A Quality Improvement Project: Diagnosis and Treatment of Hypogonadism

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Author Note

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Clinical Issue

Healthcare providers in a southwestern urban urology group often treat patients for hypogonadism in a variety of ways that are not consistent with established national standards. While testosterone replacement therapy (TRT) is controversial, patients are exposed to extensive marketing practices by pharmaceuticals that push the use of TRT causing treatment numbers to increase. It is important that healthcare providers have a good understanding of treatment, even as the research evolves. Therefore, healthcare providers should familiarize themselves with the signs and symptoms, causes, indications, possible side effects, and the national guidelines that are established by the Endocrine Society (Bleaman, Coplan, Spiegel & Roch, 2011). As the male population within the United States continues to age, it is imperative that healthcare providers recognize the symptoms of low testosterone in the aging population (Stanworth, 2008) and provide evidence-based care. Patients often present with a vast number of nonspecific complaints when their testosterone is "low." Often these symptoms are vague and testosterone is not the first thing most healthcare providers assess. Per Bhasin et al. (2010), hypogonadism is defined as "…a clinical syndrome that results from failure of the testes to produce physiological levels of testosterone (androgen deficiency) and a normal number of spermatozoa due to disruption of one or more levels of the hypothalamic-pituitary-testicular (HPT) axis" (p. 2539).

Low testosterone is a common condition in men that has been linked to other medical conditions such as osteoporosis and heart disease. In fact, per Laughlin, Barrett-Connor, and Bergstrom (2008), the risk of death is significantly elevated for men with lower testosterone, compared with those with higher testosterone. Despite the associated risks, healthcare providers may mistake symptoms of low testosterone as part of the natural aging process, which often leads to underdiagnoses or misdiagnosis for this patient population.

Approximately 1 in 4 men in America over the age of 30 have low testosterone. However, only 1 in 20 has symptoms linked to this deficiency (Vann, 2007). Vann (2007) goes on to say, some estimates propose the prevalence of low testosterone to impact about 13 million American men. As the American population ages, it is estimated that 39% of American men will develop hypogonadism (Tartavoulle & Porche, 2012). Patients with low testosterone are at an elevated risk of being over treated which can lead to the development of thrombocytopenia and hyperestrogenism. This project will identify gaps in provider knowledge of national guidelines for the management of low testosterone in a general urology practice in a southwestern urban area. Upon the identification of knowledge gaps, an educational intervention will be implemented with the goal of increasing provider awareness of evidence-based guidelines for the management of low testosterone.

Purpose

The purpose of this project was to evaluate and improve provider knowledge level of national guidelines through an educational intervention utilizing the Endocrine Society Clinical Practice Guideline (ESCPG) in a urology practice. The objectives of this project were to: (1) measure knowledge level of ESCPG for treatment of hypogonadism of six healthcare providers within a urological patient population, (2) develop an educational intervention for providers for diagnosis and treatment of hypogonadism following the ESCPG, and (3) measure the providers' knowledge of national guidelines after the educational intervention.

Background

The safety of testosterone replacement therapy remains unclear and there is no convincing evidence to date that it increases the risk of prostate cancer. Some studies have found

an increased incidence of cardiovascular events in men treated with testosterone, but others have not (Abramowicz, Zuccotti, & Pflonm, 2016). Quality improvement methodology, when implemented can narrow quality gaps. This topic is very important since testosterone replacement therapy is becoming more popular with increased commercial advertising.

Combined with the aging population, it has never been more important for prescribers to understand, diagnose, and manage hypogonadism properly. "Monitoring for treatment efficacy and possible adverse events should be based on the Endocrine Society's guidelines for monitoring patients on TRT" (Davidiuk & Broderick, 2016, p. 919). Davidiuk and Broderick (2016) go on to say that the Endocrine Society's Clinical Practice Guidelines are used to guide clinical management of TRT-related polycythemia and state that hematocrit (Hct) values >54% warrant discontinuation of TRT until further assessment. Even though the demand for TRT has increased, education for healthcare providers has not evolved to include long-term testosterone management.

Significance

This topic is very important since the goal of evidence-based care is to improve patient outcomes. Combined with the aging population, it has never been more important for healthcare providers to understand, diagnose, and manage hypogonadism properly. Since gaps do exist between national guideline recommendations and general clinic practice, the aim of this project was to measure knowledge level of ESCPG for the treatment of hypogonadism of 5-11 healthcare providers within a urological patient population based on evidence from the ESCPG. The clinical practice guidelines from the Endocrine Society provide specific parameters for monitoring patients receiving TRT. Testosterone level, digital rectal exam, PSA, hematocrit, and

liver function tests should be checked at baseline, evaluated at 3 and 6 months after treatment starts and then annually to assess whether symptoms have responded to treatment and whether the patient is suffering from any adverse effects (Bassil, Alkaade, & Morley, 2009). Per Bhasin (1997), it is distressing that a considerable proportion of hypogonadal men continue to be undiagnosed, diagnosed late, or inappropriately treated. Thus, a paradoxical situation has developed in which testosterone replacement therapy continues to be underutilized or inappropriately used for legitimate indications, while its use for unapproved indications continues to expand (Bhasin, 1997). Providers are lacking knowledge related to these guidelines and that is why an educational intervention is appropriate.

