, 2014).

Weather on the Altiplano can be extreme; warm summer days that reach 20 degrees Celsius and can be coupled with nights that drop near 0 degrees Celsius. Sandstorms and tornados are common wind events that erode and transport surface sediments throughout the plain. Also, floods and droughts are regular occurrences that are dependent on the season. Anthropogenic actives that include deforestation and over grazing from livestock can perpetuate the windblown and river transported erosion that soil experiences (Ramos et al, 2014; Ormachea, et al 2016).

Arsenic in Groundwater

The majority of the wells found in the Altiplano are hand dug either with shovels or hand augers. The wells used for human consumption are either centralized to be shared by the community or smaller wells can be located within dwellings (Ormachea et al, 2015). On occasion the wells found in dwellings are utilized for small scale irrigation techniques. The method of water extraction varied for daily use and also field sampling. The variability was dependent on the existing extraction method used by the locals (either pumps when available or by lowered buckets) (Ormachea et al, 2013).

A large variation in depth to ground water was observed at different locations in the Altiplano. The range of depth values recorded were 0.68 meters to 8.33 meters from shallowest to deepest respectfully. Groundwater temperature was also wide-ranging, from the same locations where the depths were measured, the temperature ranged from 9.7 degrees Celsius to 20.7 degrees Celsius (Ormachea et al, 2013).

Well water found in the Altiplano is highly contaminated with As. Near or above 90% of all drinking water wells measured within the Altiplano are found to have elevated As concentrations that exceed the WHO guidelines. Deeper wells are not used frequently for residential use; however, the deep aquifer wells that were measured found As values of roughly $15\mu\text{gL}^{-1}$ (Ormachea et al, 2016). Shallow aquifers are a much larger problem due to the fact that they are widely utilized and are significantly more contaminated. It is common to find As concentrations in swallow wells to be above $100\mu\text{gL}^{-1}$. Some superficial wells are found to have As concentrations as high as $400\mu\text{gL}^{-1}$. More comprehensive studies that survey a larger area of the Altiplano rather than isolated around Lake Poopo have concluded that not enough information is known to be able to accurately map As contaminated water within the aquifer that has the intended purpose of predicting where the highest As concentrations will be found (Ramos et al, 2012).

It is believed that groundwater As concentrations are related to water residence time within the aquifer, local geology and precipitation. Researchers that have conducted measurements of groundwater believe that the longer a body of water is in contact with As rich bedrock the higher the As values will be measured in the water. Many volcanic rock types in the area are known to contain an average of 5.7mgL^{-1} which can affect the groundwater greatly. In the case of groundwater, precipitation is believed to delude As concentrations within the aquifer (Ormachea et al, 2013).

Arsenic in Surface Water

There are two main categories of surface water sources in the Altiplano and they are heated hydrothermal inputs and river discharge.

Hydrothermal inputs have been measured for a variety of qualities. They are found to range in PH from 6.8- 8.3. The thermal water is believed to mix with cool groundwater that increase the redox value to an average of +172mV. Electroconductivity is wide ranging but generally has high values that range from 1,860-75,810 μScm^{-1} . Temperature of the hydrothermal springs range from 40-75 Celsius. Bicarbonate is also found in high concentrations (429-1892 mgL^{-1}) due to the weathering of limestones located in the Eastern Cordillera. Bicarbonate is important to identify because it has a strong correlation with As concentrations and is believed to facilitate the mobility of As through adsorption competition. A large majority of the thermal water inputs are contaminated with As values that exceed the WHO regulation and are found to peak at roughly 65 μgL^{-1} (Ormachea et al, 2015).

In the Altiplano rivers are widely used for irrigation and only moderately used for consumption. However, because the rivers are transportation for ground and hydrothermal water it is important to monitor their health. The three main rivers located in the high plains are the Marques, Sevaruyo and the Cortadera Rivers. Water samples were obtained from each river and analyzed in the same manner. The rivers tend to be slight alkaline with PH values that hover around 8.5 on average (Ramos, et al 2012). The conductivity of the river water ranges from 452-2076 μS . Bicarbonate is also identified in the rivers at levels that average almost 500 mgL^{-1} . Concentrations of As vary from 8.6 – 117.4 μgL^{-1} . The higher than expected As concentrations found in headwaters are deemed to be caused by As mobility from volcanic sediment and the adsorption/desorption relationship with sediments along the Eastern Ridge (Ormachea et al, 2016).

