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To improve the health care status of African Americans and at-risk populations including economically disadvantaged populations, through education, employment, community service and research.

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The Journal is devoted to scholarly writing that addresses:

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2. Future trends in theory and practice;
3. Current research studies pertaining to African Americans and disadvantaged populations;
4. Identification of sources that critically examine local and national health problems; and
5. Description of programs and services that promote national health initiatives.

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ABSTRACT

Purpose: The purpose of this pilot study was to assess the impact of individualized exercise programs, fall prevention education, and motivational coaching on fall risk in older adults with Type II diabetes, who reside in underserved communities.

Sample: Thirty African Americans adults 50 years of age and older, who were independent community ambulators, and lived in underserved areas participated in the study. The cohort consisted of 12 participants with diabetes (intervention group), and 18 participants without diabetes (control group).

Methods: A pretest posttest nonequivalent groups quasi experimental design was used. Fall risk was measured using the Timed Up and Go (TUG), the Short Physical Performance Battery (SPPB) test, the modified Test for Sensory Integration in Balance (mCTSIB), and monofilament testing. The intervention group received fall prevention education and motivational coaching, and they performed a 12-week individualized home exercise program (HEP). The control group received fall prevention education only.

Results: There were no statistically significant differences between the intervention and the control groups for the TUG or SPPB scores, although the scores for both measures trended toward improvement in the intervention group (11.6 sec. to 10.8 sec TUG; 3.7 ft. /sec to 3.2 ft. /sec respectively for gait speed in the SPPB; and 15.8 sec. to 14.4 sec. for chair rise in the SPPB). A statistically significant difference was found when performance on the mCTSIB was compared for the intervention group, at baseline and after the 12-week individualized home exercise program (6/12 improved to 9/10; p = 0.02). There were no statistically significant differences in exercise compliance, when the different types of motivational coaching were compared.

Conclusion: Older adults can improve gait balance if they are compliant with a HEP that includes balance-specific activities.

Keywords: diabetes, fall risk, home exercise
Diabetes mellitus is a health condition that affects over 25 million Americans (Center for Disease Control and Prevention [CDC], 2014). Diabetes has been linked to many health risks, including falls. Falls in the diabetic population often occur as the result of factors such as peripheral neuropathy, impaired balance, decreased strength, pain, and complications with medication (Crews, Yalla, Fleischer, & Wu, 2013). Individuals who reside in households with an income of less than $15,000 are three times more likely to develop diabetes, compared to individuals who reside in households with an income of $75,000 or greater. At 15.6%, the prevalence of diabetes among African Americans in North Carolina is higher than the prevalence for any other ethnic group. In North Carolina, the prevalence of diabetes is four times higher once individuals reach the age of 45 (Forsyth County Public Health).

Exercise and fall prevention education have been shown to improve factors that are associated with falls (strength, balance, and mobility) in community dwelling older adults. Those interventions may also reduce the incidence of falls (Shumway-Cook et al., 2007; Shumway-Cook, Gruber, Baldwin, & Liao, 1997). Home-based exercise is one method used to self-manage diabetes. Even low intensity exercise is effective in decreasing risk of falls and improving self-reported physical functioning in otherwise sedentary populations (Morgan, Virmig, Duque, Abdel-Moty, & DeVito, 2004). Decreasing fall risk and improving patient safety are vital goals of physical therapy (PT) practice. Physical therapists assess patients and prescribe individualized programs that target functional limitations. Fall risk assessments are essential, in order to establish a baseline measurement. The Timed-Up-and-Go (TUG) test is a measure of gait speed and fall risk. This measure has been shown to have excellent test-retest reliability, inter-rater reliability, sensitivity and specificity, and validity in community dwelling elderly populations (Rehabilitation Measures Database Website, 2013b). The TUG is highly recommended by the Neurology Section of the American Physical Therapy Association (APTA).

In order to perform the test, a participant began seated in a chair with armrests. When instructed by the word “go”, the participant stands up, walks three meters, turns around, walks back to the chair, and sits down. Participants are often given a practice trial before their timed and recorded trial. A standard stopwatch is used to measure from the time the participants stands up until they return to their seat. Participants who test at 12 seconds or greater on the TUG are considered to be at risk for falls (Vicarro, Perera, & Studenski, 2011).

The Modified Clinical Test of Sensory Interaction on Balance (mCTSIB) tests balance as it relates to the vision, somatosensory, and vestibular systems; the test helps to identify deficits in each sensory system. The mCTSIB was found to have excellent inter-rater reliability, test-retest reliability, and validity in community dwelling elderly, stroke, and healthy young adult populations (Rehabilitation Measures Database Website, 2013a). To perform the test, participants are asked to stand still for 30 seconds in four different conditions: 1) Standing on a firm surface, feet together, arms across chest, with eyes open; 2) Standing on a firm surface, feet together, arms across chest, with eyes closed; 3) Standing on foam pad, feet together, arms across chest, with eyes open; and 4) Standing on foam pad, feet together, arms across chest, with eyes closed. Patient performance is timed for 30 seconds. A standard stopwatch is used to measure from the time. If a patient is unable to maintain the position for 30 seconds, they are provided with a maximum of two additional attempts. The scores of the three trials are then averaged.

The Short Physical Performance Battery (SPPB) is utilized to measure balance, gait speed, leg strength, and endurance, all of which relate to fall risk. This test has been shown to have excellent reliability and validity in populations of community dwelling older adults and those with cardiovascular diseases (Puthoff, 2008). The SPPB consists of three different tests. The scores range from 0 (worst performance) to 12 (best performance). Test 1 involves repeated chair stands. The participant begins the test by sitting in a chair. When told to begin, the participant is instructed to stand up and sit down five times without the use of his/her arms. The participant is timed as he/she performs this task. Test 2 is a balance test in which the participant is asked to stand in three different positions and hold each position for 10 seconds. The three positions consist of semi-tandem (inside heel of one foot touching big toe of the other), side-by-side (feet together), and tandem (heel of one foot
touching the toes of the other). Test 3 is the 8-foot walk. The 8-foot walk test requires the participant to walk 8 feet at their usual pace while being timed to the nearest hundredth of a second (Rehab Measures: CTSIB. Rehabilitation Measures Database Web site, 2013).

Monofilament testing is used to assess protective sensation of the feet. This tool has been shown to have validity when measuring sensation in diabetic populations, and it has also been shown to have moderate intra-rater reliability in healthy adult populations (Rahman, Griffin, Rathmann, & Wareham, 2003; Shumway-Cook, Gruber, Baldwin, & Liao, 1997). The monofilament is used to touch five specified areas on each of the patient's feet, in order to check protective sensation. With participants keeping their eyes closed and seated in a comfortable position, the tester touches 10 specified areas of the feet with the monofilament, and documents whether the participant reports sensation in each area. The monofilament is held perpendicular to the foot and pressed lightly until there was an approximate bend of 1 cm noted in the shaft of the filament. The results of this assessment are recorded as the total number of times out of 10 attempts that the patient is able to accurately sense the monofilament touching his/her foot.

Many factors, such as safety, adherence and motivation, are taken into account when prescribing exercises to reduce fall risk (Haas et al., 2012). Adherence is a concern with home based exercise programs. Structuring exercise programs that enhance compliance is crucial for older adults, especially for those with restricted access to healthcare resources. Studies have found that church-based support is influential in improving self-management of Type II diabetes in African-Americans who reside in North Carolina (Samuel-Hodge et al., 2000). For this study, motivational coaching techniques from church leaders and PT students were compared to determine which source of motivation was likely to have the most impact on patient compliance with the prescribed home exercise programs. The authors hypothesized that an individualized HEP, in combination with motivational coaching from church leaders, would result in increased HEP compliance and decreased fall risk in African-Americans with Type II diabetes.

The importance of this pilot study to the field of Physical Therapy was to identify affordable methods of providing effective treatment to decrease fall risk in populations who have limited access to health care. The purpose of this study was to assess how an individualized home exercise program and motivational coaching would impact fall risk in African-American residents with diabetes, who resided in an underserved area of North Carolina. This study was approved by the Institutional Review Board at Winston-Salem State University (WSSU).

METHODS

Participants
Thirty African-American residents, who resided in zip codes which were considered underserved areas based on county statistics, participated in the study. The participants were 50 years of age and older. Individuals were excluded from this study if they had any neurological conditions that could affect balance, or any health conditions that were contraindications to exercise. Participants were recruited via flyers posted on bulletin boards located in the underserved areas of the county. They were assigned to the intervention group if they had been diagnosed with Type II diabetes, based on an HgA1c blood test administered by a trained phlebotomist at the data collection site. They were assigned to the control group if they were not diagnosed with Type II diabetes after being administered the HgA1c blood test.

Setting
Data were collected at five locations in east Winston-Salem, NC, over a nine-month period. The locations were determined by the service areas typically accessed by the RAMS Know H.O.W (Health on Wheels) mobile clinic. Permission for data collection was obtained from administrators at each site. The RAMS Know H.O.W. mobile clinic was used to transport testing equipment and for data collection setup at the collection sites. Data were collected by physical therapy (PT) graduate students under the supervision of faculty from WSSU. Written informed consent was obtained from all participants prior to data collection.

Procedures
Recruited participants had their blood drawn in order
to determine or confirm a diagnosis of diabetes. Trained phlebotomists performed the Hemoglobin A1c (HgA1c) tests. The blood test results were interpreted by a Nurse Practitioner (NP) who had been assigned to the mobile clinic. Individuals who were diagnosed with diabetes were then screened by the NP for safe participation in the study. If cleared by the NP, they were invited to participate in the study. Individuals who had been diagnosed with diabetes, and who agreed to participate in the study were placed in the intervention group. Individuals who, after the HgA1c test were not determined to have diabetes, but who were 50 years or older, lived in the specified zip codes that designate underserved areas, and agreed to participate in the study, were placed in the control group. Individuals who were not cleared to participate in this study by the NP were referred to an appropriate health care professional by the NP. A pretest posttest nonequivalent groups quasi experimental design was used.

Tests and Measures
All participants in the intervention and the control groups received an initial fall risk assessment, in order to establish a baseline. Participants wore a gait belt during all assessments and were guarded by a student PT to minimize risk of falls and ensure participant safety. Students remained under the supervision of trained and experienced clinicians throughout the assessments. The TUG, mCTSIB, and SPPB test were performed on all participants. In addition, monofilament testing was used to examine protective sensation of the participants’ feet. The intervention group was given an individualized home exercise program (HEP), which included the use of an Airex brand foam mat for balance. The HEP was created under the supervision of experienced clinicians, based on deficits found on the initial assessment. Intervention group participants were educated how to safely and correctly perform the exercises at home; and they were provided an educational packet which included exercise tips for individuals with diabetes. They were also instructed what they should do if an adverse event occurred while they were exercising. The intervention group was asked not to make any significant changes in their exercise routine outside of the HEP which had been provided to them.

The control group received fall prevention education, using materials taken from the Centers for Disease Control and Prevention STEADI Initiative Tool Kit. STEADI is an acronym for Stopping Elderly Accidents, Deaths, & Injuries (Centers for Disease Control and Prevention, 2016).

Approximately six weeks after the initial assessment, the intervention group was reassessed for fall risk, using the same four tests utilized in the initial assessment. Adjustments were made to the HEPs, depending on participant needs and changing deficits. The intervention group also received a 60-minute educational session, which was conducted by WSSU occupational therapy students, using information excerpted from the “A Matter of Balance” program. A Matter of Balance is a structured group intervention that emphasizes practical strategies to reduce fear of falling and increase activity levels. Participants learn to view falls and fear of falling as controllable, set realistic goals to increase activity, change their environment to reduce fall risk factors, and exercise to increase strength and balance (National Council on Aging, 2011). Twelve weeks after the initial assessment all participants in the intervention and control groups were reassessed for fall risk, using the TUG, mCTSIB, SPPB and monofilament testing.

Motivational Coaching
Weekly motivational coaching was conducted through phone calls to participants in the intervention group. Prior to initiation of the coaching intervention, PT graduate students and paid church motivational coaches were trained how to provide motivational coaching to the participants. Training included information regarding the association of diabetes and falls, how diabetes impacts health, the definition of a fall, a script for telephone calls, a printed chart to record phone call information and patient compliance with program. The coaches were also instructed how to respond to potential participant questions or concerns. Participants in the intervention group were randomly assigned to a motivational coach, either a student PT or a church member. Participants received weekly calls from their motivational coach throughout the duration of the study.
Data Analysis
Data for the compliance and completion of the HEP were analyzed using simple percentage calculations. Data for the TUG, mCTSIB, and SPPB assessments were analyzed using SPSS, version 21. A comparative analysis repeated ANOVA was used for the TUG with scores from pre-tests and post-tests of the intervention and control groups. An intra-class correlation coefficient was used for intra-rater reliability of the outcome measures. A level of probability of ≤ 0.05 was used to determine significance. Data from the SPPB were analyzed using T-test results, and data from the mCTSIB were analyzed using Pearson’s Chi-Squared test.

RESULTS

Descriptive Statistics
There were 30 participants recruited for the study with 12 in the intervention group and 18 in the control group. The intervention group had 41.7% males and 58.3% females. The control group was had 44.4% males and 55.6% females.

The average age for all participants was 64.0 ± 8.8 years with a range of 50-84 years of age. The average age in the intervention group was 67.8 ± 10.2 and the average age in the control group was 61.4 ± 7.0. See Table 1 for participant descriptives.

The average HgA1C for the intervention group was 8.93±3.14 with a range of 4.0-14.0. The average HgA1C for the control group was 6.22±1.06 with a range of 5.3-8.7. See Table 2 for blood test data.

Timed-Up and Go
At baseline, the intervention group had an average time of 11.6 ± 2.1 seconds. At 12 weeks, the average time was 10.8 ± 6.4 seconds. The average TUG for the control group was 8.4 ± 5.5 seconds at baseline and 10.7 ± 5.1 seconds at 12 weeks. There were no statistically significant differences between the two groups.

Short Physical Performance Battery
The average gait time was 3.7 ± 1.2 seconds at baseline and 3.2 ± 1.5 seconds at 12 weeks. The average chair stand time at was 15.5 ± 7.9 seconds at baseline and 14.4 ± 7.6 seconds at 12 weeks. No statistically significant changes were observed with chair stand or gait speed tests. Data from the balance portion of the SPPB were not analyzed, as all but two participants were able to successfully complete all three positions at baseline. All participants successfully completed all three balance positions at the final assessment.

mCTSIB
At baseline, six out of 12 intervention participants were able to successfully complete all four mCTSIB positions and at 12 weeks nine out of 10 participants were able to complete all four positions successfully. There was a statistically significant change in sensory integration and balance (p=0.02). See Figure 1 for mCTSIB performance.

Coaching
There were no statistically significant differences between the intervention group participants who were coached by church members and those participants who were coached by students. Five of six participants in each of the coaching groups completed the study.

HEP Compliance
Compliance was defined as the percent of weekly contacts that the intervention participants were called, answered the call, and stated that they were completing their exercises.

Completion
Completion for the intervention group was defined as a participant who attended the initial assessment, the six week assessment, and the 12-week assessment and who received weekly calls from the motivational coaches. Completion for the control group was defined as a participant who attended the initial assessment and the 12 week assessment.

Discussion
This pilot study provided initial insight into the effect that patient’s adherence to individualized HEPs and motivational coaching have on decreasing fall risk in
participants with diabetes residing in underserved communities. From this study, the authors concluded that individualized home exercise programs are beneficial in reducing deficits in sensory integration associated with increased risk for falls. Though the majority of the results were not statistically significant, there was a noted trend in improvement in assessment scores of the intervention group from the baseline to the 12-week re-assessment.