Benefit to Nursing Practice

The nursing profession will gain from this project because it will provide an improved approach to diagnosing and management hypogonadism by healthcare providers. Quality improvement projects can bring about change in clinical practice. These projects improve clinicians' knowledge and the quality of care provided to patients. Minor changes in a clinical practice can bring about change on a national level by implementing evidence-based practice. The expected outcomes of this project were to shed light on the providers' knowledge of national guidelines after an educational intervention. The desire is that providers will begin to consider implementing the evidence-based guidelines.

PICOT

PICOT: In providers in a urological practice treating patients who have hypogonadism, how does an educational intervention about current standards of practice affect knowledge level compared to pre-intervention knowledge level?

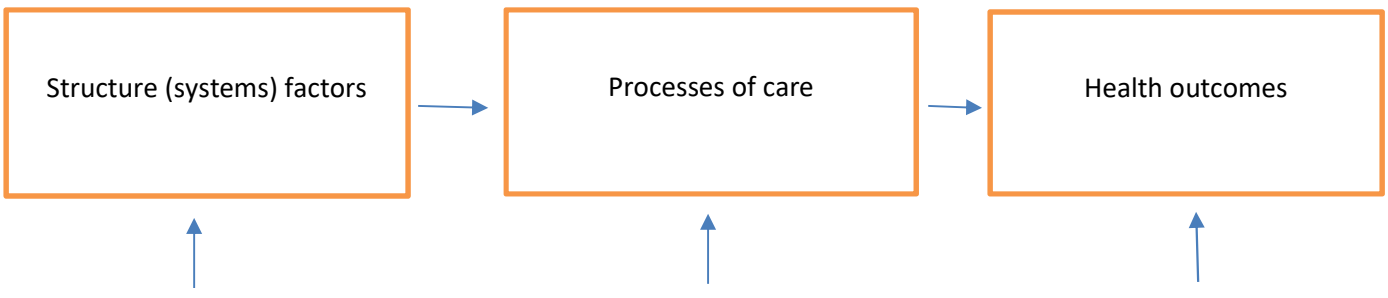
Goals

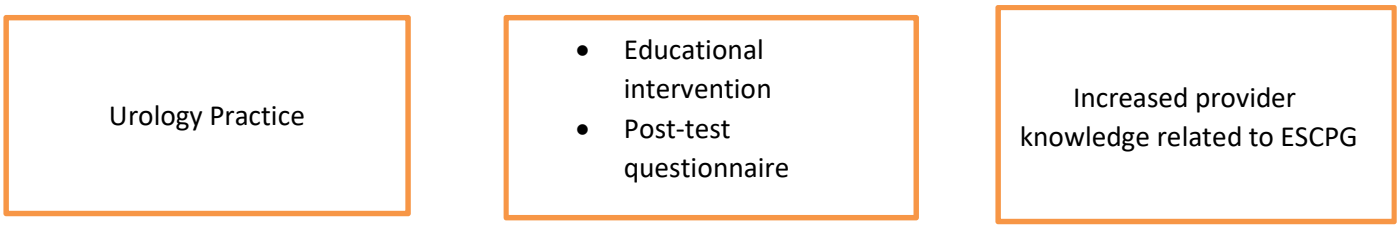
The goal of this project was to improve participant's knowledge of national guidelines. Improved provider knowledge will lead to accurate diagnosis and treatment of male hypogonadism. The expected outcome for this project was that providers would understand the ESCPG and incorporate the evidence-based guidelines for patient management. By adjusting their prescribing practices to that of the evidence-based based guidelines, patient outcomes will improve.

Framework

Quality of care is imperative when it comes to patient care. This project aimed to increase provider knowledge after an educational intervention to ensure their knowledge level of evidence-based care. The Donabedian Model assumes the existence of essential factors in assessing quality-structure, process, and outcome and possibly a causal relationship (Voyce, 2015). Concern about the quality of medical care in the United States has increased over the past several years. One way to improve the quality of care is by providing evidence-based care. The Donabedian Model, which describes a "structure-process-outcome" framework, has been selected for this quality improvement project. This model is widely utilized and allows the researcher to conceptualize the underlying mechanisms that may contribute to an inadequate quality of care for patients (Liu, Singer, Sun, & Camargo, 2011).

Donabedian Model in Urology Practice





Review of Literature

An extensive literature review was completed for this project using several search databases to include: EBSCO, Elsevier, Medcom, CINAL, and Medline Plus. The search terms used for this literature review included: male menopause, andropause, androgen deficiency, testosterone deficiency, late-onset hypogonadism, low t, and testosterone replacement therapy. The searches produced numerous studies on testosterone treatment, its indication, and possible negative impacts on health. However, there were no studies found that examined the prescribing practices for the treatment of hypogonadism. Likewise, several studies have returned with vague treatment practices that utilize different recommendations other than that recommended by the Endocrine Society such as the American Urological Association (AUA, 2015). Some of the literature is very specific about treatment practices and recommendations, while others are vague, many had small sample sizes and lack support from credible references that are not biased for financial purposes. For example, Snyder et al. (2016) presented a credible study with an adequate sample size, a double-blind, placebo-controlled design, but they limited their study to only patients older than 65 years of age. Finkle et al. (2014) conducted a cohort study of the risk of acute non-fatal myocardial infarction (MI) following an initial testosterone prescription in a

large health-care database. They report in older men, and in younger men with pre-existing diagnosed heart disease, the risk of MI following initiation of testosterone prescription is substantially increased; however, several of the authors have a competing interest in a company that develops statistical methods software.