Discussion

Most of the freshwater that is utilized by the population located in the Altiplano either from groundwater or rivers are highly contaminated with As well above the WHO guidelines. The multiple sources of As in the hydrological system, complex geological lithology and seasonally variation in precipitation make it very difficult to predict where As values will be most dangerous in the future (Ramos et al, 2014).

Some findings are clear. Nearly 90% of the water used for human consumption is contaminated with As (Ormachea et al, 2016). Water inputs from hydrothermal activity, groundwater

discharge or retention that occurs seasonally and runoff all influence the water quality that is available to the population. Dangerously high values of As can be found in all three intertwined systems (Ramos et al, 2012). The high As concentrations are caused mainly by naturally processes but can be accelerated by human activity (Ormachea et al, 2015).

Surface water is not considerably altered by the groundwater's As concentrations due to the fact that As is frequently found at higher values at the surface than in the deep aquifers. The highest contributor to As contamination is degraded country rock that already has high values of As containing minerals but now is acting as modern sediments. The majority of sediments in question are volcanic in origin and As is released by the breakdown of mafic minerals. While the As travels through a complex water system it interacts with carbonates and silicates that reduce As adsorption and increases its mobility (Ramos et al, 2012; Ormachea et al, 2013).

After comparing information from the Bolivian Altiplano, the Northern Appalachian Mountains and Non-basin/ Mountain data points I believe that to deploy resources responsibly, sample sites that have a geological history of mountain building and also are home to hydrothermal activity should be given preference as research sites because of their increased likelihood to have higher than average As concentrations (Peters, 2008) (Ormachea, 2016) (Ramos, 2012). Within Virginia's borders, drainage basins, hydrothermal springs that are part of the Southern Appalachian Mountains are both available for research and may be currently a neglected public health concern. To accomplish these goals public servants, geographers, health professionals, and scientists should collaborate to identify and correct the public health issue (Allen and Akpinar-Elci, 2016).

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Emerging Vector- borne Diseases Caribbean Perspective: Should we be worried about Chikungunya?

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Abstract

Zika virus is currently attracting a huge international attention. Recently concluded Rio Olympics are a testament to the importance of public health planning and preparedness to counter the threat of emerging infections. Zika is a documented condition from 1940's and is not so extensively studied until recently. The similarity of the virus transmission and the presence of a common vector pose a significant threat to the community. The strong link of the vector to the environmental conditions is another factor that has to thoroughly explored to prevent the rapid spread that was evident in other regions of the world.

Three essential steps are proposed in the control and require further studies. Firstly, raising the awareness efficiency towards the disease. Second, the vector control and the impact of climate change on the spread of the vector needs to be understood. And thirdly, true burden of the disease and the cost of prevention to the health system need to be explored in depth.

Introduction

Currently the latest Zika virus epidemic to trigger international attention to vector-born diseases. Previously considered a mild, self-limiting illness, because of the increasing microcephaly incidence among new born babies has drawn considerable media coverage. Zika is a flavi-viral disease caused primarily by the bite of Aedes mosquitoes. The first cases of Zika were identified in monkeys in 1947 through a surveillance network for yellow fever in Uganda. Human cases were identified in 1952 in Uganda and later in Tanzania. Since then, outbreaks were noticed in several regions of the world with the more recent onset in Brazil and the association with microcephaly and Guillian-Barre Syndrome (WHO, 2016). The striking similarity with regards to the spread of the disease reminds of another emerging infectious disease introduced in the continents of Americas not so long ago. Dengue and Chikungunya viral diseases previously unknown to the region were introduced to the region and now are endemic in many countries in the Americas.

Chikungunya fever is also an acute febrile illness caused by an arthropod-borne alpha virus, Chikungunya virus (CHIKV). The virus is primarily transmitted to humans via the bite of an infected *Aedes* species mosquito. CHIKV was first recognized as a human pathogen during an outbreak in 1952 in southern Tanzania, Africa, and since then, cases have been identified in many countries in Africa and Asia (Robinson, 1955) (WHO, 2006). Chikungunya—often shortened to “chik” by scientists—is a Swahili word that means “that which bends up,” a reference to some victims’ inability to walk upright. The disease is known to occur in large parts of Southeast and South Asia, as well as in Africa (Enserink, 2006).