Participants who adhered to the home exercise programs experienced minimal improvements in lower extremity strength, static standing balance, and dynamic standing balance, as indicated by slight increases in the SPPB and TUG assessments. Statistically significant differences were detected in the ability of participants to complete all four positions of the mCTSIB when exercising at home with their individual, study provided dense foam, compared to the control group. This result supports the findings of studies that show the importance of specific, individualized exercise programs and their positive impact on fall risk reduction. One such study provided specific, individualized exercise programs and tracked compliance in community dwelling older adults. The results indicated that fall risk was reduced with specific HEP programs and when compliance was greatest (Shumway-Cook, Gruber, Baldwin, & Liao, 1997).

Motivational coaching provided participants with both a reminder to perform the exercises as well as encouragement. In addition, the weekly calls gave the participants an opportunity to ask any questions that they had about the exercises. The weekly calls also gave the motivational coaches the opportunity to ensure that the participants were performing the exercises safely and with proper technique. It could not be determined if compliance was improved for participants secondary to coaching alone.

There were limitations in the study that made statistical analysis and data collection difficult, but that could be improved upon for future duplication of the study. Connecting with participants via telephone presented some difficulty when attempting to provide coaching. One way to solve this problem would be for the participants to provide the day and hours that they will be available consistently for weekly motivational calls.

Secondly, recruitment of participants proved to be challenging. Recruitment was limited to a relatively small zip code area of the underserved population supported by the grant, thus restricting the total number of intervention participants. The small number of participants had a direct effect on the clinical significance of the data analysis. Further research should be done with a larger sample size in order to determine whether a clinically significant difference exists between adults with diabetes who exercise in the home and those who do not, as well as comparing coaching to lack of coaching for the intervention and control groups.

This study differed from previous fall prevention studies in that participants performed their exercises daily in their home environment and were all residents of an underserved community. Results from a study by Shumway-Cook, et al (2013), demonstrated that group therapy performed three times per week could impact fall risk as measured by exercise compliance, TUG scores, and chair rise data in a population of 453 older adults. The Shumway-Cook study produced similar improvements in TUG and chair rise data when compared to this pilot study; however its much larger sample size may allow the results to demonstrate causality. Shumway et al (2013) demonstrated a change in Chair Stand test scores of +1.2 from initial to final assessments and a change in Timed Up and Go scores of -0.7 from initial to final assessments. In comparison, our study produced a change in TUG scores of the intervention group of -2.74 and chair stand scores difference of -1.09 from initial to final assessments.

**Conclusion**

This pilot study demonstrates that individualized HEP, in addition to motivational coaching and fall prevention education, may be beneficial in decreasing fall risk by improving sensory integration, as measured by the mCTSIB. The pilot study’s findings suggest that older adults living in underserved communities can improve balance in as little as 12 weeks, when compliant with a HEP that includes balance-specific activities. These improvements could lead to a decreased risk for falls. Future studies with larger sample sizes and control groups should investigate the use of this type of program, along with the impact of motivational coaching and education on fall prevention, in underserved populations with limited access to health resources.
Table 1. Participant Descriptives

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<th>Control</th>
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Table 2. Diabetic Testing

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ADA guidelines for Type 2 diabetes at A1C levels above 6.5 percent

Table 3. Compliance with HEP based on number of weekly calls with affirmative answers

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<th>Coaching Group</th>
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<td>Church Motivational Coaches</td>
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<tr>
<td>Student Motivational Coaches</td>
<td>94.5%</td>
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</table>
Figure 1. Change in TUG Score (Measured in seconds)

Error bars: 95% CI


Acknowledgements
Novant Health Care Systems provided financial support for this project and for the Rams Know H.O.W. mobile clinic operations. Because of the grant support for this study, which restricted the withholding of treatment, the authors were unable to assign participants to a true control group of adults with diabetes who did not receive an intervention.
ABSTRACT

Purpose: The purpose of this study was to examine whether disparities in chronic diseases such as overweight/obesity, diabetes, hypertension, coronary heart disease (CHD) risk and associated factors like dietary intake were associated with acculturation (language(s) usually spoken at home) of Mexican Americans and other Hispanics.

Methods: The authors used physical examination-based data and participants’ self-report of prior diagnoses to assess immigration-based disparities in awareness of diabetes, hypertension, hypercholesterolemia, and overweight among 860 participants aged 40 years or more, in the 2011-2012 National Health and Nutrition Examination Survey (NHANES). Data were analyzed using SUDAAN statistical software. Statistical procedures used to address the study objectives included t-tests and chi-square tests.

Results: The findings demonstrated that language usually spoken at home (English more than Spanish or only English) was associated with higher intakes of total fat, total saturated fat, total monounsaturated fat, total polyunsaturated fat and sodium, compared with other groups defined by language usually spoken at home (only Spanish, more Spanish than English, and both equally). Overweight, obesity and prediabetes were more common in those who spoke English and Spanish equally. Diabetes, hypertension and CHD were not significantly associated with language usually spoken at home.

Keywords: Chronic Diseases, Acculturation, Mexican-Americans, Hispanics
Latino/Hispanic immigrants tend to have better health and lower mortality rates despite disparities in access to care, higher levels of poverty, lower educational attainment, and other socioeconomic disadvantages (Singh & Hiatt, 2006; Morales, Lara, Kington, Valdez, & Escarce, 2002; Singh, Rodriguez-Lainz, & Kogan, 2013). These immigrants have consistently been shown to have higher life expectancies than the American-born population (Singh et al., 2013). Although Latino/Hispanic immigrants tend to be healthier than Americans, they experience deterioration in their health status over time (Singh & Hiatt, 2006; Roshania, Narayan, & Oza-Frank, 2008). Among Latinos/Hispanics immigrants, differentials in mortality have increased over time for major cancers, cardiovascular diseases, diabetes, respiratory diseases, hypertension, obesity, and cancer (Singh & Hiatt, 2006).

Immigration to a new country may cause a substantial shift in a person's lifestyle and environment. Among these potential shifts is dietary acculturation, the process that occurs when immigrants adopt the food choices or dietary patterns of their new environment (Satia-Abouta, Patterson, Neuhouser, & Elder, 2002). Changes in lifestyle and availability of Western foods are hypothesized to be associated with increased consumption of fats and refined carbohydrates, which can result in rapid modifications in chronic disease risk (Ayala, Baquero, & Klinger, 2008; Perez-Escamilla, 2011; Batis, Hernandez-Barrera, Barquera, Rivera, & Popkin, 2011). This hypothesis is supported by the finding that higher rates of dietary changes among certain immigrants, from traditional diets to Western diets, are associated with overweight and obesity (Roshania et al., 2008). These negative acculturation effects are assumed to be driven by unhealthy Western lifestyles (Roshania et al., 2008). Obesity is a proven risk factor for a number of chronic diseases such as hypertension, hyperlipidemia, cardiovascular disease, and diabetes (Cordain et al., 2005). Higher acculturation has increased the prevalence of diabetes and cardiovascular disease (CVD) risk (O’Brien, 2014; Lopez et al., 2015). While many studies support the hypothesis that acculturation has increased the prevalence of diabetes and CVD risk specifically among Hispanics (Perez-Escamilla & Putnik, 2007; Lopez et al., 2015; Eamranond et al., 2009; Mainous III et al., 2006).

The primary aim of Healthy People 2020, a national health promotion and disease prevention initiative, is to reduce the health inequalities among various sociodemographic groups. There is growing interest in the health status of Latinos/Hispanics as one of the focus areas aimed at minimizing health disparities (US Department of Health and Human Services & Office of Disease Prevention and Health Promotion, 2012). The role of acculturation in influencing dietary patterns and health outcome has received increasing attention in recent years. However, many of the studies on acculturation, dietary and health outcome among Latinos/Hispanics have produced inconsistent findings (Perez-Escamilla & Putnik, 2007; Lopez et al., 2015; Eamranond et al., 2009; Mainous III et al., 2006). In an attempt to resolve these inconsistencies, this study was conducted to: 1) examine the role of acculturation in the United States (US) in dietary intakes; and 2) examine the related risks for chronic health diseases among Mexican-Americans and other Hispanics.

METHODS

Design

The authors analyzed data extracted from the 2011-2012 National Health and Nutritional Examination Survey (NHANES). NHANES is a cross-sectional survey using complex, stratified, multistage probability sampling to select participants. The NHANES target population is the noninstitutionalized, civilian US population, aged 2 months and older with oversampling of certain population subgroups to increase the reliability and precision of estimates of health status. Subgroups oversampled include as Hispanics, non-Hispanic Blacks, older adults, low income Whites, and others. NHANES combines dietary interviews with physical examinations and laboratory studies. Eight hundred and sixty Mexican-American and other Hispanic subjects aged 40 years or more were utilized in the study.

Study Measures

Acculturation: Determination of acculturation was determined through personal interview data on the language(s) usually spoken at home. The following
questions were asked of Latino participants: “What language(s) do you usually speak at home? The five response categories were: Only Spanish; More Spanish than English; Both Equally; More English than Spanish; and Only English.

**Overweight & Obesity:** The extent of overweight and obesity were characterized based on body mass index (BMI), which was calculated using the following formula: weight (kg)/height^2 (m). The BMIs of the participants were categorized as underweight (BMI less than 18.5 kg/m^2), normal (BMI between 18.5 and 24.9 kg/m^2), overweight (BMI between 25.0 and 29.9 kg/m^2) and obese (BMI of 30 kg/m^2 or more).

**Waist circumference:** Visceral fat and a high waist circumference is associated with an increased risk for diabetes, dyslipidemia, hypertension, and CVD. Waist circumference for men and women above thresholds of 102cm (40 inches) and 88cm (35 inches) respectively; indicate increased risk of such diseases.

**Diabetes:** Diabetes was defined as blood levels of hemoglobin A1c (HbA1c) greater than 6.5%, or plasma fasting glucose greater than 125 mg/dL. Levels of HbA1c between 5.7 and 6.4%, or plasma fasting glucose between 100 and 125 mg/dL were considered pre-diabetes.

**Hypertension:** Hypertension, or high blood pressure was defined as average systolic and diastolic blood pressure levels of 140/90 mmHg or higher.

**Coronary Heart Disease:** Coronary heart disease risk was defined based on a diagnosis by a doctor or other health professional.

**Demographic variables:** The demographic variables used in the study were gender, age, and race/ethnicity.

The data were analyzed using SUDAAN software (Research Triangle Institute International, Research Triangle Park, North Carolina). SUDAAN is the recommended software for analyzing of NHANES data. Statistical procedure used to address the study objectives were t-tests and chi-square tests. The significance level used was 5% (p < 0.05).

**RESULTS**

The socio-demographic characteristics variables of participants are shown in Table 1. Fifty-three percent of the subjects were female and 81% were between 40 and 69 years of age, with a mean age of 57.1 years (SD 11.1 years).

<table>
<thead>
<tr>
<th>Variables</th>
<th>Number</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>404</td>
<td>47.0</td>
</tr>
<tr>
<td>Female</td>
<td>456</td>
<td>53.0</td>
</tr>
<tr>
<td>Total</td>
<td>860</td>
<td>100.0</td>
</tr>
<tr>
<td>Age Group</td>
<td></td>
<td></td>
</tr>
<tr>
<td>40-49 years</td>
<td>254</td>
<td>29.5</td>
</tr>
<tr>
<td>50-59 years</td>
<td>230</td>
<td>26.7</td>
</tr>
<tr>
<td>60-69 years</td>
<td>247</td>
<td>28.7</td>
</tr>
<tr>
<td>70-79 years</td>
<td>94</td>
<td>10.9</td>
</tr>
<tr>
<td>80 years or more</td>
<td>35</td>
<td>4.1</td>
</tr>
<tr>
<td>Total</td>
<td>860</td>
<td>100.0</td>
</tr>
</tbody>
</table>
The measures of dietary intake by language usually spoken at home are summarized in Table 2. Although not statistically significant (p>0.05) the trend showed that total caloric intake increases as subjects moved from speaking only Spanish to only English. Subjects who spoke only Spanish or more Spanish than English had significantly lower intakes of energy than those who spoke more English than Spanish or only English. Those who spoke more English than Spanish or only English had significantly higher intakes of total fat, total monounsaturated fat, and total polyunsaturated fat than the other groups (p<0.05). Total saturated fat intake was significantly higher for those who spoke more English than Spanish, or spoke English only, compared with those who spoke only Spanish or More Spanish than English. Cholesterol intake was significantly higher in subjects who spoke more English than Spanish or English only than in those who spoke only Spanish. The subjects who spoke more English than Spanish had significantly higher sodium intake than those who spoke only Spanish, more Spanish than English, and English and Spanish equally. There were no significant differences in dietary fiber intake between the groups.

### Table 2: Dietary Intakes by Language(s) Usually Spoken at Home

<table>
<thead>
<tr>
<th>Dietary Intake</th>
<th>Only Spanish</th>
<th>More Spanish than English</th>
<th>Both Equally</th>
<th>More English than Spanish</th>
<th>Only English</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean±SEM</td>
<td>Mean±SEM</td>
<td>Mean±SEM</td>
<td>Mean±SEM</td>
<td>Mean±SEM</td>
</tr>
<tr>
<td>n=405</td>
<td>n=129</td>
<td>n=81</td>
<td>n=96</td>
<td>n=96</td>
<td>n=96</td>
</tr>
<tr>
<td>Total Energy (kcal)</td>
<td>1,815.8±40.9</td>
<td>1,887.8±63.5</td>
<td>1,940.1±103.3</td>
<td>2,169.5±124.1</td>
<td>2,112.6±91.2</td>
</tr>
<tr>
<td>Total Fat (g)</td>
<td>61.4±1.8</td>
<td>62.6±2.9</td>
<td>68.9±4.5</td>
<td>86.5±6.0</td>
<td>78.3±3.8</td>
</tr>
<tr>
<td>Total Saturated Fat (g)</td>
<td>19.5±0.6</td>
<td>19.7±1.0</td>
<td>21.8±1.5</td>
<td>27.3±1.8</td>
<td>24.5±1.2</td>
</tr>
<tr>
<td>Total Monounsaturated Fat (g)</td>
<td>22.7±0.7</td>
<td>22.6±1.1</td>
<td>25.5±1.6</td>
<td>32.0±2.5</td>
<td>29.2±1.6</td>
</tr>
<tr>
<td>Total Polyunsaturated Fat (g)</td>
<td>13.7±0.5</td>
<td>14.5±0.8</td>
<td>15.3±1.4</td>
<td>20.0±1.7</td>
<td>17.9±1.1</td>
</tr>
<tr>
<td>Cholesterol (mg)</td>
<td>262.6±12.0</td>
<td>297.0±19.8</td>
<td>288.6±32.3</td>
<td>324.0±22.8</td>
<td>290.2±22.8</td>
</tr>
<tr>
<td>Sodium (mg)</td>
<td>2,910.8±81.5</td>
<td>3,236.9±150.6</td>
<td>3,254.4±202.3</td>
<td>3,726.6±224.8</td>
<td>3,451.3±172.3</td>
</tr>
<tr>
<td>Dietary Fiber (g)</td>
<td>18.4±0.6</td>
<td>19.7±1.0</td>
<td>19.1±1.3</td>
<td>17.5±1.2</td>
<td>17.6±1.1</td>
</tr>
</tbody>
</table>

a,b,c Means with different letters as superscript are significantly different (p<0.05).
The mean BMI levels of the groups were in the overweight and obesity ranges (Table 3). Significantly higher (p<0.05) mean BMI and waist circumference levels was associated with subjects who spoke more English than Spanish, or both languages equally, compared to those who spoke only Spanish or more Spanish than English. The mean waist circumference was significantly higher (p<0.05) in those who spoke only English than in those who spoke both languages equally.

