Combining Fitness and Physical Therapy as a Treatments for Post-partum Pelvic Floor Dysfunction - Urinary Incontinence – a Case Study

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by

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Authorization to Submit Thesis

This thesis of Alexandra H. Holmes submitted for the degree of Masters of Movement and Leisure Sciences with a Major in Exercise Science and titled "Combining Fitness and Physical Therapy as a Treatments for Post-partum Pelvic Floor Dysfunction - Urinary Incontinence – a Case Study," has been reviewed in final form. Permission, as indicated by the signatures and dates below, is now granted to submit final copies to the College of Graduate Studies for approval.

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Abstract

The purpose of this study was twofold; 1) to investigate if the Pure Barre workout program would more efficiently improve SUI symptoms combined with physical therapy treatment. 2) To examine if the Pure Barre workout had any effect on self-efficacy of women diagnosed with SUI. It was hypothesized that including Pure Barre in physical therapy treatment would have an acute effect on recovery scores and self-efficacy in patients with SUI compared to patients only seeking physical therapy treatment. The study was a case study comparison between two participants. Self-efficacy was tracked throughout the duration and was reported upon joining the study, at week 4, and at week 8. Progress notes reported by the physical therapist were also reported every two months. Both participants had been patients for roughly two months prior to joining. Both participants completed two progress notes with the final completed following their completion of the 8-week intervention. Data from both participants showed a potential benefit of adding in the Pure Barre workout both on self-efficacy and on progress note data. However, with a lack of a control group, it is unclear if the findings support Pure Barre specifically or simply an increase in physical activity. Therefore, the study demonstrates potential benefits that need to be investigated with a larger study that incorporates a control and a secondary intervention group.

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Dedication

Dedicated to my husband who has continuously supported me as I continue my education. Who has stayed up late studying with me, listened to endless presentations over and over, and has always pushed me to pursue my passion. I could not have done it without you.

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Chapter 1: Introduction

Pelvic Floor Disorders (PFD) are a common issue among women (Norton & Brubaker, 2006; *Pelvic Floor Disorder*, n.d.; Wilkinson, 2006). Typically, incidents rates are highest middle-aged women ranging from 25-60 years old (Danforth, Townsend, Lifford, Curhan, Resnick, & Grodstein, 2006; Nygaard & Shaw, 2016). More education has become available to women allowing them to understand PFD's they may suffer from are not 'normal'(Markland et al., 2011; Mayo, 2020; Shamliyan et al., 2008). Within the last decade there has been an increase in reporting and seeking of treatment for PFD's. For many years women were led to believe that PFD's were a 'normal' part of aging or pregnancy (Ghaderi & Oskouei, 2014; Tarukallo et al., 2018). Along with the thought of 'normalcy', PFD's in some cases have been shown to cause decreases in self-efficacy, selfconfidence, in women (Basu et al., 2011; Wilkinson, 2006). Women have previously reported feelings of embarrassment, anxiety, and decreased drive for socialization due to possible disruptions from PFD's (Danforth, Townsend, Lifford, Curhan, Resnick, Grodstein, et al., 2006; Duralde et al., 2016; Vasavada, 2016). The lack of education and understanding of PFD's has caused a gross underreporting of PFD's leading to a lack of treatment for these women. Due to emerging specialties in PFD's the stigma of 'normalcy' is decreasing and women are seeking treatment.

The umbrella classification of PFD encompasses a host of different disorders. The most common types of PFD's are pelvic organ prolapse, pelvic urinary incontinence, pelvic fecal incontinence, and pelvic pain (Ghaderi & Oskouei, 2014; Ohtake & Borello-France, 2017). Pelvic organ prolapses and pelvic urinary incontinence are most seen and treated, with pelvic urinary incontinence being the most common (Markland et al., 2011; Mayo, 2020). Classifications of pelvic urinary incontinence are dependent on the cause of the incontinence. The most common form of incontinence is stress urinary incontinence (SUI) (Markland et al., 2011; Mayo, 2020; Vasavada, 2016). Many different factors can play a role in developing SUI such as aging, poor muscle control of the pelvic floor, child birth or any form of trauma to the muscles of the pelvic floor (Chawathey, 2015; Danforth, Townsend, Lifford, Curhan, Resnick, & Grodstein, 2006; Nygaard & Shaw, 2016). While urinary incontinence tends to be more prevalent in older women, it has been seen in women of all ages (Ghaderi & Oskouei, 2014). Treatment for urinary incontinence ranges from physical activity to surgery depending on the severity, with surgical intervention being the last resort for treatment of SUI. Before a surgical intervention is considered other treatment options such as physical therapy are used to treat SUI.