It is an RNA virus that belongs to the alphavirus genus of the family *Togaviridae* (WHO, 2014). Recent research suggests that CHIKV had caused human infections in Africa since the 17th century. In fact, Chikungunya virus itself is characterized by fever, severe myalgias and arthralgias, dermatological manifestations and frequently, chronic arthritis (Meason, 2016). However similarities of symptoms between Chikungunya and Dengue Virus has misled the diagnostic of the disease. In fact, both diseases cause high fever and severe joint pain, and with poor clinical knowledge and laboratory testing, DENV and CHIKV were indistinguishable (CDC, 2015). Similarly, Zika virus exhibits similar symptomatology as seen in Chikungunya and Dengue.

After its discovery, and its proper labeling, CHIKV was the cause of sporadic outbreaks in Southeast Asia, Africa and India by 1980 (Meason, 2014). Since then, its epidemiological status is endemic in Africa. However, after a major outbreak in Kenya in 2004, its status became pandemic, by spreading to the islands of the Indian Ocean and infecting over 1 million individuals (Meason, 2014). In 2005, the French island La Reunion, has witnessed a major outbreak causing previously unseen mortality rates which highlighted the virulence of CHIKV (WHO, 2006). Chronic Arthritis was reported in 93.7% of infected individuals (Enserink, 2006). Unfortunately, “Even two years later, up to 75% of infected individuals continued to complain of symptoms attributable to chikungunya” (Gerardin, 2011).

Warmer than average temperatures attributable to the Global warming and changes in rainfall patterns allow mosquito vectors to thrive at higher altitudes and at locations where they previously have not survived, ultimately leading to a spread of mosquito-borne diseases. Introduction of mosquitoes into the environment that is conducive for sustained mosquito populations complicate the situation further. While mutations to the chikungunya virus are responsible for some portion of the re-emergence, chikungunya epidemiology is closely tied

with weather patterns in Southeast Asia. Extrapolation of this regional weather patterns, travel patterns combined with known climate factors impacting the spread of malaria and dengue, summate to a dark picture of climate change and the spread of this disease from south Asia and Africa into Europe to Caribbean and North America (Meason, 2016). The capability of Zika virus to undergo mutations is not completely known or researched at this stage. However, the presence of common vector of transmission is worrisome in the case of Zika.

Current Epidemiological Status of Chikungunya, its vectors, risk factors and novel intervention methods and the lessons drawn to understand Zika virus:

According to (PAHO/WHO, 2016), new cases of CHIKV are still being reported in the Caribbean, USA, and Europe. Those CHIKV cases, may be due to different CHIKV virus strains and their most compatible vectors. This differential geographical distribution of strains and vectors is affected by the geographical location of the outbreak, as well as molecular factors affecting the mosquito's infection (WHO, 2011 and Vega-Rua et Al., 2014). CHIKV is carried by two main vectors, *Aedes Aegypti* and *Aedes Albopictus*. (Yoon et al., 2015).

Chikungunya virus underwent a mutation at the E2 level of genomic glycoprotein to become compatible with *Albopictus* species (Salas et Al., 2015 and Vega- Rua et Al., 2014). In fact, Vega-Rua et Al., 2014, distinguish between CHIKV strains and their most compatible vector. The latter study declares the ability of CHIKV vectors to be infectious regardless of the CHIKV strain, however, CHIKV Transmission Efficiency (TE) and Dissemination Efficiency (DE) varied greatly between differently matched CHIKV strains and CHIKV vectors. For an example, one of the two vectors, *A. Albopictus*, has really high TE and DE rates, 96.7% and 83.3% respectively for the mutated Asian strain. For the original Asian strain, *A. Abopictus'* TE and DE are extremely low compared to *A. Aegypti's* (Vega-Rua et Al., 2014). *A. Abopictus'* high anthropologic preference and resilience, has amplified outbreaks. After the Asian Strain's mutation, CHIKV strains infected both vectors, which have high prevalence in the Americas especially (Vega-Rua et Al., 2014).