Table 3: BMI and Waist Circumference by Language(s) Usually Spoken at Home

<table>
<thead>
<tr>
<th>Only Spanish</th>
<th>More Spanish than English</th>
<th>Both Equally</th>
<th>More English than Spanish</th>
<th>Only English</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean±SEM</td>
<td>Mean±SEM</td>
<td>Mean±SEM</td>
<td>Mean±SEM</td>
<td>Mean±SEM</td>
</tr>
<tr>
<td>n=431</td>
<td>n=137</td>
<td>n=86</td>
<td>n=98</td>
<td>n=98</td>
</tr>
<tr>
<td>BMI (kg/m2)</td>
<td>29.6a±0.3</td>
<td>29.3a±0.4</td>
<td>31.1b±0.6</td>
<td>31.1b±0.7</td>
</tr>
<tr>
<td></td>
<td>n=413</td>
<td>n=134</td>
<td>n=84</td>
<td>n=98</td>
</tr>
<tr>
<td>Waist Circumference (cm)</td>
<td>100.1a±0.6</td>
<td>99.9a±1.0</td>
<td>104.8b±1.5</td>
<td>103.7b,c±1.5</td>
</tr>
</tbody>
</table>

a,b,c Means with different letters as superscript are significantly different (p<0.05)

Table 4 summarizes the Fasting Blood Glucose and HbA1c levels by language(s) usually spoken at home. Subjects who spoke both English and Spanish equally had a mean fasting blood glucose level considered characteristic of diabetes, while the remaining groups had mean fasting blood glucose levels within the range considered pre-diabetes. Subjects who spoke only Spanish or both Spanish and English equally had significantly higher (p<0.05) fasting blood glucose levels than those who spoke more Spanish than English or only English. Subjects who spoke only English had significantly lower (p>0.05) HbA1c levels than those who spoke only Spanish, more Spanish than English, or both equally.

Table 4: Fasting Blood Glucose and HbA1c levels by Language(s) Usually Spoken at Home

<table>
<thead>
<tr>
<th>Only Spanish</th>
<th>More Spanish than English</th>
<th>Both Equally</th>
<th>More English than Spanish</th>
<th>Only English</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean±SEM</td>
<td>Mean±SEM</td>
<td>Mean±SEM</td>
<td>Mean±SEM</td>
<td>Mean±SEM</td>
</tr>
<tr>
<td>n=436</td>
<td>n=137</td>
<td>n=87</td>
<td>n=100</td>
<td>n=98</td>
</tr>
<tr>
<td>Fasting Blood Glucose (mg/dL)</td>
<td>119.1a±2.3</td>
<td>112.5b±2.9</td>
<td>126.9a±5.2</td>
<td>118.0a,b±4.5</td>
</tr>
<tr>
<td>Glycohemoglobin (%)</td>
<td>6.3a±0.1</td>
<td>6.0a±0.1</td>
<td>6.4a±0.2</td>
<td>6.2a,b±0.1</td>
</tr>
</tbody>
</table>

a,b Means with different letters as superscript are significantly different (p<0.05)

The mean systolic blood pressure was above 120 mm Hg, and mean diastolic blood pressure was below 80 mm Hg in all groups (Table 5). Subjects who spoke both Spanish and English equally had a significantly higher average systolic blood pressure level compared with those who spoke only Spanish or more Spanish than English. The average diastolic blood pressure level was significantly higher (p<0.05) in those who spoke only English than those who spoke only Spanish or both Spanish and English equally.
### Table 5: Blood Pressure Levels by Language(s) Usually Spoken at Home

<table>
<thead>
<tr>
<th>Language(s) Usually Spoken at Home</th>
<th>Mean±SEM</th>
<th>n=418</th>
<th>Mean±SEM</th>
<th>n=130</th>
<th>Mean±SEM</th>
<th>n=83</th>
<th>Mean±SEM</th>
<th>n=97</th>
<th>Mean±SEM</th>
<th>n=96</th>
</tr>
</thead>
<tbody>
<tr>
<td>n=417</td>
<td>n=130</td>
<td>n=83</td>
<td>n=97</td>
<td>n=96</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Average Systolic Blood Pressure Level (mmHg)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Only Spanish</td>
<td>125.3±0.9</td>
<td></td>
<td>123.1±1.6</td>
<td></td>
<td>129.6±2.3</td>
<td></td>
<td>124.9±2.1</td>
<td></td>
<td>126.5±2.0</td>
<td></td>
</tr>
<tr>
<td>More Spanish than English</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Both Equally</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>More English than Spanish</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Only English</td>
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<td></td>
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<td></td>
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<td></td>
</tr>
</tbody>
</table>

### Table 6: Blood Lipid Profile by Language(s) Usually Spoken at Home

<table>
<thead>
<tr>
<th>Language(s) Usually Spoken at Home</th>
<th>Mean±SEM</th>
<th>n=427</th>
<th>Mean±SEM</th>
<th>n=137</th>
<th>Mean±SEM</th>
<th>n=86</th>
<th>Mean±SEM</th>
<th>n=99</th>
<th>Mean±SEM</th>
<th>n=98</th>
</tr>
</thead>
<tbody>
<tr>
<td>n=413</td>
<td>n=137</td>
<td>n=85</td>
<td>n=97</td>
<td>n=96</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Cholesterol (mg/dL)</td>
<td>203.4±1.9</td>
<td></td>
<td>200.1±3.1</td>
<td></td>
<td>185.7±4.4</td>
<td></td>
<td>197.4±4.2</td>
<td></td>
<td>208.6±4.0</td>
<td></td>
</tr>
<tr>
<td>Triglyceride (mg/dL)</td>
<td>154.5±5.1</td>
<td></td>
<td>138.4±5.8</td>
<td></td>
<td>142.7±8.7</td>
<td></td>
<td>140.0±8.1</td>
<td></td>
<td>149.7±9.1</td>
<td></td>
</tr>
<tr>
<td>HDL-Cholesterol (mg/dL)</td>
<td>50.8±0.6</td>
<td></td>
<td>51.2±1.2</td>
<td></td>
<td>51.4±1.5</td>
<td></td>
<td>54.3±1.7</td>
<td></td>
<td>54.1±1.6</td>
<td></td>
</tr>
<tr>
<td>LDL-cholesterol (mg/dL)</td>
<td>122.6±1.6</td>
<td></td>
<td>121.2±2.9</td>
<td></td>
<td>106.6±3.6</td>
<td></td>
<td>115.5±3.8</td>
<td></td>
<td>125.3±3.6</td>
<td></td>
</tr>
</tbody>
</table>

**a,b Mean with different letters as superscript are significantly different (p<0.05)**

The blood lipid profile by language(s) usually spoken at home is summarized in Table 6. The mean total cholesterol levels were higher than the recommended level of 200 mg/dL or less, except among subjects who spoke both English and Spanish equally, or more English than Spanish. Subjects who spoke only Spanish or only English had significantly higher mean total cholesterol levels than those who spoke both Spanish and English equally. All groups except those who spoke only Spanish had mean triglyceride levels below the recommended level of 150 mg/dL or less. Subjects who spoke Spanish only had significantly higher triglyceride levels than those who spoke more Spanish than English. The mean HDL-cholesterol levels of all groups were above the recommended levels for men and women (equal to or above 40 mg/dL, or 50 mg/dL respectively). Subjects who spoke only Spanish had a significantly lower mean HDL-cholesterol level than those who spoke only English. Only subjects who spoke both English and Spanish equally, or more English than Spanish had mean LDL-cholesterol levels below the recommended level of 120 mg/dL. Subjects who spoke only Spanish had a significantly higher mean LDL-cholesterol level than those who spoke both English and Spanish equally or more English than Spanish.
The relationships of acculturation (language(s) usually spoken at home) to chronic diseases are summarized in Table 7. Significant relationships were found between language(s) usually spoken at home and overweight/obesity, and pre-diabetes. Subjects who spoke both English and Spanish equally at home were significantly (p<0.05) more likely to be overweight or obese, or prediabetic. There was no significant relationship of language(s) usually spoken at home to diabetes, hypertension or coronary heart disease.

Table 7: Relationships of Acculturation (Language(s) Usually Spoken at Home) to Chronic Diseases

<table>
<thead>
<tr>
<th></th>
<th>Chi-square Statistic</th>
<th>Probability Level1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overweight/Obesity</td>
<td>2.4658</td>
<td>0.0436</td>
</tr>
<tr>
<td>Prediabetes</td>
<td>4.1408</td>
<td>0.0025</td>
</tr>
<tr>
<td>Diabetes</td>
<td>1.4992</td>
<td>0.2004</td>
</tr>
<tr>
<td>Hypertension</td>
<td>1.3423</td>
<td>0.2524</td>
</tr>
<tr>
<td>Coronary Heart Disease</td>
<td>1.1023</td>
<td>0.3542</td>
</tr>
</tbody>
</table>

1A probability level below 0.05 indicates a significant relationship between the two variables

2BMI ≥ 25.0 kg/m2
3Fasting blood glucose between 100 - 125 mg/dL
4Fasting blood glucose > 126.0 mg/dL
5Blood pressure levels ≥ 140/90 mm Hg
6Diagnosed with coronary heart disease by a health professional

DISCUSSION

The traditional Latino/Hispanic diet is characterized by rice, beans and vegetables. Vegetables are used mainly as ingredients in the preparation of soups, rice, pasta and meat (Ayala et al., 2008; Batis et al., 2011). It is likely that Latinos/Hispanic immigrants shift from this dietary pattern to a more typical US diet after exposure to, and influence by the US environment. A systematic review by Ayala et al. (2008) indicated that several relationships were consistent irrespective of how acculturation was measured. Accordingly, there was no relationship between acculturation and intake of dietary fat or and percent energy from fat (Ayala et al., 2008). Contrary to Ayala et al., 2008, the findings of this study indicated that there is a relationship between acculturation and intake of dietary fat. Secondly, those who were less acculturated consumed more fruit, rice, beans, and less sugar and sugar-sweetened beverages. In addition, the relationships varied depending on the parameters used for measurement of acculturation (acculturation score, years in the US, birthplace, generational status and language used (Ayala et al., 2008). The results of this study showed no significant relationship between fiber intake and acculturation. Ayala et al., 2008 found some statistically significant associations between the levels of acculturation with diet, although the direction of the relationship between level of acculturation and diet were not consistent.

It is generally well recognized that dietary choices are affected by socio-economic, demographic, environmental, knowledge, and psychosocial factors (Ayala et al., 2008; Satia, 2009). The direction of the relationship between acculturation and dietary habits appears to be different among subgroups of Latinos such as Puerto Ricans, Cuban Americans, Central and South Americans (Perez-Escamilla & Putnik, 2007). This may explain why the findings of this study differ from those of previous studies.

Dietary patterns have a profound influence on body weight and chronic disease prevalence (ref). Gradual adaptation to a Western diet (including high intakes of energy, fat, sodium, and added sugar, and lower fiber intakes) has been reported to be an important risk factor for obesity, diabetes and CVD (Wirfält, Drake, & Wallström, 2013). The results of this study are consistent
with the finding that acculturation is positively related to risk factors such as overweight/obesity and prediabetes. Studies have indicated that acculturation is positively associated with weight gain (Perez-Escamilla, 2011; Slattery et al., 2006). Similarly, results of our current study confirmed that subjects who spoke more English than Spanish or both equally, had significantly higher BMI levels. Studies of the association between acculturation and type 2 diabetes mellitus (T2DM) in Latinos have yielded conflicting results (Perez-Escamilla & Putnik, 2007). Some studies reported that there was a positive association between acculturation and diabetes risk (O’Brien, 2014; Retana, Proffitt Leyva, Fulda DrPH, & Franks, 2014). Mainous et al. (2006) reported that Latinos/Hispanics with low acculturation (by language) have a higher risk of T2DM, and the diabetes complication of peripheral neuropathy. The findings in this study indicated that subjects who spoke both English and Spanish equally at home were significantly more likely to be prediabetic. However, there was no significant relationship of language(s) usually spoken at home to diabetes. It was reported that the inconsistent associations between acculturation and T2DM among Latinos was strongly modified by Latino subethnicity, socio-economic status, age, gender, health literacy, access to care and movement from urban to rural areas (Mainous III et al., 2006; Perez-Escamilla & Putnik, 2007). All of these variables may affect the results regarding the relationship between acculturation and diabetes.

As BMI has been proven to be related to acculturation, there is increased likelihood of positive associations with higher cardiovascular disease (CVD) risk factors including hypertension, high triglyceride, low HDL-cholesterol, and hypercholesterolemia. Prior studies of the association between acculturation and CVD have yielded inconsistent results. Vaeth et al. (2005) reported that Latinos/Hispanics with middle or high levels of acculturation are at increased risk of hypertension. Eamranond et al. (2009) reported that there was a lower risk of CVD in Hispanics who were English proficient or spoke Spanish at home. They reported that Spanish-speaking Latinos/Hispanics had higher systolic blood pressure, LDL-cholesterol, and fasting blood glucose levels compared with English-speaking Latinos/Hispanics (Eamranond et al., 2009). However, this study’s findings indicated no significant association between hypertension and language(s) usually spoken at home.

This study’s results were mixed on the relationship of blood lipid profile to acculturation. Consistent with the findings of Eamranond et al. (2009), the researchers observed that Hispanics who spoke only Spanish had a significantly higher mean LDL-cholesterol level than those who spoke both English and Spanish equally or more English than Spanish. Contrary to other reports (Eamranond et al., 2009; Lopez et al., 2015; López, Peralta, Lee, Al Hazzouri, & Haan, 2014) that indicated greater acculturation is associated with a lower risk of CVD, our results indicate that there was no significant association between CHD and language(s) usually spoken at home.

There are limitations that apply to this study. First, the data set is cross-sectional, which limits the ability to make inferences about causality. Second, language(s) usually spoken in the home is the only measure of acculturation used in NHANES. The NHANES data set provided no data regarding background characteristics of the subjects such as whether the subjects were first or second generation immigrants, or whether they were from rural or urban areas. Dietary acculturation and changes of food behaviors were not available in the NHANES database.

CONCLUSION

This research study demonstrated that language(s) usually spoken at home (English more than Spanish or only English) was associated with higher intakes of total fat, total saturated fat, total monounsaturated fat, total polyunsaturated fat and sodium than the other groups. However, there was no significant relationship between language(s) usually spoken at home with fiber intake. Overweight/obesity and prediabetes were associated with language(s) usually spoken at home (English and Spanish equally). Diabetes, hypertension and CHD had no significant relationship with language(s) usually spoken at home.

Given the severity of obesity and diabetes among Latinos, well-designed prospective studies on acculturation, dietary intake, and health outcomes are needed. Acculturation of sub-groups of Latinos/Hispanics (Mexican-Americans, Puerto Ricans, Cubans, Central and South Americans) should be compared as there may be differences among Hispanic cultural groups that
could affect the results. Future studies should examine different parameters related to acculturation such as generational status, dietary acculturation score, social acculturation and birthplace given the complexity and multi-dimensional nature of the process of acculturation. Healthy eating is one of the most powerful tools to reduce onset of chronic diseases. Therefore, future studies should focus on development of dietary interventions to mediate the contribution of acculturation to chronic disease risks.


EXAMINING THE ASSOCIATION BETWEEN HEALTHCARE QUALITY AND HEALTH STATUS AMONG AMERICAN CHILDREN

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ABSTRACT

Purpose: The purpose of this study was to examine potential risk factors associated with health outcomes for American children, ages 5 to 12.