Prescribing Practices

Lee (2014) conducted an electronic search on studies of undertreated hypogonadism from 2006 to 2013 and concluded that androgen deficiency syndrome has been overlooked in most clinical settings. Her study also found that current evidence-based knowledge and treatment of testosterone replacement therapy has been inadequately assessed and treated. The findings by Lee support those of Bassil and Morley, (2010), who also found this condition is often overlooked in clinical settings since symptoms are often related to depression and other diseases.

Recommended Guidelines

Morales et al. (2015), discuss the controversy surrounding the treatment of low testosterone and address the fear of treating low testosterone in patients by healthcare providers. In their article, they identified and addressed the knowledge gaps among multidisciplinary providers in their clinical decision-making in managing testosterone deficiency syndrome. Some of the recommended guidelines by the Endocrine Society include: making a diagnosis of androgen deficiency only in men with consistent signs and symptoms of low serum testosterone levels, measuring serum LH and FSH levels to distinguish between primary (testicular) and secondary (pituitary-hypothalamic) hypogonadism, and finally, the ESCPG recommends against testosterone therapy in patients with hematocrit above 50%. This study used the ESCPG as a tool.

Individualized Approach

Bleaman, Coplan, Spiegel, and Roch (2011) discuss, although current ESCPG support prescribing testosterone to patients with hypogonadism, the decision to treat may be best made on a case-by-case basis. The Endocrine Society recommends a conservative approach to older men, recommending that TRT is offered only to those with consistently low testosterone levels and significant symptoms of hypogonadism. Careful consideration is warranted before initiating therapy in men of any age, and in older men who receive TRT, testosterone levels should be maintained at the lower part of the normal range for young men. Since there are gaps in therapy treatment, some providers over treat, while others under treat per the ESG.

Testosterone Physiologic Effect

Tartavoulle and Porche (2012) reported on the impact of low male testosterone levels on multiple organ systems. Low testosterone impacts men's health with physiologic effects on cognition, muscle mass and strength, bone density, metabolic function, and mood. Differential diagnosis is based on history, physical exam, clinical symptoms, and testosterone levels. The medical management of low testosterone consists of replacement therapy and associated symptom management. By not following evidence-based guidelines, the physiological effects on the patient are significant.

Testosterone and Cardiovascular Safety

Morgentaler et al. (2015) found no scientific basis for the suggestion that TRT increases cardiovascular events (CV) risk. In fact, as of this date, they are unaware of any compelling evidence that TRT is associated with increased CV risk. The weight of evidence accumulated by researchers around the world over several decades clearly indicates that higher levels of

testosterone are associated with amelioration of CV risk factors and reduced risk of mortality (Morgentaler et al., 2015). According to Corona, Rastrelli, Maseroli, Sforza, and Maggi (2015), some nonprofit groups petitioned the USA Food and Drug Administration (FDA) to require warnings for CV risks on testosterone packaging. The aim of their research was to examine the available evidence on the association between TRT and CV risk. They report that it is

> important to note that well-designed, placebo-controlled trials of TRT in men who meet or do not meet the standard criteria for treatment are scant in number, and their results are often inconsistent. In addition, few randomized controlled trials (RCTs) having CV events as a primary endpoint are currently available, as the majority of information has been derived from trials designed for other purposes (Corona et al, 2015, p. 131).

They conclude that it is important to regularly monitor hematocrit levels; however, numerous studies do not support any role between TRT and adverse cardiac events. Vigen et al. (2013) indicated that testosterone therapy is associated with increased CV events. Their study included male veterans with a sample size of 8709. They designed a retrospective national cohort study of men with low testosterone levels who underwent coronary angiography. They concluded the use of testosterone therapy was associated with increased risk of adverse outcomes (Vigen et al. 2013, p. 1835). Providers are unnecessarily fearful of CV effects since this article that they stray from the guidelines by under or over-treating patients with testosterone. According to Abramowicz, Zuccotti, and Pflomm (2016), some studies have found an increased incidence of cardiovascular events in men treated with testosterone. Observationally, according to Zhao and Schooling (2015), while testosterone falls with age among US men, ischemic heart disease becomes more common with age, suggesting a beneficial effect of testosterone on heart disease.

Younger Men and Testosterone

A recent study by Saad, Yassin, Haider, Doros, and Gooren (2015) found that young men benefit from testosterone replacement therapy as older men do. A total of 561 hypogonadal men from two registry studies were divided into age groups of ≤65 years and >65 years. Following an initial 6-week interval, all men were treated with 3-month injections of testosterone for up to 6 years. They concluded that the benefits of restoring serum testosterone in older men were not significantly different between men older than 65 years of age and younger men (Saad, 2015, p. 315).

Roberts, Chen, Pruthi, and Lee (2014) conducted an experimental double-blind, randomized study that included a 20-week treatment period. They also concluded that baseline characteristics did not differ significantly from young and older men. However, this study has a weakness that should be considered. It is possible that effects on the heart and other organs may take longer than 20 weeks to occur (Roberts et al., p. 122).