High prevalence of *Aedes* mosquitoes is due to "lack of trash collection, poor municipal piped water supplies, uncontrolled urban development and insecticide resistance, weaknesses of vector control methodologies" (Salas et Al., 2015). Their prevalence is geographically and environmentally influenced. According to a Brazilian study published in 2016, *A. Abopictus*, tend to proliferate in rural outdoor areas and *A. Aegypti* is more adapted to urban indoor environments (Madariaga, 2016). Unlike the latter, *A. Abopictus* has higher resilience caused by

many factors like: a higher virus dissemination and infection, a longer life span that can reach 8 weeks, a higher adaptation to cool high altitude environments and a higher rate of larva survival in dry environments (Madalaria, 2016 and Salas Et Al., 2015). Given the following, “Both vectors combined put 99% of the population of Brazil at risk of acquiring CHIKV” (Madariaga, 2016). The ability of Zika virus to use one of the two strains of the vector is completely not known. This is another factor that has to be considered in handling the virus transmission.

Selective prevalence, and acquired resilience explained above, have led to a transcontinental spread of Aedes vectors. An abundance of rich quality information about Global Geographic distribution of different CHIKV strains and their associated vectors provides a clearer understanding of Aedes mosquito migration patterns and CHIKV transcontinental prevalence. According to Gonzalez et Al., *A. Aegypti* was incriminated for the outbreak in Mexico in 2014, since it had a higher prevalence in case clustered areas compared to *A. Abopictus* (Gonzalez et Al., 2015). Gonzalez et Al. also argues that *A. Aegypti* was the main vector in outbreaks caused by CHIKV unaltered Asian strain, since it can only be carried by *A. Aegypti*.

Exploring Aedes mosquitos' migration trends, and Zika virus strain virulence, play an important role in assessing the true risk factors of the disease for future effective intervention methods.

A very interesting study -about the prevalence of CHIKV neutralizing antibodies conducted in North Eastern Thailand, has shown a significantly low rate of CHIKV symptomatic infection among elderly, whom lived during the time of previous CHIKV exposure. This group of elderly had a prevalence of CHIKV neutralizing antibodies that seemed to be circulating in their blood for years (Nitattattana et Al. 2014).

This theory is further supported by a study that showed an association between the prevalence of CHIKV Neutralizing Immunoglobulin G3 (IgG3) antibodies their life and long protection from chronic arthritis effect (Kam et Al, 2012). It is also associated with the speed of viral clearance out of the blood (Kam et Al, 2012). Kam et Al. suggested that “The absence of early CHIKV-specific IgG3 may therefore serve as a specific marker of patients with increased risk of disease”. In assessing the burden of the disease, and case management techniques, further studies about CHIKV Chronic Arthritis need to be conducted. Coudrec & Lecuit, 2015, raised a very interesting theory explaining the possibility of a relationship between reoccurring CHIKV infections among previously exposed populations, and joint pain. In other words, is joint pain after CHIKV

infection, due to reoccurring, continuous infections? It has to be researched if similar pattern is present in cases with Zika infection if any and, such patterns can be used to map the prevalence and spread of the epidemic. Currently, microcephaly and Guillian-Barre syndrome are attributed to the exposure of Zika virus.

A multi-facet exploration of components contributing to costs control and efficiency assurance can do no harm. Components like CHIKV herd immunity, CHIKV human reservoir, asymptomatic prevalence of CHIKV, and CHIKV chronic arthralgia were often studied and considered (Galatas et Al., 2016). Similar approach is necessary to understand the evolution of Zika virus.

Furthermore, a study performed in Mauritius post to its CHIKV epidemic, explored its population's needed herd immunity level that will assure protection from future epidemics. (Ramchurn et Al., 2008). In the study conducted in Maritius, cases of CHIKV dropped to 0 after couple of months only. Ramchurn et Al. suggest that seroprevalence studies can be more helpful in finding an answer to the protective effect of previous infections. The life-long immunity to CHIKV acquired after infection is broadly discussed in the literature. In fact, WHO states this statement in one of its CHIKV factsheets (WHO, 2014).

Interestingly, data collected through the history of CHIKV epidemics, statistically prove the protective effect of CHIKV previous infections from current ones (Galatas et Al., 2016 and Nitatpattana et Al. 2014).

Thirdly, accuracy of prevalence measures can be attributed to CHIKV transmission modes among humans (Vazeille et Al., 2007). It was later on proven that "the disease can be transmitted vertically from mother to fetus or theoretically by blood transfusion (although no cases have been reported so far)" (Madariaga, 2016). According to Yoon et Al., 2015, two asymptomatic blood donors in the Caribbean, had Chikungunya viral antigens in their blood.