Background: American children are diagnosed with serious acute and chronic disease types in increasing numbers. It is imperative to investigate existing children’s health outcomes in the United States, which may be interrelated due to the lack of healthcare quality, inaccessibility to quality care, and other factors. This study examined inpatient admissions for pediatric patients using the Kids’ Inpatient Database (KID) of the Healthcare Cost and Utilization Project (HCUP), and the Agency for Healthcare Research and Quality (AHRQ, 2014). The variables of this study included minority status (MS), healthcare quality (HQ), disease prevalence (DP), diabetes (DM), nutritional and miscellaneous metabolic disorders (NMMD), bronchitis and asthma (BA), kidney and urinary tract infections (KUTI), and viral infections (VI) and epilepsy/convulsions (EC).

Sample: A large, randomly drawn sample (N = 524,581) of boys (n = 244,553) and girls (n = 280,028) ages 5 to 12, from the 2012 KID was examined in this research study, to test for the association between disease prevalence and healthcare quality. The Pearson Chi Square test was applied to measure for significant variable relationships in this research study.

Results: The results of this study found a statistically significant association between healthcare quality and disease prevalence (p < .001). Other significant associations were also found as a result of the Chi square analysis.

Conclusion: Strong associations were found when socio-economic status was examined with the prevalence for diabetes (DIA), nutritional and miscellaneous metabolic disorders (NMMD), bronchitis and asthma (BA), kidney and urinary tract infections (KUTI), viral infections (VI) and epilepsy/convulsions (EC). The research findings substantiate the importance of the quality of healthcare and healthcare services delivery for all children, especially those who are members of minority/ethnic groups.

Keywords: healthcare, disease, prevalence, children, gender
Racial and ethnic health disparities are not new in the U.S., but the last 10 years have seen a tremendous focus on such inequities, due in part to the release of the Institute of Medicine’s Unequal Treatment Report (Hanlon, Rosenthal, & Hinkle, 2011; Beal & Hasnain-Wynia, 2013). The prevalence of health problems and disparities may be associated with factors such as race, ethnicity, socioeconomic status, and other risk factors across multiple system levels (Centers for Disease Control and Prevention, 2012).

Research studies have reported that American children (infants, children, and adolescents) suffer from a variety of preventable diseases that may impact them throughout childhood and into adulthood, such as asthma, obesity, diabetes, high cholesterol, and heart disease (National Center for Health Statistics, 2011). Attempts to fully integrate health services for children and youth across major service systems (health, mental health, education, child welfare, and juvenile justice) are still in their infancy (Jenson & Fraser, 2016).

To make a significant difference in the health of children and youth, federal policy cannot be constrained to the mere creation of coordinated systems of care, though this would be a substantial achievement (Healthy People 2020; 2008; 2014). Healthcare policies must also address the poverty and social inequities associated with poor health and well-being among children. Health promotion and disease prevention may be the key in reducing the prevalence of diseases. Children living in low and middle-income households are more prone to poor health, due to greater difficulties accessing timely medical care and a higher risk of illness and accidents. Mehta, Lee, and Ylitalo (2013) found important racial/ethnic disparities across many of the indicators of children’s health, adjusting for socioeconomic status, nativity, and access to health care. Individuals responsible for developing health policies in the U.S. have primarily focused on the analysis of health interventions. However, researchers and analysts believe that prevention should also be a high priority initiative in many economically disadvantaged communities (Russell & Sinha, 2016).

The collection and analysis of current and accurate health care data is imperative, in order to inform decision making and to improve health care delivery (AHRQ, 2014). The Kids’ Inpatient Database (KID) is part of a family of databases and software tools developed for the Healthcare Cost and Utilization Project (HCUP). The KID is the largest publicly-available all-payer pediatric inpatient care database in the United States. The KID has been produced every three years since the initial publication in 1997 (AHRQ, 2014).

**Purpose**

The purpose of this study was to analyze KID data in order to: 1) examine potential risk factors associated with health outcomes for children ages 5 to 12; and 2) provide public health information to help to promote acute and chronic disease awareness and knowledge of potentially associated risk factors, which may help to stimulate healthy lifestyle behavior among American children and adults.

**Methodology**

The data in this study were retrieved from the 2012 KID. A randomly selected sample of 524,581 American children, who reside within 46 U.S. states, was examined. The association between children’s health outcomes and potential risk factors (a = .05) was examined. The KID contained categorical data which warranted the application of a non-parametric testing method. The Chi Square test for association was applied to determine the association between all study variables. The variables examined were: socio-economic status (SES), which was measured for its association with minority status (MS), healthcare quality (HQ), diabetes (DIA), nutritional and miscellaneous metabolic disorders (NMMD), bronchitis and asthma (BA), kidney and urinary tract infections (KUTI), viral infections (VI), and epilepsy/convulsions (EC). The variable, minority status (MS), was measured for its association with DIA, disease prevalence (DP), and HQ. There was also a test for association between HQ and gender (GEN) and HQ and DP. The level of the children’s healthcare quality experience was defined based on reported valid/proper and invalid/improper treatment procedures. The children’s health status was based on both existent and non-existent disease prevalence (AHRQ, 2014). The determination of whether a child resided in an economically disadvantaged community was based on the child’s zip code at the time of the analysis.
The Cramer’s V and Phi statistics were used to measure the strength of association for each study variable. When the Chi Square test for association method is applied to assess a 2 X 2 cross tabulation table, the best measure to test for strength of association is Phi; and Cramer’s V is the best measure for strength of association when assessing a cross tabulation table larger than 2 X 2 (Statistics Solutions, 2016). Figure 1 represents the standard for assessing the strength of association when analyzing Cramer’s V and Phi coefficients (Statistics Solutions, 2016).

**Figure 1 - Standard for Cramer’s V and Phi Coefficients**

<table>
<thead>
<tr>
<th>Levels of Association</th>
<th>Strength of Association</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; . 10</td>
<td>Weak</td>
</tr>
<tr>
<td>.11 to .30</td>
<td>Moderate</td>
</tr>
<tr>
<td>.31 to .35</td>
<td>Strong</td>
</tr>
<tr>
<td>&gt; .35</td>
<td>Very Strong</td>
</tr>
</tbody>
</table>

**Results**

Thirty-one percent of the sample resided within economically disadvantaged communities; 47% were White; 15% were Black; 19% were Hispanic/Latino; 15% were categorized as Other; 3% were Asian/Pacific Islander; and 1% was identified as Native American. Fifty-three percent of the sample was classified as belonging to a minority ethnic group. Forty-seven percent of the sample was male (n = 244,553), and 53% was female (n = 280,028).

There was a statistically significant association (p < .001) between SES and MS, HQ, and the six negative children’s health outcomes which were examined in this study (see Table 1). A statistically significant association was found between MS and DP, and a statistically significant association was also found between HQ and MS, in addition to HQ and GEN. The Cramer’s V and Phi coefficients were obtained for all statistically significant associations and revealed very strong relationships between SES and DIA, NMMD, BA, KUTI, VI, EC, and DP (see Table 1).

Phi coefficients revealed very strong relationships between HQ and DP, HQ and GEN, and HQ and MS. Cramer’s V and Phi coefficients were determined to be of equal value for each Chi Square test for association. Cramer’s V and Phi coefficients greater than .40, imply that there is a very strong relationship between the measured variables, but the variables may measure the same concept (Marchant-Shapiro, 2014).

**Conclusion**

The research findings substantiated the importance of healthcare quality and socioeconomic status, as demonstrated by the associations between those variables and specific disease prevalence. Strong associations were found between socio-economic status and the prevalence for diabetes, nutritional and miscellaneous metabolic disorders, bronchitis and asthma, kidney and urinary tract infections, viral infections and epilepsy/convulsions. There was also a strong association between gender and ethnicity with healthcare quality.

The findings of this research study provide support for increased nationwide efforts to improve healthcare quality and to promote gender and racial equality, in order to eliminate children’s health disparities. American health systems should continue to develop health promotion and disease prevention educational programs, in order to facilitate a reduction in disease prevalence among children. There should also be initiatives established to provide cultural competence training, which may serve to reduce ethnic, racial, and gender disparities and to promote cultural awareness within hospitals and health
facilities. In addition to improving children’s healthcare quality within the health systems, efforts to improve accessibility of quality care for children who reside in economically disadvantaged communities should be heightened, in order to eliminate children’s healthcare disparities in the United States.

Table 1 – Associations between Socioeconomic Status (SES), Minority Status (MS), Healthcare Quality (HQ), Disease Prevalence (DP) and Health Conditions

<table>
<thead>
<tr>
<th></th>
<th>X2</th>
<th>P value</th>
<th>Cramers V and Phi</th>
</tr>
</thead>
<tbody>
<tr>
<td>DP and SES</td>
<td>62686.523</td>
<td>&lt; .001</td>
<td>.346</td>
</tr>
<tr>
<td>MS and SES</td>
<td>246552.868</td>
<td>&lt; .001</td>
<td>.686</td>
</tr>
<tr>
<td>HQ and SES</td>
<td>131145.982</td>
<td>&lt; .001</td>
<td>.500</td>
</tr>
<tr>
<td>DIA and SES</td>
<td>489898.763</td>
<td>&lt; .001</td>
<td>.966</td>
</tr>
<tr>
<td>NMMD and SES</td>
<td>461044.805</td>
<td>&lt; .001</td>
<td>.937</td>
</tr>
<tr>
<td>BA and SES</td>
<td>494672.348</td>
<td>&lt; .001</td>
<td>.971</td>
</tr>
<tr>
<td>KUTI and SES</td>
<td>483711.617</td>
<td>&lt; .001</td>
<td>.960</td>
</tr>
<tr>
<td>VI and SES</td>
<td>480067.652</td>
<td>&lt; .001</td>
<td>.954</td>
</tr>
<tr>
<td>EC and SES</td>
<td>446113.236</td>
<td>&lt; .001</td>
<td>.922</td>
</tr>
<tr>
<td>DIA and MS</td>
<td>246559.530</td>
<td>&lt; .001</td>
<td>.686</td>
</tr>
<tr>
<td>MS and DP</td>
<td>229747.873</td>
<td>&lt; .001</td>
<td>.662</td>
</tr>
<tr>
<td>MS and HQ</td>
<td>131144.968</td>
<td>&lt; .001</td>
<td>.500</td>
</tr>
<tr>
<td>GEN and HQ</td>
<td>130760.332</td>
<td>&lt; .001</td>
<td>.499</td>
</tr>
<tr>
<td>HQ and DP</td>
<td>131145.982</td>
<td>&lt; .001</td>
<td>.500</td>
</tr>
</tbody>
</table>
REFERENCES


A COMPARISON OF GAIT AND LOWER EXTREMITY MUSCLE ACTIVITY WITH AND WITHOUT ANKLE-FOOT ORTHOSES IN CHILDREN WITHOUT IMPAIRMENTS: A PRELIMINARY STUDY

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ABSTRACT

Purpose: The purpose of this pilot study was to examine the effects of two different ankle foot orthoses (AFO) on gait characteristics and muscle activity in unimpaired healthy children, in order to provide baseline data on the effects of AFOs on gait and muscle activity.

Sample: A convenience sample of eleven elementary school children, who did not have any musculoskeletal and neuromuscular pathology, participated in the study.

Methods: Participants participated in three trials. They ambulated on the GAITRite electronic walkway without an AFO, while wearing a solid, prefabricated AFO, and while wearing a KiddieGAIT™ dynamic AFO (DAFO). During the ambulation trials, electromyography (EMG) data were collected on the tibialis anterior, medial gastrocnemius, biceps femoris, and vastus medialis. Spatial and temporal gait characteristics were also measured.

Results: When gait activities with the KiddieGAIT™ DAFO and without an AFO were compared, there were statistically significant differences for stride length (mean= 109.2 ±14.22 cm; p= 0.0413) and heel off/on percent (mean 18.94 ± 6.64%; p= 0.0399). When the DAFO, prefabricated AFO and no AFO trials were compared, statistically significant differences were found for swing time (mean= 0.37 ± 0.044 sec; p= 0.0424), swing percent of cycle (mean = 40.11±1.66%; p= 0.044), stance percent of cycle (mean= 59.88±1.65%; p= 0.0392) and muscle activity for the tibialis anterior (mean= 195.1±54.31; p= 0.019).

Conclusion: The use of the KiddieGAIT™ DAFO may increase propulsion during ambulation in unimpaired healthy children.

Keywords: AFO, Dynamic AFO, Gait, EMG
Ankle-foot orthoses (AFOs) are commonly used to improve gait characteristics in children with various neuromuscular or musculoskeletal impairments. The dynamic AFO (DAFO) and prefabricated, off-the-shelf AFO are popular orthotics, and are selected for use based on factors such as the amount of stability required, severity of functional limitation, monetary cost, energy cost, effectiveness, and patient compliance (May, 2011).

Dynamic AFOs are often constructed with materials that have energy storing properties, such as carbon fiber, which may lower the physiological energy cost for an individual using this type of orthotic. Prefabricated AFOs are typically mass-produced and can be made with many different materials, with varying amounts of flexibility. A thermoplastic-type material is commonly used, resulting in a more rigid orthotic than the dynamic AFO (Edelstein and Moroz, 2011). Prefabricated AFOs are often used to determine the appropriateness of an AFO or as a short-term alternative, while a custom orthotic is being fabricated.

Determining the appropriateness and effectiveness of an AFO can be a challenge, given the variety of devices available. Understanding the effects that AFO's have on gait is valuable to this decision making process. In order to determine if an AFO is appropriate and/or effective, a comprehensive gait analysis is necessary. This analysis should include a recording of temporal and spatial characteristics, with and without an AFO. The analysis should also include an examination of muscle activity (GAITRite, 2010). A list of operational definitions of common measurements of gait characteristics can be found in Table 1.

Several studies have investigated the temporal and spatial characteristics of AFO use. In one study, Hayek et al. (2007) compared the gait characteristics of 56 children with diplegic and hemiplegic spastic cerebral palsy, who ambulated either barefoot or with an AFO prescribed by their physician. The study utilized three dimensional (3D) gait analysis with an eight camera system and a force plate signal output to determine the gait characteristics. The study found that the participants with hemiplegia demonstrated an increase in stride length and a reduction in cadence when wearing the AFO; however, gait speed was not affected. Participants with diplegia demonstrated an increase in stride length and an increase in walking velocity with the AFO, but there was no difference in cadence. Both groups demonstrated an increase in dorsiflexion at initial contact and at swing in both lower extremities with AFO use.

Another study compared three different AFOs to barefoot walking in 37 children with hemiplegic cerebral palsy, with an 8 camera 3D analysis system (Van Gestel, Molenaars, Huenuerts, Seyker & Desloovere 2008). The AFOs which were used included a posterior leaf spring AFO (PLS), a dual carbon fiber spring AFO (CFO), and an Orteams, which is designed to allow more mobility in the foot during gait. A decrease in cadence and an increase in step length were seen for all AFOs; and an improved ability to increase plantarflexion was found with the use of the CFO.

Abel, Juhl, Vaughn, & Damiano (1998) studied the effects of various AFOs on 35 children with spastic diplegic cerebral palsy and equinus or pes planovalgus deformities. A 3D gait analysis found an increase in velocity, stride length, and single limb support time, but no change in cadence.

Buckon et al. (2004) compared barefoot walking to ambulation with solid AFOs, hinged ankle foot orthoses (HAFO) and PLS AFOs in 16 children with spastic diplegia, using a 3D gait analysis with a six camera system. The researcher found an increase in step length and stride length, and a decrease in cadence when ambulating with any of the AFOs. However, the gait velocity was reduced when the participants ambulated with HAFOs compared to a PLS AFO.