Analysis

After reviewing the scholarly evidence for this specific literature review, the empirical evidence is strong, clear, and precise. Synthesizing literature is important so that findings may be incorporated into the final project (Harvard, 2016). Several of the articles within my search contain useful information that could possibly be used in this quality improvement project. Testosterone-replacement therapy for aging men is controversial and is being debated amid heightened concern about associated cardiovascular risks (Testosterone-replacement therapy, 2014). For this project, there was a pre/post-test questionnaire Likert scale used. There are few studies that examine the risks associated with testosterone replacement therapy when national

guidelines are utilized in this population, this project looks closely at the knowledge level of national guidelines within a urology practice. Since uncertain safety concerns still exist about TRT, The American Academy of Clinical Endocrinology (AACE) recommends close monitoring of TRT patients by using established national guidelines (Margo & Winn, 2006).

Design

A pre/post-test questionnaire was used for this project. A pre-test questionnaire was distributed to participants and knowledge level of current guidelines was identified. An educational intervention was presented based on the national guidelines. A post-test questionnaire was then completed by participants to assess participant's knowledge after the educational intervention.

This quality improvement project was conducted in a urology practice in a southwestern town. The data collected from the pre/post-test questionnaires were used solely for this quality improvement project.

After gaps were identified during the pre-test questionnaire, an educational intervention was provided following the national guidelines. Providers were asked to take a post-test questionnaire to measure their knowledge gained from the educational intervention.

Benefits of the quality improvement project for individual provider participants include increasing knowledge about the evidence-based guidelines established by the ESCPG that can be implemented into provider practice. Anticipated benefits of this quality improvement project for society include improved outcomes that are based on national standards when providers incorporate the ESCPG into clinical practice.

Sample

The sample for this project included physicians (urologist), nurse practitioners, and physician assistants who volunteered to participate in the study. All providers at this clinic were board certified urologists, physician assistants, and nurse practitioners. Eight urologists, two nurse practitioners, and one physician assistant practice urology at this clinic. Five urologists are male and three females. Both nurse practitioners were male and the physician assistant was female. All healthcare participants at this clinic have practiced longer than seven years. Most of the providers have additional training in male and female hormone replacement therapy and all are a convenience sample. Provider participants were recruited conveniently by this investigator walking up to them in the clinic and delivering the following verbiage:

"Hello, my name is Michael Shroth and I am a Doctor of Nursing Practice student at South University. I am conducting a quality improvement project on providers' knowledge of the national guidelines for testosterone replacement therapy established by the Endocrine Society.

Participation in this quality improvement project includes taking a questionnaire about your knowledge of current practice for testosterone replacement therapy, which will take about 10 minutes. An educational intervention will be conducted regarding gaps identified. This portion will take approximately 40 minutes and a post-test questionnaire will take approximately 10 minutes. The total time commitment will be approximately 1 hour."

Setting

The setting for this project was a urology practice in southwestern town. This practice has several sites with multiple providers. This clinic accepts private insurance, Medicare, and Medicaid patients. There are generally 150-175 patients treated at three different clinics daily,

some of who have been referred for low testosterone treatment. Most patients are referred to this practice since it is considered a specialty practice.

Procedure

The project was approved by South University's Institutional Review Board. Provider participants signed consent forms prior to their pre-test questionnaire. The initial phase of the project involved a pre-test questionnaire, which took about 10 minutes. This questionnaire was hand delivered to the provider participants in paper format. The data were then analyzed based on the ESCPG and gaps identified. An educational intervention was provided. The educational intervention took approximately 40-minutes in length. Upon completion of the educational component, provider participants completed a 10-minute post-test questionnaire to evaluate their knowledge related to hormone replacement therapy as it relates to the ESCPG. The results of the post-test questionnaire relate to the health outcomes dimension of Donabedian's Model with an expected change in provider knowledge after the educational presentation of ESCPGs.

Data Collection Process

There was one questionnaire used to collect data during this project from the same provider participants; the same for the pre-and post-test questionnaires. The questions were constructed using a 5 point Likert Scale format for the pre-and post-test questionnaires to measure the knowledge level of the providers before and after the educational intervention. The Likert Scale is a commonly used scale to measure the degree in which participants agree or disagree with the opinion expressed by a statement (Polit & Beck, 2012). The questionnaire contained 10 statements and the participant numeric responses for each item were added together

for total scores. The pre-and post-test questionnaires were developed by this researcher using research-based evidenced to address the PICOT question and distributed to all participants in the project.

Demographic variables including age, gender, professional role, and years of experience may impact results and were considered. The pre-and post-test questionnaires were coded for provider participants so comparisons could be made related to knowledge level. Content validity was established since the ESCPG were used as the basis of the instrument. Reliability could be established by the test-retest method; however, reliability has yet not been established because of time restrictions for completion of this project.

Data Analysis

The scores scale ranges from 1-5, with 5 strongly agreeing with the statement and 1 strongly disagreeing. The Likert Scale measures variables at the ordinal level; however, the total score is considered interval data and I compared total pre-and post-test questionnaire scores. The values obtained from each item in the instrument were added together for a single score for each provider participant.

This project included 6 (n=6) participants, 3 of whom were medical doctors (MD's); 1 female physician assistant (PA), and 2 male nurse practitioners (NP's). Two of the MD's are male and one is female (Figure 1 & 2). These six provider participants have a combined total of 26 years of practice.