Within the last ten years physical therapy has begun to play a large role in treatment of pelvic floor disorders (Bo & Sherburn, 2005; Ghaderi & Oskouei, 2014). Physical therapy utilizes hands on

techniques combined with strengthening exercises done by the patient (Arvonen et al., 2001; Shamliyan et al., 2008). The plan of care presented by the physical therapist largely relies on the severity and cause of the SUI. Some common treatment methods have been pelvic floor palpitations and manipulations by the therapist coupled with exercise done by the patients to regain control over the muscles of the pelvic floor, specifically the muscles surrounding the bladder and urethra (Arvonen et al., 2001).

Along with physical therapy treatment, it has been found that physical activity helps to treat and decrease the prevalence of urinary incontinence (Ghaderi & Oskouei, 2014). Activities focused specifically on strengthening of the abdominal and pelvic floor muscles are most beneficial to helping with SUI. Increases in strength and control of abdominal and pelvic floor muscles help to maintain control of the bladder and decrease total leakage (Nygaard & Shaw, 2016). In order for physical activity to be helpful in treatment of SUI the type of exercise is important. Choosing exercises that target the deep and superficial abdominal muscles will help to engage the pelvic floor muscles as well (Ghaderi & Oskouei, 2014; Nygaard & Shaw, 2016; Tarukallo et al., 2018). The core muscles and pelvic floor muscles when properly firing, work together as one unit (Cundiff, 2004; Kim et al., 2011; Vasavada, 2016). It is thought that coupling physical therapy treatments with specific targeted exercises will help to not only decrease time spent in physical therapy but will also improve control of urinary incontinence and self-efficacy (Ghaderi & Oskouei, 2014; Vasavada, 2016).

It is hypothesized that an activity such as Pure Barre will greatly help. The exercises done at Pure Barre are total body work that heavily rely on a strong core to stabilize the entire body as the workout progresses. Pure Barre incorporate along of core and pelvic floor muscle work to strengthen the muscles of the core such as the obliques, transverse abdomius, and lower muscles of the more which help to strengthen the pelvic floor (Kim et al., 2011; Vasavada, 2016). The workouts are also very low impact, decreasing the likelihood of leakage during the workout allowing women to feel confident in their ability to partake in exercise. The goal of coupling Pure Barre and physical therapy is to help women build their self-efficacy within social and athletic activities.

Adding the Pure Barre workouts to a standard plan of care given by a physical therapist is hypothesized to affect how quickly an acute change in SUI can be seen in the patient. If we can decrease the number of visits needed for physical therapy; it could help increase the number of women who want to seek treatment, by seeming more attainable with busy life scheduled. Seeking treatment will be very beneficial for the self-efficacy detriments they may have experienced while dealing with SUI. The hypothesis to not only help them treat SUI better but also to improve their selfesteem, self-efficacy and quality of life. Therefore, the purpose of this study was twofold; 1) to investigate if the Pure Barre workout program would more efficiently improve SUI symptoms

combined with physical therapy treatment. 2) To examine if the Pure Barre workout had any effect on self-efficacy of women diagnosed with SUI. It was hypothesized that including Pure Barre in physical therapy treatment will have an acute effect on recovery scores and self-efficacy in patients with SUI compared to patients only seeking physical therapy treatment.