Also theoretical, or unreported yet, CHIKV infections through saliva are potential. In a study performed on CHIKV infected mice, a high prevalence of CHIKV in their oral cavity was observed (Rolph et Al., 2016). The latter study suggests further investigation in the oral transmission of CHIKV, because if it's true, oral transmission of CHIKV will affect children and immune-deficient individuals and also, the responsibility of public health workers to warn individuals from sharing utensils, or from buccal kissing an infected individual (Rolph et Al., 2016). Currently, sexual

transmission of Zika virus is postulated and is seen as a cause for microcephaly. Further investigations might prove any associated neurological conditions attributable to Zika.

As for vectors, not surprisingly, modes of transmission are also affected by geography, human urbanism and the presence of primates in the area of epidemic (CDC, 2015). CDC's public health grounds about the prevention of mosquito borne disease, differentiates between two CHIKV life cycles: 1) The Sylvatic cycle: mostly present in Africa or in jungles, 2) the urban or epidemic cycle: this cycle does not require incorporating other hosts, it can be human-mosquito- human mediated. The urban cycle is threatening, since one infected person can infect a mosquito which in return can infect other individuals. This fear is real, since several outbreaks in Europe were brought by human reservoirs, caught by *Aedes*, to then cause autochthonous infections to individuals who never left Europe (Baldacchino et Al., 2015). That's why, Europe's focus on effective surveillance on *Aedes* species is serious and effective. Because the only way to prevent outbreaks in Europe right now is by keeping mosquitoes controlled and not infected. These control methods, previously discussed, are divided into five categories: environmental (source reduction), mechanical (trapping), biological (e.g. copepods, *Bacillus thuringiensis* var. *israelensis*, *Wolbachia*), chemical (insect growth regulators) and genetic (sterile insect technique and genetically modified mosquitoes) (Baldacchino et Al., 2015).

Risk factors of CHIKV are directly linked to risk factors of *Aedes Albopictus* and *Aegypti* proliferation since human infections are solely due to CHIKV being injected in the blood by the bites of infected female *Aedes* (WHO, 2015). In fact, the failure to previously assess and control *A. Aegypti* in Latin American countries, after several major Dengue outbreaks, has led to the proliferation of the mosquito in those areas. This proliferation has led to the fast dispersal of CHIKV in neighboring Caribbean countries and a peak in Central America after in the recent past years (Salas et. Al., 2015). Sharing the same vectors, this proliferation and high virulence will potentially lead to Zika Virus outbreaks in both areas if *Aedes* population reduction wasn't addressed urgently. (Salas et. Al., 2015). To target the bull's eye, Salas et Al., identify the major risk factors linked to the Caribbean and the Central American spread. Identified risk factors include environmental factors (Rainy and temperate regions), Social behaviors (intense traveling activity, low education about CHIKV and Mosquito control methods), and biological factors (The nativity of the Mexican population to CHIKV) (Salas et Al., 2015). Addressing those risk factors as

well as applying preventative measures (use of insecticides, cleaning still and stagnant water masses, apply screens to windows, conduct awareness campaigns) is the only current approved approach for reducing CHIKV prevalence.

Those methods however, haven't showed a greater efficiency in developing countries. As a proof, starting by education and raise of awareness efficiency: WHO highlights this fact by stating an example from the Ebola outbreak: Most infected individuals, did not know anything about the disease's virulence, transmission or prevention, even though affected African countries were in a state of Public Health Emergency of International Concern (Lucey, 2016). Moreover, in the CHIKV scope, a study exploring explore the link between environmental factors and socioeconomic status (SES)/education level status in the island of Mayotte, shows a close association between high risks of infection and poor education (Raude et Al., 2009).

Environmental factors in Mayotte, (urban vs. rural residence) are closely linked with SES, therefore rural residence is not a risk factor of higher rates of CHIKV prevalence, it's rather a reflection of health disparities and inequities (Raude et Al., 2009).

Secondly, application of preventative measures to reduce the proliferation of *Aedes* mosquitoes, was not successful since the *aedes Albopictus* has been circulating in Brazil for an example, since the 1980s (Madagaria, 2016).