Dursun, Dursun, & Alican (2002) studied the effects of AFOs on children with spastic cerebral palsy and dynamic equinus deformity. The researchers utilized videotape recordings to analyze temporal and spatial gait characteristics. Their study found that use of the AFOs increased velocity, cadence, stride length, and stride width within this population.

There have been a few studies that have examined gait characteristics and muscle activity simultaneously in children wearing AFOs. Radtka, Skinner, Dixon and Johanson (1997) compared the gait characteristics of 10 children with spastic cerebral palsy and dynamic equinus gait pattern, ambulating with a solid AFO, with a DAFO, and without an AFO. The participants wore each AFO for one month prior to the measurements. The researchers utilized surface electromyography (EMG) to determine the timing of lower extremity
muscle groups, 3D motion analysis to measure joint motions, and contact-closing footswitches to measure gait speed, stride length, and cadence. The study found significant differences in stride length and cadence when comparing ambulation with an AFO and without an AFO, but there was no effect on gait speed. There was no statistically significant difference between joint motions at the knee, hip, pelvis and trunk at initial contact and mid stance, and no differences noted with muscle timing. Plantarflexion was reduced during stance with the solid AFO and the DAFO. There were no statistically significant differences found in any measurement when comparing the solid AFO versus the DAFO.

In order to compare custom made AFOs and DAFOs, Lam, Leong, Li, Hu, and Lu (2005) used a six camera video system to collect 3D kinematic and kinetic data, as well as EMG muscle activity on 13 subjects with spastic cerebral palsy. An increase in stride length and reduced plantarflexion was noted for the custom made AFO and the DAFO. The tibialis anterior had a decrease in force with the use of the custom made AFO and the DAFO. An increase in force was seen in the calf muscles with the AFO usage. No increase in calf muscle force was noted without the use of an AFO or with the use of the DAFO. There was also an increase in force for the hamstrings with the use of the custom made AFO, and the DAFO.

Romkes, Hell, & Brunner (2005) also used a six video camera system with 3D analysis and EMG to evaluate the effects of a HAFO on gait characteristics and muscle activity in ten children with hemiplegic cerebral palsy. The participants demonstrated an increase in step length and stride length and a decrease in cadence, which resulted in a faster gait speed.

Multiple studies have investigated the effects of AFOs on children with pathological impairments; however, the results are difficult to compare because the studies examined different pathologies, utilized multiple types of AFOs, and used different methods to determine gait characteristics. Disorders such as cerebral palsy can vary in severity relative to musculoskeletal or neuromuscular impairments. These variances introduce additional variables in the examination of muscle activity and ambulation. To date, there have been no published studies analyzing the effects of AFOs on unimpaired children. The purpose of this pilot study was to isolate the effects of two different types of AFOs on spatial and temporal gait characteristics and peak muscle activity in unimpaired children, in order to provide baseline data for further study. The researchers analyzed children without neurological or musculoskeletal impairments in order to minimize variability and isolate the changes due to the orthotic devices.

**METHODS**

**Participants**

This study utilized a convenience sample of children from a local elementary school, who were enrolled in the first through fourth grades. Participants were included in the study if they were independent in ambulation, if they had no gait deviations, and if they had no loss of motion in either lower extremity. Participants were excluded if they had a history of musculoskeletal, neuromuscular or cardiopulmonary impairment, as reported by their parent or guardian. An informed consent containing the risks, benefits, and rights of all participants was obtained from each subject’s parent/guardian prior to collection of data. This study was approved by the University’s Institutional Review Board.

**Equipment**

The equipment used in this study included: 1) A Sammons Preston Prefabricated AFO; 2) A KiddieGAIT™ DAFO; 3) Boys Cohesion GT H&L by Saucony; 4) The GAITRite™ Electronic Walkway; 5) A Noraxon Telemetry Unit; 6) Bipolar Ag/AgCl Snap Disposable Surface Electrodes (3.8cm diameter); and 7) Alcohol Wipes.

The AFOs utilized in this study were an unmodified polypropylene prefabricated AFO purchased from Sammons Preston. The unmodified KiddieGAIT™ DAFO was produced by Allard USA. According to Allard USA (Orthoped 2010), the KiddieGAIT™ DAFO is indicated for individuals with: foot drop; gait deviations secondary to proprioceptive deficit; idiopathic toe walkers with no midfoot collapse; low tone crouch gait; spina bifida; spastic diplegia; or muscular dystrophy. Hayek et al. (2007) stated the KiddieGAIT™ DAFO is contraindicated in instances where full range of motion was absent or in the presence of an excessively rigid foot structure. In order to minimize variations in different devices, one
type of dynamic AFO was used for all participants. In order to minimize inconsistencies caused by footwear, all participants wore identical Boys Cohesion GT H&L shoes made by Saucony.

The GAITRiteTM electronic walkway was chosen to measure the temporal and spatial gait characteristics. It is a portable and validated method to measure temporal and spatial gait characteristics. The GAITRite has been confirmed as a reliable and valid method for calculating temporal and spatial gait characteristics (McDonough, Batavia, Chen, Kwon & Ziai, 2001). According to the GAITRite Technical manual (2010), “the electronic walkway contains eight sensor pads encapsulated in a roll up carpet to produce an active area 24 inches (61cm) wide and 192 inches (488cm) long. In this arrangement the active area is a grid, 48 sensors by 384 sensors placed on .5 inch (1.27 cm) centers, totaling 18,432 sensors.”

A Noraxon Telemyo EMG telemetry unit (Noraxon U.S., Inc., Scottsdale AZ) was utilized to measure the muscle activity of the medial gastrocnemius, tibialis anterior, vastus medialis, and biceps femoris. The amplifier bandwidth frequency ranged from 16 to 500 Hz, with an input voltage of 12 VDC at 1.5 A. The input impedance of the amplifier was 20,000 kΩ, and the common-mode rejection ratio was 130 Db. Bipolar Ag/AgCl snap disposable surface electrodes with a 3.8 cm diameter were placed over the selected muscles. Alcohol wipes were utilized to clean the skin prior to placement of the electrodes.

Procedure

Each participant performed three different trials, which included: 1) ambulating without an AFO, 2) ambulating with the prefabricated AFO, and 3) ambulating with the KiddieGAIT™ DAFO. Random selection was utilized to establish the trial order, and to determine whether the AFO was to be worn on the right or left lower extremity for each participant. Each subject was fitted with the appropriate size shoe. A shoe that was one half size larger was worn with the AFO, in order to accommodate the orthotic device. When determining the size for the unmodified prefabricated AFO, the distal end of the AFO was positioned slightly proximal to the first MTP joint in each subject. Correct fitting for the KiddieGAIT™ DAFO required the entire foot to fit on the foot platform. After the fitting was completed, bipolar silver silver/chloride disposable surface electrodes were placed over the muscle bellies of the medial gastrocnemius, tibialis anterior, vastus medialis, and biceps femoris. A maximum voluntary isometric contraction (MVIC) was collected for each muscle, according to the Kendall manual muscle testing procedure. (Kendall, McCreary, Provance, Rodgers, & Romani, 2005).

After the randomly selected AFO was donned, each subject ambulated 400 feet to allow for the accommodation of the orthotic device. The subject was then instructed to walk at a self-selected pace across the GAITRite electronic walkway. During this walk, EMG data were collected. Muscle activity was recorded in the aforementioned muscles during each trial, using the Noraxon Myosystem 1200 EMG device. A three to five-minute rest period was utilized between each trial, in order to prevent fatigue and to allow time for donning and doffing the AFOs. Each trial was performed using the above noted process.

As the participants ambulated on the GAITRite electronic walkway, the following parameters were measured and recorded: velocity, cadence, step time, step length, cycle time, stride length, swing time, stance time, percent of time in swing phase, percent of time in stance phase, toe in/out angle, percent of time in single limb support, percent of time in double limb support, and heel off/on percent.

Data Analysis

Demographic information was summarized using descriptive statistics. An analysis of variance (ANOVA) with post hoc Newman-Keuls Multiple Comparison Test was used to compare ambulation trials with the KiddieGAIT™ DAFO, with the prefabricated AFO, and without an AFO. T-tests were utilized to compare the gait characteristics of the AFO side to the non-AFO side for the separate conditions of wearing the KiddieGAIT™ and the prefabricated AFO.
RESULTS

A sample of 11 subjects (6 males and 5 females, mean age of 5.55 ± 1.578 years, mean height of 116.76 ± 10.798 cm, and mean weight of 22.85 ± 4.122 kg), participated in this study. Due to inconsistencies in the EMG recording for one participant, 10 subjects were included for the EMG component of the study. The stride length for the KiddieGAIT™ DAFO trial (mean = 109.2 ±14.22 cm) was greater than the stride length for the non AFO trial (mean = 108.2 ±14.54 cm), (p = 0.0413), (t = 2.341), (df = 10). See Table 1. The differences between the means for both comparisons were statistically significant (p<0.05). There were no statistically significant differences found by the t-tests when comparing the prefabricated AFO to the non-AFO side (See Tables 2 and 3).

When using ANOVA to compare the KiddieGAIT™ DAFO, the prefabricated AFO, and the non-AFO trials, a significant difference was found for swing time, swing percent of cycle, stance percent of cycle, and tibialis anterior average peak of gait cycle (See Table 4). The swing time was greater for the KiddieGAIT™ DAFO (mean = 0.3739 ± 0.04443 sec) when compared to no AFO (mean = 0.3505 ±0.03813 sec), but no statistically significant difference was found when comparing the prefabricated AFO to the KiddieGAIT™ DAFO (mean = 0.3660 ± 0.04757 sec), or between the prefabricated AFO and non-AFO trials, (p = 0.0424), (f= 3.716), (df= 2). For the swing percent of cycle, there was a greater mean for the KiddieGAIT™ DAFO (mean = 40.11±1.658%) when compared to the prefabricated AFO (mean = 38.83%, SD = 2.068), and to no AFO (mean = 38.57±1.306%), (p= 0.0436), (f= 3.678), (df= 2). No statistically significant difference was noted when comparing the prefabricated AFO to no AFO.

For the stance percent of cycle, there was a lower mean for the KiddieGAIT™ DAFO (mean= 59.88±1.647%), when compared to the prefabricated AFO (mean= 61.21± 2.082%) and no AFO (mean= 61.43±1.287%), (p= 0.0392), (f= 3.826), (df= 2). The differences were not statistically significant. The average peak gait cycle of the tibialis anterior had a greater percent of muscle activity for the prefabricated AFO (mean= 179.0±46.29) when compared to no AFO, (p= 0.0194), (f= 4.950), (df= 2). No significant difference in muscle activity was noted when comparing the KiddieGAIT™ DAFO to the prefabricated AFO.

DISCUSSION

The results of this pilot study suggest that use of the KiddieGAIT™ DAFO can have a therapeutic impact on children with lower extremity impairments that affect gait. Statistically significant differences were found when comparing the use of the DAFO, the AFO, and no AFO. The results may serve as a baseline for examining the effects of the use of AFOs on children with impairments.

The increase in stride length when comparing the KiddieGAIT™ DAFO to no AFO is consistent with other studies (Abel, Juhl, Vaughn, & Damiano1998; Durson, Durson & Alican, 2002; Hayek et al., 2007; Lam, Leong, Li, Hu & Lu, 2005; Radtka, Skinner, Dixon & Johanson, 1997; Romkes, Hell & Brunner, 2005). The ability to increase stride length by the use of the KiddieGAIT™ DAFO in unimpaired children could benefit children with unilateral pathological involvement. Many children with musculoskeletal and neuromuscular impairments demonstrate a decrease in stride length on their involved side for various reasons such as decreased muscle strength, increased spasticity, or decreased proprioception (May, 2011). If the KiddieGAIT™ DAFO improves stride length in this population, a more symmetrical gait pattern could be developed, which may facilitate functional improvement and decrease energy cost associated with many gait deviations.

When comparing the KiddieGAIT™ DAFO side to the non-AFO side within each trial, there was an increase in the heel off/on percent. A possible cause for the increase in heel off/on percentage may be the increase in stride length seen with the KiddieGAIT™ DAFO. In children without musculoskeletal or neuromuscular impairments, the increase in stride length may have caused the percent of time the heel is in contact with the floor during the stance phase of gait to increase. Since stride length was found to be greater
on the KiddieGAIT™ DAFO side when compared to the no AFO side, an assumption can be made that step length was also increased, but not enough to generate a significant difference. The increase in swing time, increase in swing percent of cycle, and the decrease in stance percent of cycle, differ from the study by Romkes, Hell & Brunner (2005), which found no change in stance phase duration. These inconsistencies may result from the different types AFOs used in each study. Romkes, Hell & Brunner (2005) utilized a HAFO while this study utilized the KiddieGAIT™ DAFO. The energy storing properties of the KiddieGAIT™ DAFO could be responsible for the increase in swing time and swing percent of the gait cycle, as well as the subsequent decrease in stance percent of gait cycle in this study. The changes in gait characteristics found when comparing the KiddieGAIT™ DAFO to the prefabricated AFO and to no AFO, could benefit children with pathological impairments that alter their gait pattern. If the use of the KiddieGAIT™ DAFO can replicate these dynamic changes in children with impairments, the use of the DAFO may vastly increase functional mobility and quality of life.

The increase in peak muscle activity of the tibialis anterior that was found when comparing both AFOs to the norm was unexpected. An AFO is expected to reduce muscle activity of the tibialis anterior during swing phase of gait, as seen in the studies performed by Lam, Leong, Li, Hu & Lu (2005) and Romkes, Hell & Brunner (2005). The absence of pathology in the pilot study participants could provide an explanation. Most of the studies that examine the use of AFOs are in children with pathological impairments, who often have proprioceptive deficits. In unimpaired children, proprioception is intact. As a result, the platform of the AFO could serve as a feedback mechanism when contacting the plantar surface of the foot, causing the children to increase dorsiflexion during the swing phase of gait.

The only results for the prefabricated AFO that demonstrated a significant difference was an increase in peak muscle activity for the tibialis anterior. This result may also be linked to intact proprioception and the foot platform serving as a feedback mechanism increasing dorsiflexion therefore, this result would not be expected in children with pathological impairments. Since no statistically significant differences were found between the prefabricated AFO and no AFO in children without pathological impairments, additional research is needed to better understand the effects of prefabricated AFOs.

LIMITATIONS

There are several limitations to this study. An abnormal gait pattern may have been demonstrated by the participants because of the use of unfamiliar orthotics and equipment such as the surface electrodes and wireless EMG sensors. However, after ambulating 400 feet to allow for accommodation of the AFOs and other equipment, the participants appeared to display minimal gait deviations. The fact that the AFOs were unmodified could potentially alter the biomechanical advantage of the two AFOs being assessed. In future research, modified AFOs should be utilized to determine the real world application of AFOs. The limited number of participants (10) potentially altered the number of significantly different results. Future research should include more subjects in order to increase the reliability and validity of the study. Finally, inaccurate maximum voluntary isometric contractions could have been obtained if the children did not completely understand the directions which were provided.