Chapter 2: Review of Literature

2.1 Pelvic Floor Disorders

Pelvic floor disorders or dysfunction (PFD) is not an uncommon occurrence among the population. PFD's can be seen in both men and women with a wide range in age (Freeman, 2004; Wilkinson, 2006). In fact, more than 200 million people live and deal with some form of a PFD worldwide (Bo, 2004; Norton & Brubaker, 2006; *Pelvic Floor Disorder*, n.d.). However, due to the nature of the disorders and an old thought that it was just something you had to live with reporting is still thought to be significantly low (Arvonen et al., 2001; Basu et al., 2011; Nygaard et al., 2015). Within the last decade more reporting is happening especially among women worldwide (Basu et al., 2011; Chawathey, 2015). PFD has been associated with two basic beliefs: 1) it is a normal physical characteristic following specific life events; 2) It goes away with time but has a slow process. There are a number of people, particularly women, who are seeking answers and strategies to return their pelvic floor function to normal more rapidly.

2.1.1 Common Pelvic Floor Disorders

The most common types of PFD's are pelvic organ prolapse, pelvic urinary incontinence, pelvic fecal incontinence, and pelvic pain. Pelvic organ prolapses and pelvic urinary incontinence tend to be more prevalent (Bo & Sherburn, 2005; *Pelvic Floor Disorder*, n.d.; Wilkinson, 2006), especially in women. Roughly 40 percent of women experiencing some form of prolapse (Markland et al., 2011).Pelvic urinary incontinence can be classified in many different ways depending on what causes the incontinence. Stress urinary incontinence (SUI) is most prevalent form of incontinence and is usually triggered by coughing, laughing, or sneezing (Bo, 2004; Bo & Sherburn, 2005; Wilkinson, 2006).

2.1.2 Causes of Common Pelvic Floor Disorders

There are many different factors that can contribute to someone suffering from PFD. It can be factors that contribute to the cause of PFD such as aging or childbirth; or factors that cause PFD's to worsen like poor muscle control (Nygaard et al., 2015; Tarukallo et al., 2018; Wilkinson, 2006). Typically, there is some form of weaknesses in the pelvic floor muscles (PFM). The lack of muscle control of the PFM's can come from a variety of causes such as muscle wasting from age, lack of

proper muscle engagement, body mass index (BMI) or trauma to the muscles themselves (Chawathey, 2015; Danforth, Townsend, Lifford, Curhan, Resnick, & Grodstein, 2006; Tarukallo et al., 2018) The PFM's are classified into different groups based on their anatomical positions within the pelvis. There are the pelvic diaphragm muscles which consist of the pubococcygeus, puborectalis, and iliococcygeus. All together those muscles are known as the levitator ani and are the deep muscles of the pelvic floor. The urogenital diaphragm muscles are comprised of the ischiocavernosus, bulbospongiosus, and the transverse perinei superfacialis, together also known as the perineal muscles. This group is the superficial muscles. There are also the urethral and sphincter muscles that complete the musculature of the pelvic floor (Bo & Sherburn, 2005; Danforth, Townsend, Lifford, Curhan, Resnick, & Grodstein, 2006). All of these muscles work together to help support the organs which lie in the pelvic floor. Not only do they support the organs, but they work to help control the functions of each of the organs as well.

The muscles when working properly should all co-contract to ensure proper function of the bladder, urethra, and colon, which comprise the organs of the pelvic floor. However, when they fail to do so is when the different disorders can present themselves. As the muscles contract, they are helping to close the different sphincters and control pressures within the bladder and urethra (Chawathey, 2015; Danforth, Townsend, Lifford, Curhan, Resnick, & Grodstein, 2006; Nygaard et al., 2015). Once these muscles fail to fire at the same time or have undergone some sort of damage, PFD's such as prolapse, or incontinence happen. Unfortunately, many of these disorders occur on a spectrum of disordered function and go undiagnosed until the function is significantly reduced.

As stated, before many women believe it is normal or just a part of life. Therefore, they are not prompted to seek treatment until it is unbearable. Additionally, PFD's can also present as asymptomatic for a long time, causing the dysfunction to become more significant over time. A person may have a PFD but because they lack symptoms, they do not seek treatment. Unfortunately, by the time symptoms arise the issue can be much harder to fix (Norton & Brubaker, 2006).