Figure 1

Gender of Provider Participants

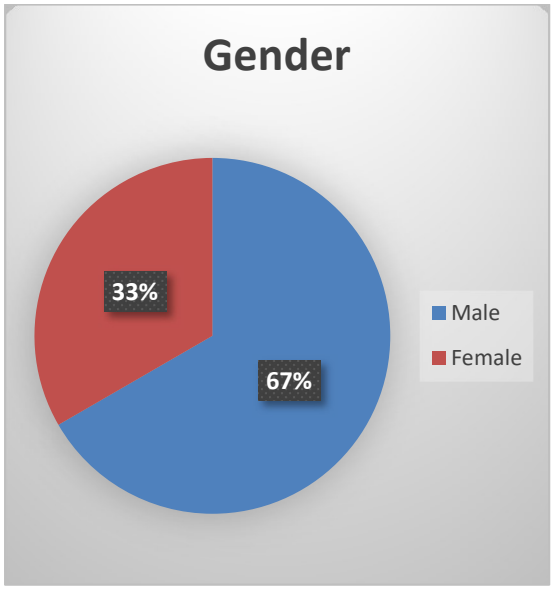
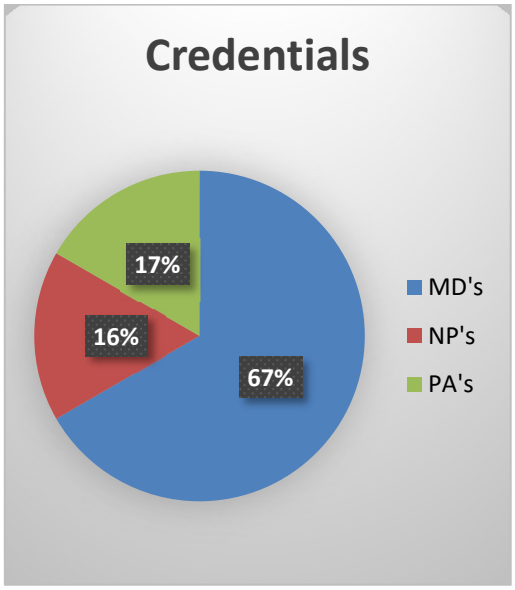


Figure 2

Credentials of Provider Participants



The educational intervention was completed March 14, 2017, at the practicum site during the monthly staff meeting. Immediately after the educational intervention, the post-test questionnaire was distributed and completed by the provider participants while this researcher was in the room.

Using the Minitab Express (minitab.com) program, a paired t-test was performed on the total scores of the pre-and post-test questionnaires to determine whether there was a significant mean difference in knowledge level between the pre-and post-test questionnaires after the educational intervention. Provider participants' knowledge level for the pre-test mean score (41.50 ± 4.183) was compared to post-test mean score (48.83 ± 1.169); a statistically significant difference was identified, 7.333 (95% CI, 3.049 to 11.618), $t = 4.40$, $p < 0.0070$. The paired t-test confirms a change in knowledge levels. While the p was statistically significant, caution is needed because of the small sample size. Based on the p-value of 0.0070, there is a 0.70%

chance the results of this project could be random. The p-value is small, meaning the results are statistically significant.

Pre-and Post-Test Questionnaire Results

Pre-test questionnaire results revealed a mean score of 41.50 out of a possible 50 points. The standard deviation for the pre-test questionnaire was 4.183 (Table 1). Post-test questionnaire results revealed a mean score of 48.83 out of a possible 50 points. The standard deviation for the post-test questionnaire was 1.169 (Table 1).

Table 1

Means Score of Pre-and Post-Test Questionnaires

Descriptive Statistics

Sample	N	Mean	StDev	SE Mean
Post-test	6	48.833	1.169	0.477
Pre-test	6	41.500	4.183	1.708

The participants scored an average of 48.8 with SEM +0/- 0.4733. This was a narrow range and indicates the sample represents the true population. The range of total scores was from 47.6065 to 50.0, which indicates a very narrow range, again, supporting the variability of the data.

Overall, all providers had an average of 7.33% increase in knowledge level from pre-to post-test questionnaires after the educational intervention. All six provider participants indicated that they are now aware of the ESCPG and all agree that they will utilize the evidence-based guidelines. All providers indicated they plan to change their current treatment of patients if the treatment is not evidence-based. Provider 001 had an increase in knowledge level from 70% to

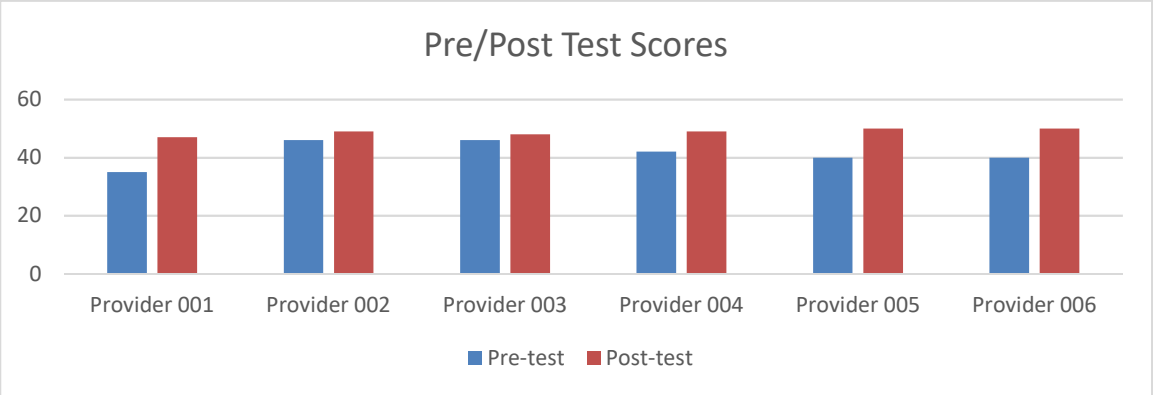
94%, provider 002 from 92% to 98%, provider 003 from 92% to 96%, provider 004 from 84% to 98%, provider 005 from 80% to 100%, and provider 006 increase from 80% to 100% (Figure 3).