CONCLUSION

In children without impairments, the KiddieGAIT™ DAFO was able to alter gait characteristics. The KiddieGAIT™ increased percent of time in swing phase, decreased percent of time in stance phase, and increased stride length. These results indicate that the KiddieGAIT™ DAFO may increase propulsion during ambulation. The only statistically significant difference for the prefabricated AFO was an increase in peak muscle activity of the tibialis anterior. Given that the subjects in this study did not have musculoskeletal or neuromuscular impairments, the researchers assume that the results of the study were due to the effects of the DAFO and AFO. Although the findings of this pilot study cannot be applied to children with impairments, they may provide baseline information for future research with children with impairments.
<table>
<thead>
<tr>
<th>Operational Definition</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Velocity</td>
<td>Velocity is calculated by dividing the distance walked by the ambulation time. (cm/second)</td>
</tr>
<tr>
<td>Ambulation time</td>
<td>Ambulation time is the time elapsed between first contact of the first and last footfalls.</td>
</tr>
<tr>
<td>Cadence</td>
<td>Cadence is the number of steps per minute</td>
</tr>
<tr>
<td>Line of Progression</td>
<td>Line of progression is the line connecting the heel centers of two consecutive footfalls of the same foot.</td>
</tr>
<tr>
<td>Stride length</td>
<td>Stride length is measured on the line of progression between the heel points of two consecutive footprints of the same foot (left to left, right to right). (cm)</td>
</tr>
<tr>
<td>Step length</td>
<td>Step length is the linear distance measured from heel strike of one foot to the next heel strike of contralateral foot. (cm)</td>
</tr>
<tr>
<td>Step width</td>
<td>Step width is measured from the midline midpoint of the current footprint to the midline midpoint of the previous footprint on the opposite foot. (cm)</td>
</tr>
<tr>
<td>Heel off/on</td>
<td>Heel off/on percent is the percentage of time the calcaneus is in contact with the supporting surface during the stance phase of the gait cycle.</td>
</tr>
<tr>
<td>Step time</td>
<td>Step time is the time elapsed from initial contact of one foot to initial contact of the opposite foot. (seconds)</td>
</tr>
<tr>
<td>Cycle time</td>
<td>Cycle time is the time when the heel of one foot strikes the ground to the time at which the same foot strikes the ground again. (seconds)</td>
</tr>
<tr>
<td>Swing Time</td>
<td>The swing phase is initiated with toe off and ends with initial contact of the same foot; swing time is the time elapsed between the last contact of the current footfall to the initial contact of the next footfall of the same foot. (seconds)</td>
</tr>
<tr>
<td>Stance Time</td>
<td>The stance phase is the weight bearing portion of each gait cycle initiated at heel contact and ending at toe off of the same foot; stance time is the time elapsed between the initial contact and the last contact of a single footfall. (seconds)</td>
</tr>
<tr>
<td>Toe in/out angle</td>
<td>Toe in/out angle is the angle between the line of progression and the midline of the footprint. (degrees)</td>
</tr>
<tr>
<td>Single limb support</td>
<td>Single limb support occurs when only one foot is in contact with the ground. (seconds)</td>
</tr>
<tr>
<td>Double limb support</td>
<td>Double limb support occurs when both feet are in contact with the ground simultaneously. (seconds)</td>
</tr>
</tbody>
</table>
### Table 2: T Test Results

<table>
<thead>
<tr>
<th></th>
<th>Prefabricated</th>
<th>No AFO (shoes on)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step Time</td>
<td>0.471±0.064</td>
<td>0.472±0.057</td>
</tr>
<tr>
<td>Step Length (cm)</td>
<td>54.850±7.038</td>
<td>52.290±6.067</td>
</tr>
<tr>
<td>Cycle Time (sec)</td>
<td>0.943±0.112</td>
<td>0.945±0.116</td>
</tr>
<tr>
<td>Stride Length (cm)</td>
<td>104.500±12.490</td>
<td>104.400±12.360</td>
</tr>
<tr>
<td>Swing Time (sec)</td>
<td>0.366±0.048</td>
<td>0.357±0.035</td>
</tr>
<tr>
<td>Stance Time (sec)</td>
<td>0.578±0.078</td>
<td>0.589±0.086</td>
</tr>
<tr>
<td>Swing Percent of Gait Cycle</td>
<td>38.830±2.068</td>
<td>37.890±2.122</td>
</tr>
<tr>
<td>Stance Percent of Gait Cycle</td>
<td>61.210±2.082</td>
<td>62.130±2.135</td>
</tr>
<tr>
<td>Degree Toe in/out</td>
<td>1.327±5.497</td>
<td>2.491±5.836</td>
</tr>
<tr>
<td>Single Limb Support Percentage</td>
<td>37.710±2.364</td>
<td>38.750±2.250</td>
</tr>
<tr>
<td>Heel off/on Percentage</td>
<td>18.920±7.887</td>
<td>16.330±7.840</td>
</tr>
</tbody>
</table>

* Denotes statistically significant results

### Table 3: T Test Results

<table>
<thead>
<tr>
<th></th>
<th>Kiddie Gait</th>
<th>No AFO (shoes on)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step Time</td>
<td>0.467±0.056</td>
<td>0.467±0.048</td>
</tr>
<tr>
<td>Step Length (cm)</td>
<td>54.660±7.362</td>
<td>53.710±7.590</td>
</tr>
<tr>
<td>Cycle Time (sec)</td>
<td>0.932±0.100</td>
<td>0.931±0.100</td>
</tr>
<tr>
<td>*Stride Length (cm)</td>
<td>109.200±14.220</td>
<td>108.200±14.540</td>
</tr>
<tr>
<td>Swing Time (sec)</td>
<td>0.374±0.044</td>
<td>0.358±0.037</td>
</tr>
<tr>
<td>Stance Time (sec)</td>
<td>0.558±0.060</td>
<td>0.573±0.071</td>
</tr>
<tr>
<td>Swing Percent of Gait Cycle</td>
<td>40.110±1.658</td>
<td>38.560±2.115</td>
</tr>
<tr>
<td>Stance Percent of Gait Cycle</td>
<td>59.880±1.647</td>
<td>60.930±1.426</td>
</tr>
<tr>
<td>Degree Toe in/out</td>
<td>0.218±6.042</td>
<td>3.373±3.591</td>
</tr>
<tr>
<td>Single Limb Support Percentage</td>
<td>38.530±2.040</td>
<td>40.150±1.919</td>
</tr>
<tr>
<td>*Heel off/on Percentage</td>
<td>18.940±6.624</td>
<td>13.960±8.064</td>
</tr>
</tbody>
</table>

* Denotes significantly different results
Table 4: ANOVA Results

<table>
<thead>
<tr>
<th></th>
<th>Prefabricated AFO</th>
<th>Kiddie Gait</th>
<th>No AFO (shoes on)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Velocity</strong></td>
<td>112.000±20.230</td>
<td>117.000±18.890</td>
<td>119.000±19.000</td>
</tr>
<tr>
<td><strong>Cadence</strong></td>
<td>129.100±17.190</td>
<td>129.900±14.460</td>
<td>133.000±13.000</td>
</tr>
<tr>
<td><strong>Step Time (sec)</strong></td>
<td>.471±0.064</td>
<td>0.467±0.056</td>
<td>0.456±0.047</td>
</tr>
<tr>
<td><strong>Step Length (cm)</strong></td>
<td>51.850±7.038</td>
<td>54.660±7.036</td>
<td>54.480±8.208</td>
</tr>
<tr>
<td><strong>Cycle Time (sec)</strong></td>
<td>0.943±0.119</td>
<td>0.932±0.100</td>
<td>0.909±0.094</td>
</tr>
<tr>
<td><strong>Swing Time (sec)</strong></td>
<td>0.366±0.048</td>
<td>0.374±0.044</td>
<td>0.350±0.038</td>
</tr>
<tr>
<td><strong>Stance Time (sec)</strong></td>
<td>0.578±0.078</td>
<td>0.558±0.061</td>
<td>0.558±0.059</td>
</tr>
<tr>
<td><strong>Stance Percent of Gait Cycle</strong></td>
<td>38.830±2.068</td>
<td>40.110±1.658</td>
<td>38.570±1.306</td>
</tr>
<tr>
<td><strong>Degree Toe in/out</strong></td>
<td>1.327±5.497</td>
<td>0.218±6.042</td>
<td>2.718±4.959</td>
</tr>
<tr>
<td><strong>Single Limb Support Percentage</strong></td>
<td>37.710±2.364</td>
<td>38.530±2.040</td>
<td>38.330±2.116</td>
</tr>
<tr>
<td><strong>Heel off/on percent</strong></td>
<td>18.920±7.877</td>
<td>18.940±6.642</td>
<td>15.970±8.176</td>
</tr>
<tr>
<td><strong>Vastus Medialis Average Peak Gait Cycle (uV)</strong></td>
<td>178.300±39.260</td>
<td>185.800±68.010</td>
<td></td>
</tr>
<tr>
<td></td>
<td>141.700±50.590</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Biceps Femoris Average Peak Gait Cycle (uV)</strong></td>
<td>174.100±36.730</td>
<td>149.200±27.140</td>
<td></td>
</tr>
<tr>
<td></td>
<td>152.60±46.480</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Medial Gastrconemius Average Peak Gait Cycle (uV)</strong></td>
<td>158.800±32.750</td>
<td>184.600±36.490</td>
<td></td>
</tr>
<tr>
<td></td>
<td>161.400±54.730</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Tibialis Anterior Average Peak Gait Cycle (uV)</strong></td>
<td>179.000±46.290</td>
<td>195.100±54.310</td>
<td>138.600±27.810</td>
</tr>
</tbody>
</table>

* Denotes statistically significant results


ABSTRACT

This article describes the experiences of four trans-disciplinary faculty members at a Historically Black College/University (HBCU), who were involved in a Faculty Learning Community (FLC). Faculty members included undergraduate and graduate level professors, in the areas of medical sociology, occupational therapy and physical therapy. The focus of the FLC was to improve teaching practices, student learning, and student engagement through high touch practices and innovative classroom techniques. Members of the FLC shared teaching challenges and teaching methods used in the classrooms. They explored the book, “What the Best College Teachers Do,” by Ken Bain, in an attempt to improve classroom-teaching skills. The faculty worked collectively to address needs in undergraduate health professions classes, in order to build a bridge to the upper level health professions curriculum (i.e. Occupational Therapy and Physical Therapy). This article outlines the piloted strategies in the areas of student assessment, critical thinking, and student engagement.

Keywords: Teaching practice, assessment, critical thinking, student engagement, faculty learning community
“We identify teaching excellence when we see evidence about the remarkable feats of student learning and indications that the teaching helped and encouraged those results; we learn something about developing teaching excellence when we try to discover what fostered that educational success” (Bain, 2004, pp.15).

Students at Historically Black Colleges and Universities are more likely to be first generation college students with a variety of learning backgrounds (Thurgood Marshall College Fund, 2015). The majority of the undergraduate students (72.3%) at the University in this study self-identified as Black or African American; and 35.7% of the graduate students self-identified as African American (Winston-Salem State University, 2016). The students entered the University under the motto, “Enter to Learn, Depart to Serve.” This motto is reinforced through the University’s curricular design, which encourages service to underserved populations. Graduates of the University are exposed to the idea of utilizing their education by working in marginalized communities.

In the summer of 2014, four trans-disciplinary faculty members who were involved in a faculty learning community (FLC) consulted their University’s Center of Excellence in Teaching and Learning, in an attempt to employ high touch practices and to improve learning outcomes in their classrooms. The FLC was comprised of a medical sociology professor, two physical therapy professors, and an occupational therapy professor. The skills in need of improvement were self-identified, based on student feedback from completed course evaluations. The University’s Institutional Assessment and Research Department had provided the course evaluations to the faculty. Students enrolled in the classes completed the evaluations anonymously. The evaluations utilized a Likert scale and open-ended options, allowing the students to provide subjective comments. Faculty reflection focused on the subjective student comments.

Research suggests that FLCs improve upon faculty interest in teaching, and they provide a supportive atmosphere for adopting new strategies in the classroom (Hord, 2009). The members of the FLC read and critically reviewed the book “What the Best College Teachers Do,” by Ken Bain (2004), in order to improve their teaching skills. Bain’s book focuses on the methods and teaching styles that are most effective for college students. The professors in the FLC sought to examine how health professions students would respond to the teaching strategies proposed by Bain, based on how the professors evaluated students, conducted class, and prepared to teach. This article describes the strategies used to build bridges in order to join educational pedagogy with student success across the health disciplines, based on the faculty members’ qualitative reflection of classroom experiences and student feedback.

METHODS

By mutual consent, the FLC professors identified three pedagogical themes: Assessments; Critical Thinking; and Student Engagement. After the themes where identified, faculty members self-reflected on their teaching practices, by noting their attitude, position, role, and implementation of activities in the classroom. The faculty members then redesigned one of their classes, by piloting high touch practices described by the Bain text. The high touch practices used by the FLC were Scaffolding; Big Picture Questions; Background Knowledge Probes; Changing Student’s Thinking; and Critical Thinking.

Over the course of two semesters (8 months), the group met monthly to reflect and to receive feedback from each other regarding proposed classroom strategies, in order to ensure that targeted activities were easily applicable to real world health care experiences. This allowed the faculty members to bridge the varied and diverse backgrounds of the students across curricular design towards a common career goal. Each professor, based on student responses and interactions during specific activities, subjectively assessed the high touch practices. The final semester student evaluations were also considered during the professors’ assessment. The professors reflected on the types of assessments they used, how they had engaged students in the classroom setting, and the critical thinking components of learning outcomes. The professors presented their reflective illustrations in a thematic manner. Members of the FLC then summarized their reflections of the piloted practices, in order to identify the most effective techniques.
Student Assessments

According to Bain, “learning is a developmental process rather than only a question of acquisition” and “grading becomes not a means to rank but a way to communicate with students” (Bain, pp.153). By accepting these concepts, the professors can appreciate the need for a method of student assessment, which asks, “What do they know?” and “What would they like to know?” This was the challenge for FLC members as they began the academic year.

Medical Sociology Professor

To facilitate learning, the medical sociology professor provided mini lectures, which averaged 20-35 minutes in a 75-minute course, for each course section. The mini lectures were paired with daily activities, such as the review of a case study or current event, to offer practice and assessment of conceptual world problems (Bain, 2004). Scaffolding techniques were often used to develop study skills and assess students’ understanding of objectives over the course of the semester. Scaffolding techniques included having students develop and complete individual study guides (which were reviewed by the professor) in preparation for course examinations. Another technique was the use of current events to facilitate a real world application of specific concepts. This technique was used to assess the students’ progress in learning and applying the concepts.

The University offered faculty the opportunity to participate in Midterm Assessment Plans (MAP). This assessment tool allowed for the mid-semester collection of data from students, and provided the professor with information they could use to address student concerns and improve the delivery of course content. The MAPs were also beneficial in showing students that the professor cared about their learning process, by identifying what was not working in the course, and using the students’ responses to improve the course for optimal learning, prior to the end of the semester.

Occupational Therapy Professor

Case studies help students apply what they were learning to real life situations, and serve as a useful tool to evaluate student learning. Throughout the semester, the OT professor used one specific case study to discuss ethical dilemmas, the appropriateness of various neurological assessments, adaptive equipment, and home/environmental modification needs. Students discussed the case in small groups. These small group discussions led to general classroom discussions. Students were actively engaged during the process. Conversations between students in the small groups and in the larger classroom setting encouraged the development of critical thinking skills. Use of the case study helped the students apply the course material and examine the case from various perspectives. For example, in one course the case study focused on the accessibility of the home environment. In another course, it focused on applying occupational therapy framework terminology. The use of the case studies enabled the students to view potential clients in a holistic manner, and to comprehend the occupational therapy process. The use of case studies was beneficial, as evidenced by the richness and depth of the class conversations and questions, and the students’ ability to apply the information in future coursework.

Physical Therapy Professor 1

In order to assess student biases and knowledge, a series of questions was asked on the first day of class, including: 1) What big picture questions will my course answer? 2) What skills and professional characteristics will my course develop? 3) How can I encourage student interest in these questions and skills? 4) What intellectual models are students likely to bring with them that the professor will want them to challenge? And 5) How can the professor help them construct that intellectual challenge?“.