Thirdly, in addressing environmental factors, The Human Rights journal emphasizes the role of humans in controlling this epidemic by allocating international efforts to solve the climate change crisis (Meason, 2014). In fact there's evidence of a correlation between weather trends (precipitation and temperature) and the rise of *Aedes Albopictus* and *Aedes Aegypti* prevalence (Meason, 2014). Changes like prolonged periods of drought, followed by heaving showers - phenomenon observed in the Caribbean, and Grenada – are major environmental risk factors of CHIKV disease (Meason, 2014, Salas et Al., 2015, and Madagaria, 2016). However, knowing that environmental factors are distal risk factors and are hard to control, and given that CHIKV, Zika Virus and Dengue virus are urgent public health issues emerging epidemically, and potentially in a Pandemic manner, other strategies to control and prevent future outbreaks are investigated. Fourthly, it is true that some insecticides were found efficient in killing *Aedes* mosquitoes, however, their side effect on other insects or species is unknown (Marini, 2015).

Fortunately, innovational surveillance and intervention strategies including: 1) novel vaccine candidates, 2) better diagnosis and reporting of cases, integrated vector control, and finally, 3)

better assessment of CHIKV 's risk factors, its pathology and its transmission modes. These methods, are most likely to play a major role in future CHIKV, DENV and ZIKV outbreak preparedness. (Salas et Al., 2015 and Knerrer et Al., 2013).

Vector Control innovational interventions aim to slash *Aedes Albopictus*' and *Aedes Aegypti*'s virulence and abundance. Gene alteration methods like the Sterile Insect Technique (SIT). SIT, is a technique to genetically sterilize males in order to reduce the number of mosquitoes (Bart, 2014). This technique is indeed successful in producing sterile males, but it will not be applied until revising an assured technique to reverse the genetic sterilization of mosquito males. Such studies may affect the ecosystem greatly, thus its pros and cons have to be thoroughly investigated (Harvard T.H Chan School of Public health, Weekly news). Other genomic based intervention include the alteration of either RNA or a specific protein, or glycoproteins of *Aedes* mosquitoes. However, such studies are costly and exhibit low stability of altered genome in mosquitoes. (Weaver, 2012).

A cost effective, eco-friendly, efficient intervention is by "Biological Control". Biological control, is the use of a natural predator or parasite that will attack *Aedes* mosquitoes or alter their infection transmission (Johnson, 2015 and Knerrer, 2013). Infecting mosquitoes by *Wolbachia*, a self-spreading and self-sustaining parasite that will live within the mosquito, leading to a permeant change through future generations. "Implementation is relatively inexpensive and the benefit/cost ratios of some programs have been more than 100. Classical biological control has been used to suppress over 200 species of invasive insects and 40 species of weeds in many countries around the world" (Knerrer, 2013). Moreover, the article published by Salas et Al. in 2015, emphasizes the success of infecting aedes with different strains of *Wolbachia*: "wMelPol and wMel strains which suppress CHIKV infection in *Ae. aegypti* and *Ae. albopictus*, respectively, leading to complete prevention of infection by CHIKV (Salas et Al., 2015).

Nevertheless, before applying any of these interventions however, a detailed assessment of the true burden of Zika disease should be the guide to allocating resources, and choosing the most effective and feasible methodology (Burt, 2014 and Ramchurn et Al., 2008).

In summary, Zika virus interventions should be only addressed after a complete assessment of Zika's risk factors, transmission modes, pathology, real magnitude, burden, and prevalence. Also, a complete assessment of CHIKV vectors' risk factors migration, prevalence, behavior, virulence should be completed prior to intervention will be able to inform the Zika virus control.

The gap in the literature falls when assessing the prevalence of CHIKV, proving the concept of herd immunity needed or obtained to fight against or obtained from an outbreak.

Should we be worried in Virginia?

This is very pertinent in view of the recent emerging infectious diseases. Chikungunya and Dengue proved to be newly introduced infections and gaining foothold not only in the Americas but more so increasingly seen in the USA. Countries in Central, Southern Americas and the Caribbean accounted for almost half-million cases in 2014 alone. In 2014, in the United States, 2811 cases of Chikungunya were reported, with majority being in travelers returning from endemic zones. This is down to 896 in 2015 and to 75 cases in 2016 respectively. There were documented cases of local transmission in the states of Florida and Texas, but the case count is in single digits. [37, 38]. With regards to Zika virus, currently, there are 81 imported cases in the commonwealth of Virginia. All of these are attributable to travel and none are indigenously acquired (CDC, 2016)

The fact that capable and common vector [*Aedes albopictus*] presence in our state is matter of concern. Expanding number of cases, ongoing endemic disease transmission in the areas surrounding the United States, increased travel to the States from endemic zones put the Commonwealth on the verge of an impending outbreak.

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