There is convincing evidence ($t = 4.40$, $p = 0.007$) that the educational intervention improved scores. The total scores improved, on average, by approximately 7 points. It is important to look at the 95% Confidence Interval (95% CI). In this project, the 95% CI is from 3.0 to 11.61. This confirms that, although the difference in scores is statistically significant, it is relatively small. We can be 95% sure that the CI contains the true population. Several participants scored low on the pre-test questionnaire when asked about their knowledge of ESCPG and if they incorporate the national guidelines in their practice. Four out of six providers acknowledged that treatment should be stopped when hematocrit levels reach 54%. One-hundred percent of all six provider participants indicated on the questionnaire they plan to change their current treatment of patients if it is not evidence-based.

Figure 3

Pre-and Post-Test Questionnaire Scores

Figure 3 bar graph denotes data comparison between pre-and post-test questionnaire scores.



Comparing pre-and post-test questionnaire scores are considered continuous (scale) data; this is important since there is a difference in mean pre-and post-educational intervention scores. The importance of using the bar graph to compare pre-and post-test questionnaire scores is that it provides a visual used to compare the means of the two samples or related data.

When comparing post-test questionnaire total scores for nurse practitioners and physician assistants versus medical doctors, there was no significant difference in their post-test scores. The data indicate, there are no differences in knowledge level between NPs, PAs, and MDs. When comparing post-test questionnaire total scores for male providers versus female providers, there were no significant differences in their post-test scores. The data revealed, no differences in knowledge level between male and female provider participants.

Discussion

Data collection and analysis were completed within a two-week timeframe. Consents were signed and pre-test questionnaires were distributed by hand. Analysis of the total pre-test questionnaire scores began. Provider participants then participated in an educational intervention as planned, using a power point presentation on March 14, 2017. Upon completion of the educational intervention, post-test questionnaires were immediately distributed to the provider participants and promptly completed.

The purpose of this project was to evaluate and improve provider knowledge level of the ESCPG through an educational intervention utilizing the ESCPG in a urology practice. The objectives of this project are to (1) measure knowledge level of ESCPG for treatment of hypogonadism of 5-11 healthcare providers within a urological patient population, (2) develop an educational intervention for providers for diagnosis and treatment of hypogonadism following

the ESCPG, and (3) measure the providers' knowledge of national guidelines after the educational intervention.

The purpose and objectives of this project have been achieved. Provider knowledge level of the national guidelines has been measured, an educational intervention presented, and post-educational intervention scores evaluated and compared. Provider knowledge level has increased with all provider participants (Figure 3) and the educational intervention was effective when comparing the pre-and post-test total scores (Figure 3).

The Donabedian Model used for this project provided the framework for quality improvement implementation. Ultimately, the goal of evidence-based practice is to improve quality of care by improving patient outcomes. This model helped to conceptualize variables that contributed to inadequate quality of care for patients (Liu, Singer, Sun & Camargo, 2011). Using the Donabedian Model, the structure of the system was the urology practice, the process of care was the educational intervention and post-test questionnaire, and the health outcome was the increased provider knowledge related to the ESCPG. This was the framework used to guide this project into practice.

When reviewing the literature, Lee (2014) found that current evidence-based knowledge and treatment of testosterone replacement therapy has been inadequately assessed and treated. This article relates to this authors study since it assessed knowledge of national guidelines. Morales et al. (2015) identified and addressed the knowledge gaps among multidisciplinary providers in their clinical decision-making in managing testosterone deficiency syndrome. This article relates to this authors study because we assessed knowledge gaps among multidisciplinary providers when treating low testosterone, and none were identified between professional roles.

Implications for Future Research

Further study is needed to explore the effects of a more robust educational intervention based on all the national guidelines. While this study and existing literature suggest that educational interventions improve provider knowledge of evidence-based guidelines, a longitudinal study to explore the impact of the educational intervention on practice and patient outcomes is needed. Also, reliability of the pre-and post-test questionnaire could be established by the test-retest method with future studies that are not restricted by time.

Strengths and Limitations of the Study

A strength of this study is that it lays the ground work for future studies looking at the impact of increased provider knowledge of evidence-based national guidelines on patient outcomes. Also, in advanced practice, multiple providers should be included when they are practice at the same level. A challenge for this study is that the provider participants were a convenience sample from the same urology practice. Therefore, the selection of provider participants may have been based on motivation, availability, and engagement. The pre-and post-test questionnaires were self-reported, which could have led to bias by method variance. Other limitations of this study are the small sample size, and the primary researcher being employed at the clinic as a provider.