The professor displayed large post-it note pads throughout the classroom. Each pad contained a question regarding past learning experiences. Students were asked to reflect on experiences that had positively or negatively influenced their learning and to write their reflections down on each notepad. The students then formed self-selected groups and analyzed the information on the notepads. They searched for trends and made suggestions regarding the themes the instructor would use in the classroom for that semester. Students were excited about the opportunity to provide feedback, and they eagerly provided suggestions for immediate implementation. In addition, the PT professor added a “Big Picture Question” to the beginning of each lecture. The big picture question facilitated discussions designed to help students understand the importance of
each topic, relative to the student’s future as a physical therapist (Bain, 2004, pp.50).

**Physical Therapy Professor 2**

The PT professor’s goal was to transform her focus from a purely performance-based approach to a learning-centered approach. The learning-centered approach was less focused on the grade each student achieved, and was more focused on helping students answer the questions, “What did you learn?” and “How will you apply it?”

In a Therapeutic Exercise class, the professor started the semester with a “background knowledge probe.” Because of the students’ varied backgrounds, they came to the course with preconceived ideas about exercise. The professor first needed to assess the students’ comfort level and familiarity with the concept of exercise. She asked the students to respond to the question, “Would you be comfortable designing an exercise program for someone with back pain?” The students who believed they were very comfortable with the exercise design were encouraged during class to share their experiences. The students who were the least comfortable with exercise design were encouraged to interact with the class members who felt more comfortable, in order to share ideas and discuss myths about exercise. The students’ responses set the foundation for the flow of the course throughout the semester.

**Critical Thinking: Building Reasoning Abilities that Stretch Across Disciplines**

“Give students many opportunities to use their reasoning abilities as they tackle fascinating problems and receive challenges to their thinking.” (Bain, pp 87)

Recognizing that critical thinking results from an integration of several reasoning abilities is a crucial first step in designing intellectual classroom experiences. Bain identifies reasoning skills (developing intellectual self-reliance, probing for assumptions, hypothetico-deductive reasoning, drawing inferences from data) and suggests that many are shared across disciplines.

**Medical Sociology Professor**

**Developing Intellectual Self-reliance**

“Does the course change the student’s thinking?” The medical sociology professor examined this question in an undergraduate General Sociology course, in order to ascertain how the course content transcended disciplines. Faculty members were tasked with teaching sociology concepts, using the critical thinking process. Critical thinking concepts included identifying and summarizing the issue, analyzing and deconstructing the issue, evaluating and interpreting the information, and developing conclusions and outcomes. With the critical thinking goals as a guide, the course instructors adjusted case studies so that students identified and questioned innovative and taboo practices, societal patterns, and institutional practices. Students tested their own line of reasoning as they analyzed hypothetical policies that guide societal protocols. Examples included the placement of a transgender male student in an all-female college, and police brutality in minority communities. The students discussed the impact of these topics on society. The discussion of specific topics often compelled students to correlate sociological concepts and consequences, while they developed and utilized critical thinking skills. Ultimately, the student became more intellectually self-reliant and confident in their thinking skills.

**Occupational Therapy Professor**

**Probing for Assumptions**

In an effort to foster critical thinking in the occupational therapy students, the OT professor lectured less and attempted to stimulate classroom discussions by providing activities that required and fostered critical thinking. The Assistive Technology course provided an excellent opportunity to promote this skill. Assistive technology is any device used to enhance the functioning and ability of an individual. Examples include weighted silverware, and a long-handled reacher, which is used to pick up items or to assist individuals with dressing. In order to promote critical thinking, the professor provided students with basic supplies such as cardboard, scotch tape, string, and paperclips. The students were asked to make an assistive technology device. This activity required them to use their creativity and expand their definition of what constitutes an assistive technology device, while challenging their assumptions of how an assistive technology device should look. These critical thinking skills are necessary when working as a clinician, because resources are often limited and flexibility and creativity are required to meet
the clients’ needs. The students and the professor were amazed at what they were able to produce. The professor posed questions such as, “what is the role of assistive technology in the occupational therapy process?” This question stimulated critical thinking about the impact assistive technology can have on the clients that occupational therapists serve.

Physical Therapy Professor 1
Hypothetico-deductive Reasoning

Physical therapists employ a long sequence of decisions requiring critical thinking when practicing their craft. A reasoning ability that contributes to critical thinking, according to Arnold Arons and described by Bain, is hypothetico-deductive reasoning. Bain defined this skill as “applying relevant knowledge of principles and constraints and visualizing, in the abstract, the plausible outcomes that might result from various changes one can imagine to be imposed on the system (Bain, 2004, pp.86).” To enhance this reasoning ability, students viewed a video-case scenario. The case documented a severely involved young woman diagnosed with multiple sclerosis. The woman lived in Africa in a small home with her mother, and required assistance for mobility, feeding, dressing, and bathing. The PT professor asked students to assess the woman’s impairments, solely from observation of the video. They were asked to apply their knowledge of multiple sclerosis to develop home modifications and a treatment intervention to improve the health and quality of life for the woman and her caregiver. The students’ care plan was constrained by a lack of financial resources, the challenging home environment, and the students’ limited hands-on experience with adults living with multiple sclerosis. Students benefited from instructor cues to adapt their approach to deductive reasoning, and to imagine therapy intervention without the luxuries of stateside clinics. This educational exercise facilitated critical thinking skills, and increased the student’s understanding of global health challenges.

Physical Therapy Professor 2
Drawing Inferences from Data

This PT professor discovered the need to prepare differently for class in order to facilitate the learning outcome of critical thinking. The professor used innovative class preparation to push beyond the simple, vague, “clutter discussions of learning objectives.” She believed that the typical discussions of learning objectives, which include learning the material, thinking critically, and feeling comfortable with the topic, might not have true value in the classroom. The class preparation, instead needed to include strategies related to what the professor wanted students to “do” intellectually rather than about what they should “learn.” For example, when an instructor teaches students about different orthopedic diagnoses, he usually introduces the students to various patient management approaches, based on a patient’s specific medical status. The concept of how to manage the individual patient involves critical observation from a number of perspectives. To stimulate discussion, the professor incorporated compare and contrast diagrams. She asked the students to compare and contrast different orthopedic conditions, in order to determine the best clinical management of specific patients. The students exchanged ideas regarding the management of patients with orthopedic conditions. The students were engaged in the process, and challenged each other. If there was disagreement on a concept, they discussed the concept thoroughly before they made a final decision.

Student Engagement

“The exceptional teachers did not just want to get students speaking; they wanted them to think and learn how to engage in an exchange of ideas.” (p. 126).

Medical Sociology Professor

Thoughtful teaching pedagogy positions student engagement as the foundation of student learning. The Bain text discusses inspiration and encouragement, which are essential aspects of teaching. The medical sociology instructor used several methods to encourage student engagement, based on their interests. Students were actively inspired and encouraged by using familiar materials, such as current events, news, popular culture, music, popular movies, and trends in society. The professor also asked students to identify their preferred testing styles and types of assignments, and to assist with the design of course assessments. To encourage their involvement, students were asked to participate in a self-
evaluation by responding to the following statements: 1) What are three areas of improvement that will enhance your learning? 2) List three methods of change that you will implement to improve. 3) Write a short letter to yourself to encourage improvement.

**Occupational Therapy Professor**

The importance of student engagement cannot be overemphasized. When students are actively involved and connected with the material discussed in class, real learning takes place. Students can better understand and apply the course content when they are engaged with the information, and when they go beyond simple memorization of facts and data. This process allows students to make connections and see the relevance of the course material in their lives and in their future careers. In one class assignment, students conducted environmental assessments of various buildings on campus. They were then presented with a practical scenario to role-play, such as a specific physical disability. Because of the assignment, the students were able to understand the difficulty that citizens with disabilities experience when they are required to mobilize in the community, and to access public buildings. Activities like entering and exiting a bathroom stall, or reaching soap to wash one's hands, became more complex. Students realized that they should not take these practical tasks for granted; and they began to look at their school and community environments in a different light. This awareness may not have occurred if the students simply heard an instructor discuss the inaccessibility of buildings, or if they read about it in a book. By actively evaluating the accessibility of their environment, learning was improved, and students were able to understand the practical application of educational concepts.

**Physical Therapy Professor 1**

Motivating graduate students to engage in learning might seem an easier task than motivating undergraduate students, as graduates students tend to link each class with preparation for professional goals. In a graduate-level adult neuromuscular physical therapy course, this challenge was addressed on the first day of class by asking a “big picture” question, “What five personal characteristics do you want to develop or possess in order to be an effective, competent neuromuscular physical therapist?” The PT professor asked students how the course could develop their chosen attributes. Students submitted their written responses to the course instructor. The common themes helped the instructor to modify the course content and place greater emphasis on the desired outcomes. This student-centered activity resulted in the use of more patient cases that explored compassion, community service, and health disparities. A year after completing the neuromuscular program content, the students reviewed their ‘big picture” answers, and they reflected on the degree of progress towards their professional development goals. Big picture questions were also included in every lecture during the semester, in order to identify common problems that should be addressed during the course.

**Physical Therapy Professor 2**

A prevailing theme in Bain’s book was trust building between the professor and the students. The teacher’s belief that the students want to learn and can learn is important to student success. The students must trust that the instructor is there for them, and is concerned about their welfare and their grasp of the course material. This trusting approach allows a more “user friendly” attitude where students understood that the professor was more interested in them understanding the material, rather than just getting a good grade on an exam. The professor used a major musculoskeletal project during the semester, to establish a foundation of trust. She allowed the students to decide what information to include in the project. The goal of the project was to have students review the course material, integrate the information, and apply critical thinking skills in preparation of actual clinical practice. There are an enormous number of musculoskeletal skills and special tests used in physical therapy. When given the option, the students requested that they be administered a comprehensive skills assessment, instead of an abbreviated version that had been previously designed. The decision to allow the students input in the examination process helped the students to understand that the professor was more interested in them understanding the material, rather than just getting a good grade on an exam, and to facilitate successful mastery of the course content.
CONCLUSION

In the FLC, members found common struggles in the journey to becoming “the best college professors.” Teaching students at the undergraduate, master, and doctorate levels challenged each member as they searched for commonalities in the classroom. The professors shared the need to improve student assessment, critical thinking, and student engagement. Ken Bain’s book helped them explore these areas, brainstorm classroom techniques, and share feedback with each other on their successes and near misses. The members supported each other throughout a yearlong process, and they have continued to seek feedback from each other throughout academic journeys that vary by type of student and teaching experience. This piloted reflection on pedagogy was the first step towards a future study, which will include a pre and post quantitative analysis of student evaluations, and qualitative reflections.


TRAINING FUTURE HEALTH CARE PROFESSIONALS TO WORK IN TEAMS: THE NEED FOR INTERDISCIPLINARY PROFESSIONAL EDUCATION

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ABSTRACT

The health care payment systems in the United States reflect changes in health care delivery and financing mechanisms implemented by private insurers, public payers, and business enterprises. Allied health programs within universities should focus on developing inter- and intra-disciplinary educational strategies that establish Interdisciplinary Professional Education (IPE) training to prepare future allied health professionals. Interdisciplinary professional education programs increase the knowledge and skills of health care professionals; thereby, improving the quality of care provided in health care facilities. Interdisciplinary professional education is an essential step in preparing a collaborative practice-ready healthcare workforce. National and international organizations support the effective strategies that comprise the training and instructional modalities of IPE. Interdisciplinary professional education training is important for many reasons: it is a national priority; training directly benefits students and faculty; and training offers substantial benefits to individuals served and their communities. Interdisciplinary professional education activities in educational institutions allow allied health programs to increase visibility and engagement on their campuses and within the community through the provision of services. Students trained using the IPE approaches are more likely to become collaborative interprofessional team members who show respect and positive attitudes toward each other and work to improve patient outcomes. Health professional education reform is critical to prepare the workforce to meet the health needs of populations with significant changes to health care.

Keywords: Interdisciplinary professional education, health care professionals, interprofessional collaboration, interprofessional practice
The health care payment systems in the United States reflect changes in health care delivery and financing mechanisms implemented by private insurers, public payers, and business enterprises. The changes are attributed to decades of unprecedented increases in health-related costs. The provision of adequate health care services has become extremely expensive. Health care provider shortages contribute to the expenses and problems in multiple sectors, as the need for medical care increases. One of the strategies for addressing these challenges includes enhancing existing systems. Technology and science have provided better communications, earlier diagnoses, less invasive procedures, shorter hospital stays, and outreach capabilities, to address an assortment of health delivery problems. One approach, with numerous successes, is the creation of interdisciplinary professional teams that train health care professionals in team approaches to improve patient outcomes, thereby providing more effective and efficient health care services (U.S. Department of Health and Human Services, 2007).

Allied health programs within universities should focus on establishing inter- and intra-disciplinary educational strategies that establish interdisciplinary professional education (IPE) training to prepare future allied health professionals. Interdisciplinary professional education programs increase the knowledge and skills of health care professionals, thereby improving the quality of care provided in health care facilities. These programs focus on providing knowledge and skills that individuals can leverage in careers in preventative and rehabilitation services.

The traditional approach to training health care professionals has included the silo approach, in which information is not shared effectively throughout the educational system, resulting in reduced efficiency and effectiveness in developing a productive skill and knowledge set. Although there are common core courses (mainly in the sciences), most students do not enroll in cross-discipline courses. Health care professionals are traditionally educated in colleges and universities with a focus on their specific disciplines; and they are socialized to their professions through training and education that provide them with specialized knowledge, skills, and values that may vary across professions (Breitbach et al., 2013). Few health practitioners are trained as a part of integrated teams (Robert Wood Johnson Foundation, 2011).

Each profession has different perceptions and interpretations about the causes of illnesses and the appropriate interventions or approaches to care (Irvine, Kerridge, McPhee, & Freeman, 2002). Professionals often have stereotypical and inaccurate expectations of other health professions that may create conflict rather than collaboration. Students trained in silos are not provided early exposure to future colleagues (current students) in other professions, and have limited understanding of the health care team approach. However, students in clinical situations must interact with other health professions to share information, execute quality and safety checks, and help patients understand and comply with treatment plans. According to Trinidad (2012), “first and foremost, medical care delivered by physicians and health care delivered by others should be aligned around the values and needs of patients”. This value alignment must begin early in the educational experience. If collaboration in patient care is not included as part of the training of health professionals, hospitals, primary care providers, and other health care organizations must spend valuable resources to retrain providers (Robert Wood Johnson Foundation, 2011).

The lack of cooperative approaches to training results in decreased collaboration among health care providers, which is an integral part of the health care system. The potential human and financial costs related to decreased collaboration are enormous. In 2011, the U.S. Department of Health and Human Services reported that, at any given time, about one in every 20 patients has an infection related to their hospital care (Association of State and Territorial Health Officials, 2011). On average, one in seven Medicare beneficiaries is harmed in the course of their care which costs the government an estimated $4.4 billion every year. In part, this is because providers do not function in teams (Robert Wood Johnson Foundation, 2011, p. 1).

Changes in the health care industry and societal demographics have affected clinical education across health care professions. The changes have resulted in an increased demand for health care practitioners, as a result of: the increased number of health care practitioners expected to retire in the near future; the increased
complexity of patient care resulting in greater demands being placed on existing health care professionals; increased cost-cutting measures in health care resulting in greater workload demands on clinical staff and managers; the reduced time devoted to the clinical education of students; and the increased numbers of students entering education programs to meet personnel demands. The health care industry also recognizes that patient care requires a collaborative team effort involving multiple disciplines. These issues are resulting in innovations in clinical education and new ways to work together (American Speech and Language Hearing Association, 2009, p.1).