Conclusion

It is likely that if knowledge level of providers increase, patient outcomes may improve as reported by Bleaman, Coplan, Spiegel and Roch (2011). Tartavoulle and Porche (2012) reported on the impact of low male testosterone levels on multiple organ systems. Low testosterone impacts men's health with physiologic effects on cognition, muscle mass and

strength, bone density, metabolic function, and mood. Differential diagnosis is based on history, physical exam, clinical symptoms, and testosterone levels. The medical management of low testosterone consists of replacement therapy and associated symptom management. When evidence-based guidelines are not utilized, the physiological effect of low testosterone on the patient can be significant. A large-scale international study by Grossmann, Anawalt, and Wu (2015) highlights the need for better evidence to guide clinicians regarding testosterone therapy. When providers do not utilize the current, but limited guidelines available, patient outcomes will continue to vary. According to B. Kansas (personal communication, April 28, 2017), health care providers should focus on treating the patient and not the number.

Budget

The cost for this project was very minimal. Questionnaires were developed, printed, distributed, and analyzed for this project. Computers and scanners were used to include hardware and software. Office supplies were used as well as skilled man-hours to direct and analyze the data.

References

Abramowicz, M., Zuccotti, G., & Pflomm, J. (2016). Safety of testosterone replacement therapy. *Jama, 315*(14), 1512-1513. doi:10.1001/jama.2016.3450

American Urological Association (AUA). (2015). AUA position statement on testosterone therapy. Retrieved from https://www.auanet.org/education/testosterone-therapy.cfm

Bassil, N., & Morley, J. E. (2010). Late-life onset hypogonadism: A review. *Clinics in Geriatric Medicine, 26*(2), 197-222.

Bassil, N., Alkaade, S., & Morley, J. E. (2009). The benefits and risks of testosterone replacement therapy: a review. *Therapeutics and Clinical Risk Management*, *5*, 427–448.

Bhasin, S. (1997). Emerging issues in androgen replacement therapy. *Journal of Clinical Endocrinology & Metabolism, 82*(1), 3-8. doi:10.1210/jc.82.1.3

Bhasin, S., Cunningham, G. R., Hayes, F. J., Matsumoto, A. M., Snyder, P. J., Swerdloff, R. S., & Montori, V. M. (2010). Testosterone therapy in adult men with androgen deficiency syndromes: An endocrine society clinical practice guideline (ESCPG). *The Journal of Clinical Endocrinology & Metabolism, 91*(6), 1995-2010. doi:10.1210/jc.2005-2847

Bleaman, I., Coplan, B., Spiegel, J., & Roch, J. (2011). Testosterone replacement therapy: Take an informed, individualized approach: Although current endocrine society guidelines support prescribing testosterone to patients with hypogonadism, the decision to treat may be best made on a case-by-case basis. *JAAPA-Journal of the American Academy of Physicians Assistants, 24*(1), 42.

Borst, S. E., & Mulligan, T. (2007). Testosterone replacement therapy for older men. *Clinical Interventions in Aging*, *2*(4), 561–566.

Corona G, G., Rastrelli, G., Maseroli, E., Sforza, A., & Maggi, M. (2015). Testosterone replacement therapy and cardiovascular risk: A review. *The World Journal of Men's Health, 33*(3), 130-142. doi:10.5534/wjmh.2015.33.3.130

Davidiuk, A. J., & Broderick, G. A. (2016). Adult-onset hypogonadism: evaluation and role of testosterone replacement therapy. *Translational Andrology and Urology*, *5*(6), 824–833. http://doi.org/10.21037/tau.2016.09.02

Finkle, W. D., Greenland, S., Ridgeway, G. K., Adams, J. L., Frasco, M. A., Cook, M. B., . . . Hoover, R. N. (2014). Increased risk of non-fatal myocardial infarction following testosterone therapy prescription in men: E85805. *PLoS One, 9*(1) doi:10.1371/journal.pone.0085805

Grossmann, M., Anawalt, B. D., & Wu, W. (2015). Clinical practice patterns in the assessment and management of low testosterone in men: An international survey of endocrinologists. *Clinical Endocrinology, 82*(2), 234-241. doi:10.1111/cen.12594

Harvard. (2016). The literature review: A research journey. Retrieved from http://guides.library.harvard.edu/c.php?g=310271&p=2071511

Laughlin, G. A., Barrett-Connor, E., & Bergstrom, J. (2008). Low serum testosterone and mortality in older men. *The Journal of Clinical Endocrinology & Metabolism, 93*(1), 68-75. doi:10.1210/jc.2007-1792

Lee, Y. (2014). Androgen deficiency syndrome in older people. *Journal of The American Association of Nurse Practitioners, 26*(4), 179-186. doi:10.1002/2327-6924.12114

Liu, S. W., Singer, S. J., Sun, B. C., & Camargo, C. A. (2011). A conceptual model for assessing quality of care for patients boarding in the emergency department: structure-process-outcome. *Academic Emergency Medicine: Official Journal of the Society for Academic Emergency Medicine*, *18*(4), 430–435. http://doi.org/10.1111/j.1553-2712.2011.01033.x

Margo, K., & Winn, R. (2006). Testosterone treatments: Why, when, and how? *American Family Physician, 73*(9), 1591.