As the health care focus evolves nationally and internationally, organizations recognize the requirement to change training mechanisms of medical and health care personnel. According to the World Health Organization (2010), it is no longer enough for health workers to be professionals; in the current global climate, health workers also need to be interprofessional (p. 36). It is time for healthcare professionals to become leaders in helping other professionals to transform the health care system so that all health care professionals are prepared to offer responsible care based on comprehensive curricula with deliberate, focused, collaborative clinical experiences. If this does not occur, we will continue to have a fragmented health care system of professionals who do not respect each other’s roles and those who cannot provide the quality of care that patients require (Inter-professional Collaboration, 2016).

There is a growing emphasis on IPE in health care. Interprofessional collaboration in education and practice has been promoted for over three decades by educational panels, professional/educational organizations, and grant funding agencies (Alberto & Herth, 2009, p.1). Research has supported the benefits of interprofessional collaborations in health care. Interprofessional collaborations require continuous interaction, coordinated efforts, and knowledge sharing among health care professionals. Numerous national reports recommend improving health professions education to align with emerging health care reform. Also, changes in state and national health care delivery require health professionals to collaborate in teams, health homes and accountable care organizations (American Speech and Language Hearing Association, 2009). Federal regulations also support the use of health teams to respond not only within the acute care arena but also to provide primary prevention services that prevent the occurrence of disability and disease (ASAHP, 2010, p.1).

The World Health Organization (WHO) defines interdisciplinary professional education as education that occurs when two or more professions learn from and with each other to improve collaboration and the quality of care. The organization’s officials recognize IPE as a necessary step in preparing a ‘collaborative practice-ready’ health workforce that is better prepared to respond to local health needs (World Health Organization, 2010, p. 2). Interdisciplinary professional education must include a variety of disciplines that are important and necessary to provide comprehensive care including health disciplines, informatics and management, engineering, philosophy and ethics (ASAHP, 2010, p.1). Effective interdisciplinary professional education improves the quality of patient care, and focuses on the needs of the learners. Learners are active participants in assessing, planning, delivering, and evaluating IPE (Interdisciplinary professional education Collaborative Expert Panel, 2011, p.1).

Hall and Weaver (2001) defined interprofessional as a group of individuals from different disciplines working and communicating with each other. In the interprofessional learning environment, each member provides their knowledge, skills, and attitudes to augment and support the contributions of others. The Institute of Medicine (2003) defines IPE as an interdisciplinary (interprofessional) team that consists of different professions and occupations with varied and specialized knowledge, skills, and methods (p. 54). The ultimate goal of IPE is to promote and support the process by which students, residents, fellows, and faculty with different health disciplinary backgrounds learn and interact with each other with the focus on improving care for patients. Students from all programs should participate in interprofessional placements that provide interaction and collaboration with at least one other health discipline in the care of actual patients, clients, and families. Interdisciplinary professional education should also foster competencies beyond clinical care including leadership, advocacy, and evidence-based practice. Support should be provided for broad-based partnerships that may involve multiple practice sites.
as well as various schools and programs, to build opportunities that are meaningful through collaborative use of resources.

Support for IPE is based on the idea that informed and collaborative practices across disciplines will increase the efficiency and effectiveness of delivery systems to promote team-based, patient/family centered health care (ASAHP, 2010, p.1). The current mission of the Association of Schools of Allied Health Professions (ASAHP) is to improve health through excellence in education. The Association of Schools of Allied Health Professions (ASAHP) strongly endorses and supports interprofessional initiatives. The core objectives of ASAHP (2010) firmly place IPE and its multidisciplinary collaboration, education, development, and healthcare outcomes at the forefront of its mission (2010, p.1). O’Neil and the Pew Health Professions Commission (1998) urged colleges and universities with health professional training programs to change professional training to meet the demands of the new health care system (p. 25). According to the Institute of Medicine (2003), all health professionals should be educated to deliver patient-centered care as members of an interdisciplinary team, emphasizing evidence-based practice, quality improvement approaches, and informatics (p. 45).

The provision of services by faculty and students in the community has provided opportunities to administer quality services which improve the lives of the individuals who are served. These types of IPE activities, based in educational institutions, allow allied health programs to increase their visibility and engagement on their own campuses and within the community through the provision of services. It is essential for all health professions programs, especially schools of allied health, to provide interprofessional learning opportunities for students from a variety of health disciplines (IOM, 2003, p. 45), such as establishing clinical practices that will assist universities in extending the mission in teaching, research, and service. The establishment of a clinical practice can provide students, under the supervision of faculty, access to a patient population in order to enhance academic training. Students who practice in a supervised setting with other health care professionals are able to bridge the gap between theory and practice. Applied research technique can be used to assess the effectiveness of services delivered. Faculty and students can gather firsthand data and conduct research studies that will allow them to add to the body of knowledge within their discipline.

The Importance of Interdisciplinary Professional Education

The ever-changing health care field demands increased interprofessional collaboration and practice to provide safe, patient-centered care. Patients have complex health care needs and typically require more than one discipline to address the issues regarding their health status (ASAHP, 2010). According to the Institute of Medicine Committee on Quality (2001), healthcare professionals working in interprofessional teams can best communicate and address these complex and challenging needs. This allows sharing of expertise and perspectives to form a common goal of restoring or maintaining an individual’s health and improving outcomes while combining resources.

If practitioners are expected to function in an interprofessional practice, schools and colleges must provide their students with the skills needed, through IPE opportunities. The Institute of Medicine (2003) defines interdisciplinary professional education as a collaborative approach to develop healthcare students as future interprofessional team members. Complex medical issues are best addressed by interprofessional teams. Training future health care providers to work in teams will help facilitate this model and result in improved healthcare outcomes for patients (Bridges et al., 2011, p.1).

Interdisciplinary professional education is an approach to teaching and learning that brings together students from two or more professions to learn from and with each other to enable effective collaboration. Students from several different disciplines are educated within the same class environment; they learn about the specialty of each discipline from faculty; they learn from each other about patient care approaches; and they learn how to work together to provide better patient care. This collegiality and collaboration extends to interprofessional practice (IPP) where students from various disciplines learn how to care for patients as a collaborative team. The goal of IPP is to improve health outcomes through the education of a collaborative practice-ready workforce.
that is prepared to respond to local health needs (WHO, 2010).

Interdisciplinary professional education and collaborative practice can play an important role in improving patient care, quality, satisfaction, safety, and efficiency. Health professions training, continuing education, continuing professional development, faculty development, and community-based training must change to provide healthcare professionals, educators, and students with the collaborative care tools needed to improve the health of populations. Interdisciplinary professional education (IPE) is an approach to develop healthcare students for future interprofessional teams. Students trained using the IPE approach are more likely to become collaborative interprofessional team members who show respect and positive attitudes toward each other and work to improve patient outcomes (Buring et al., 2009).

Interdisciplinary Professional Education Is A Priority

Effective, efficient, and comprehensive health care is more important than ever with implementation of the Patient Protection and Affordable Care Act. Interprofessional health education and practice will teach and encourage students in the health professions to work together to care for patients with a coordinated and higher-quality approach.

Benefits of Interdisciplinary Professional Education for Students, Faculty and Staff

Recent health care reform has placed an added emphasis on efficient and effective care. Interdisciplinary professional education and practice will prepare students and faculty in the health professions for this shift by encouraging more collaboration across disciplines. Reforms are supported by reimbursement mechanisms (Abrams, M.K., Nuzum, M. A., Zezza, J.R., Kiszla, J. & Guterman, S., 2015).

Benefits of Interdisciplinary Professional Education for Patients, Families and Communities

Interdisciplinary professional education will extend learning beyond the classroom into the clinical setting, and will play a key role in developing new patient care approaches. It will also help to transform the national health care system, which will benefit patients, their families, and communities through improved health outcomes. As a result of the Affordable Care Act (ACA), healthcare is moving toward a team-based system that rewards collaboration and quality with the goal of improving population health. The ACA will add millions of previously uninsured and underinsured Americans to the healthcare delivery system. New community-based models of care are needed to manage the increased number of patients, while keeping costs low. Patient-centered medical homes and accountable health care organizations are using teams of providers to improve the health outcomes of populations (Buring et al., 2009).

Reforms in health profession education have been slow due to multiple and complex factors. However, these reforms are critical to preparing the workforce to meet the health needs of populations. Of primary concern are academic institutions that are increasingly challenged to find sufficient clinical experiences for students in community-based organizations that serve as models of team-based practice. The healthcare delivery system and learning environment must be tailored to meet the needs of individual patients, populations of patients, and the members of the health care team (National Research Council, 2003, p.9).

To prepare future healthcare professionals to address these needs, their education must include high-quality clinical experiences in community practices that utilize an interprofessional approach when providing health care services. Dynamic partnerships which involve universities, community practices, and other institutions are needed to provide students with innovative learning experiences in preparation for practice in the healthcare system of the future (ASAHP, 2010).

In recent years, the term “interprofessional” has become widely used because it is more inclusive of all healthcare professionals. Based on the Thirteenth Annual Report to the Secretary of the United States Department of Health and Human Services and the Congress of the United States, the Advisory Board made several recommendations at its meetings in December 2012, April 2013, and June 2013. The Advisory Committee on Interdisciplinary Community-Based Linkages (ACICBL) examined the issue of how health professions education and healthcare delivery are transformed through interprofessional collaboration and
community-based learning. The ACICBL subsequently developed four recommendations for health professions educators, funders, and policymakers (Table 1). The recommendations can be used to guide the training focus within allied health educational environments. Numerous disciplines are expected to be a part of the process (Figure 1). Disciplines can be within (intra) or external (inter) to the university landscape. Collaborative efforts are managed through detailed practice plans that identify methods of providing case-based groups and patient simulation environments for faculty to provide extended learning environments. In the Interprofessional Collaboration Model, a collaborative patient centered approach is the focus of the training environment.

The U.S. Bureau of Labor Statistics (2014) has reported that employment in healthcare is expected to grow by 26 percent between 2012 and 2022, an increase of about 4.1 million jobs. In fact, the healthcare industry is projected to add more jobs than any other industry between during that time period. The healthcare industry is projected to be among the fastest-growing industries in the economy. Several factors are expected to lead to this growth, including:

1) A growing population - Over the next decade, the U.S. population is projected to increase by approximately 9 percent. An increase in the population requires more healthcare services, which leads to projected job growth in the industry;
2) An aging population - The number of people 65 and older is projected to grow about 40% between 2012 and 2022, which is the fastest growth of any age group. Compared with younger people, older people typically have greater healthcare needs. As a result, the healthcare industry is expected to add jobs; and
3) An increase in chronic conditions - More people in the United States are expected to seek treatment for chronic conditions such as diabetes and obesity. Additional workers are expected to be needed to help prevent, manage, and treat the health concerns associated with these conditions.

Benefits of Interdisciplinary Professional Education for Students

Students must engage in IPE to enhance their clinical skills in a controlled clinical environment. Interdisciplinary professional education allows students to receive supervision by instructors and an opportunity to work side-by-side with other allied health professionals. Also, IPE allows programs to realize strategic initiatives of generating revenues to support the faculty, students, and academic programs. IPE also allows students to engage in career exploration. As with most industries, getting practical experience in healthcare is usually helpful for deciding on a career. The IPE can serve both students and non-students who have yet to settle into a career regardless of their motivations. A community health clinic could provide a different work environment for nurses and allied health professionals to engage in interprofessional professional education.

Numerous benefits are a part of IPE (Figure 2). Students complete their educational careers with exposures that, heretofore, required years of on-the-job training including the team approach; clinical experience; involvement in service learning; and exposure to the culture of health care. This experiential learning contributes to the interprofessional excellence that health payers will measure. The ideal setting to train students is in a clinical setting, which allows students to learn by doing; thereby, helping them to focus on their career goals. Not surprisingly, most students are required to enroll in a clinical component or an internship that is related to their major or career objectives. Clinical experiences can be arranged which can increase the chance of students securing a position that brings satisfaction. Not only do students discover their likes and dislikes about a job, but they enter the job market with experience that is related to their career goals. Clinical placements and internships are one of the best ways to get that experience and to test a career choice.

Summary

Interprofessional activities, based in educational institutions, allow allied health programs to increase their visibility and engagement on their own campuses and within the community through the provision of services. The ever-changing health care field demands increased interprofessional collaboration and practice to provide safe, patient-centered care. Patients have complex health care needs and typically require more than one
discipline to address the issues regarding their health status (ASAHP, 2010). If practitioners are expected to function in an interprofessional practice, schools and colleges must provide their students with the skills needed through IPE opportunities. Interdisciplinary professional education is an approach to develop healthcare students for future interprofessional teams. Students trained using this approach are more likely to become collaborative interprofessional team members who show respect and positive attitudes towards each other and work towards improving patient outcomes (Buring et al., 2009). Changes in health profession education have been slow in reform due to multiple and complex factors. However, health professional education reform is critical to preparing the workforce to meet the health needs of populations.

An Interprofessional Collaboration Model

![Interprofessional Collaboration Model](image)

Figure 1: Model of an Interprofessional Collaboration Approach to Learning and Training.
TABLE 1. The Advisory Committee on Interdisciplinary Community-Based Linkages Recommendations

<table>
<thead>
<tr>
<th>Recommendations</th>
</tr>
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<tbody>
<tr>
<td>1 Establish or strengthen partnerships among academic programs and community-based clinical practices to help community practices become learning laboratories for interprofessional and population-focused education and care.</td>
</tr>
<tr>
<td>2 Provide an incentive and recognition system designed to recruit and sustain the involvement of community-based providers as teachers and role models for the provision of interprofessional and population-focused healthcare.</td>
</tr>
<tr>
<td>3 Provide ongoing faculty development and team-based training for campus and community-based teachers who will be leaders.</td>
</tr>
<tr>
<td>4 Advance the education of students for interprofessional practice by enabling, encouraging, and rewarding active teaching and serving as preceptors to students by clinicians from professional disciplines different from their own.</td>
</tr>
</tbody>
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The mission of the School of Allied Health Sciences is to provide an enlightened and enriched academic, intellectual, moral, cultural, ethical, technological, and student-centered environment for the purpose of educating individuals to become competent allied health professionals who are capable of: Complex critical thinking; Comprehensive communication skills; Interdisciplinary collaboration; Analysis and involvement in research processes; Improving the health status of under-represented and underserved populations; Lifelong learning.
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Established in 1867 as the Lincoln Normal School by nine former slaves, Alabama State University has the unique distinction of being the oldest public historically Black college or university in the United States. ASU also has the distinction of having graduated more African-American teachers than any other institution of higher education in the country.

The College of Health Sciences is housed in the 80,000-square-foot John L. Buskey Health Sciences Center and is home to six healthcare degree programs. Completed in 2001, this building includes state of the art classrooms and laboratories, and an auditorium that seats 209 individuals. The programs of the College include: Bachelor of Science (BS) degree in Health Information Management, Bachelor of Science (BS) degree in Rehabilitation Services with a concentration in addiction studies, Certificate in Maternal and Child Health, Master of Science in Occupational Therapy (MSOT), Master of Science in Prosthetics and Orthotics (MSPO), Master of Rehabilitation Counseling (MRC), and Doctor of Physical Therapy (DPT) at the entry and transitional levels.

The Center to Advance Rehabilitative Health and Education (CARE) is located in the College of Health Sciences. The Center works to address the rehabilitative health needs of all individuals, with a special focus on African Americans and other minority populations, across five key domains: clinical services, community-based services, educational services, policy reform, and research.

Take a closer look…

at Alabama State University and the College of Health Sciences

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The College of Health Sciences at Tennessee State University was established to offer educational programs designed to produce allied health professionals and practitioners; prepare individuals who are interested in pursuing careers as educators in the health professions; to encourage, develop and support interest in research, and provide health care, when appropriate, and continuing educational services to the community.