Morales, A., C.M., Bebb, R. A., Manjoo, P, Assimakopoulos, P., Axler, J., Collier, C., . . . Lee, J. C. (2015). Diagnosis and management of testosterone deficiency syndrome in men: Clinical practice guideline. *Canadian Medical Association.Journal, 187*(18), 1369-1377. Retrieved from http://search.proquest.com.southuniversity.libproxy.edmc.edu/docview/1747402504?accountid=87314

Morgentaler, A., Miner, M. M., Caliber, M., Guay, A. T., Khera, M., & Traish, A. M. (2015). Testosterone therapy and cardiovascular risk: Advances and controversies. *Mayo Clinic Proceedings, 90*(2), 224-251. doi:10.1016/j.mayocp.2014.10.011

Polit, D. F., & Beck, C. T. (2012). *Nursing research: generating and assessing evidence for nursing practice*. Philadelphia: Wolters Kluwer Health/Lippincott Williams & Wilkins.

Roberts, C. K., Chen, B. H., Pruthi, S., & Lee, M. L. (2014). Effects of varying doses of testosterone on atherogenic markers in healthy younger and older men. *American Journal*

of Physiology. Regulatory, Integrative and Comparative Physiology, 306(2), R118-R123. doi:10.1152/ajpregu.00372.2013

Saad, F., Yassin, A., Haider, A., Doros, G., & Gooren, L. (2015). Elderly men over 65 years of age with late-onset hypogonadism benefit as much from testosterone treatment as do younger men. *Korean Journal of Urology, 56*(4), 310-317. doi:10.4111/kju.2015.56.4.310

Snyder, P. J., Bhasin, S., Cunningham, G. R., Matsumoto, A. M., Stephens-Shields, A. J., Cauley, J. A., . . . Testosterone Trials Investigators. (2016). Effects of testosterone treatment in older men. *The New England Journal of Medicine, 374*(7), 611.

Stanworth, R. D., & Jones, T. H. (2008). Testosterone for the aging male; current evidence and recommended practice. *Clinical Interventions in Aging*, *3*(1), 25–44.

Tartavoulle, T. M., & Porche, D. J. (2012). Low testosterone. *The Journal for Nurse Practitioners, 8*(10), 778-786. doi:http://dx.doi.org/10.1016/j.nurpra.2012.05.004

Testosterone-replacement therapy. (2014). The New England Journal of Medicine, 371(21), 2032-2034. Retrieved from https://search-proquest-com.southuniversity.libproxy.edmc.edu/docview/1626693040?accountid=87314

Vann, M. (2007). 1 in 4 men over 30 has low testosterone. Retrieved from http://abcnews.go.com/Health/Healthday/story?id=4508669&page=1

Vigen, R., O'Donnell, C. I., Barón, A. E., Grunwald, G. K., Maddox, T. M., Bradley, S. M., . . . Ho, P. M. (2013). Association of testosterone therapy with mortality, myocardial

infarction, and stroke in men with low testosterone levels. *Jama, 310*(17), 1829-1836. doi:10.1001/jama.2013.280386

Voyce, J., Gouveia, M. J. B., Medinas, M. A., Santos, A. S., & Ferreira, R. F. (2015). A donabedian model of the quality of nursing care from nurses' perspectives in a portuguese hospital: A pilot study. *Journal of Nursing Measurement, 23*(3), 474.

Zhao, J., & Schooling, C. M. (2015). Does falling testosterone with age among men underlie the increase in ischaemic heart disease. *Journal of Epidemiology and Community Health, 69*(4), 393-396. doi:10.1136/jech-2014-204483

Appendix A

Pre-Test Questionnaire

Pre-Test Questionnaire

Age_____ Number of Years Practicing_____

Professional Role_____ Gender_____ Participant Code_____

Please place an "X" in the box that describes your feelings of the knowledge gained from the presentation.

		Strongly Disagree		Neutral	Strongly Agree	
	Question	**1**	**2**	**3**	**4**	**5**
1	I can describe appropriate follow-up needed for new TRT patients.					
2	I can differentiate between primary and secondary hypogonadism.					
3	I can describe the best time to check total testosterone levels.					
4	I can describe what is needed to diagnose hypogonadism.					
5	I can describe the symptoms of hypogonadism.					
6	I should stop TRT if HCT levels reach 54%.					
7	I can describe the possible side-effects of TRT.					
8	I am aware of the ESCPGs and incorporate them in my practice.					
9	I follow the ESCPG and do not deviate.					
10	I am willing to change my treatment of patients if they are not evidence-based.					

Appendix B

Post-Test Questionnaire

Post-Test Questionnaire

Participant Code_____

Please place an "X" in the box that describes your feelings of the knowledge gained from the presentation.

		Strongly Disagree		Neutral	Strongly Agree	
	Question	**1**	**2**	**3**	**4**	**5**
1	I can describe appropriate follow-up needed for new TRT patients.					
2	I can differentiate between primary and secondary hypogonadism.					
3	I can describe the best time to check total testosterone levels.					
4	I can describe what is needed to diagnose hypogonadism.					
5	I can describe the symptoms of hypogonadism.					
6	I should stop TRT if HCT levels reach 54%.					
7	I can describe the possible side-effects of TRT.					
8	I am aware of the ESCPGs and incorporate them in my practice.					
9	I plan to follow the ESCPG and not deviate.					
10	I plan to change my treatment of patients if they are not evidence-based.					