2.1.3 History of Pelvic Floor Disorders

2.1.3.1 History of Urinary Incontinence

Urinary incontinence (UI) is the most common form of a PFD. As stated, millions of people worldwide suffer from UI, specifically SUI. The cost of treating UI just within the United States is up to 19.5 billion dollars per year (Bo, 2004; Danforth, Townsend, Lifford, Curhan, Resnick, & Grodstein, 2006). Costs for treating UI in the United Kingdom are comparable to the US's annually (Wilkinson, 2006). Treatment costs are so high due to the nature of the PFD's. To this day there is no quick fix. Typically treating a PFD, like UI is ongoing. Patients even if they receive surgery or use pharmaceuticals often times still end up seeking physical therapy treatment (Arvonen et al., 2001; Basu et al., 2011; Leijonhufvud et al., 2011; Shamliyan et al., 2008). If UI is such a common PFD, then why is the cost so high around the world? Perhaps since there is still little research on the topic there is a lack of good cost-effective treatment. Pelvic floor therapy is a relatively new field, especially in the United States, which is believed to play a role in the high cost of treatment. As women are educated that they do not have to live with UI and can seek treatment, better methods will be discovered and hopefully the overall cost can be lowered (Danforth, Townsend, Lifford, Curhan, Resnick, & Grodstein, 2006; Wilkinson, 2006). There could just be a lack of viable treatment options to help lower costs at the time.

UI is defined by the International Continence Society (ICS) as: "the complaint of any involuntary leakage of urine" (Bo, 2004; Danforth, Townsend, Lifford, Curhan, Resnick, & Grodstein, 2006; Wilkinson, 2006). The PFM's are meant to stabilize and control the functions of the pelvic floor organs. The PFM's are constantly firing except during voiding. Voiding is the act of urinating or defecating. The contractions of the PFM's can be described as an inward lift and squeeze around the urethra, vagina, and anus. The summative contraction of all the PFM's help to control urethral function and stop any involuntary leakage of urine. They do this by helping to stabilize the urethra and help to control the pressure within it. By doing so, it will increase the pressure within the urethra and bladder (Bo & Sherburn, 2005; Danforth, Townsend, Lifford, Curhan, Resnick, Grodstein, et al., 2006).

The muscles of the pelvic floor are capable of being voluntarily stimulated to contract. However, even with proper coaching, only about 30 percent of women can properly contract their pelvic floor musculature (Bo, 2004; Bo & Sherburn, 2005; Norton & Brubaker, 2006). Often times

when improper contraction of the PFM's happens, contractions of other muscle contractions occur. Contraction of other muscles can be attributed to a lack of understanding of how to target specific muscles. Typically, contractions in the hip adductor, abdominal muscles and gluteal muscles are observed. While these muscles help to aide in the contraction of the PFM's they offer no structural support to the pelvic floor. This can help lead to incontinence by weakening the actual PFM's due the perception that the correct contractions are happening and lack of actual contractions of the PFM's leading to slight atrophy of the PFM (Bo, 2004; Bo & Sherburn, 2005). PFD's and SUI have a higher prevalence in women when compared to men (Ghaderi & Oskouei, 2014; Wilkinson, 2006). Recently women are seeking treatment for PFD's and SUI postpartum whereas men typically would seek treatment related to prostate issues (Vasavada, 2016). Data suggest that around 50 percent of women report SUI issues while only about 15 percent of men report issues with SUI (Markland et al., 2011). Factors such as socioeconomic status, access to health care, severity of SUI, age, and race have all been found to contribute to the prevalence rates (Markland et al., 2011). SUI effects women of all ages, with the range of prevalence between 10 percent to 55 percent for women aged 16-64 years of age showing symptom (Danforth, Townsend, Lifford, Curhan, Resnick, & Grodstein, 2006; Norton & Brubaker, 2006; Wilkinson, 2006). However, only a quarter of those women were actively seeking help (Bo & Sherburn, 2005; Chawathey, 2015; Norton & Brubaker, 2006). PFD's, specifically SUI, are more common among women due to more experiences of traumatic events involving their pelvic floor than me (Kim et al., 2011; Tarukallo et al., 2018). The most common trauma to the pelvic floor being childbirth. Childbirth can have severe impacts on the stability of the pelvic floor by causing structural changes to the muscles that make up the pelvic floor. They can be torn and weakened causing the muscles to be in a state of constant firing or lack of firing (Tarukallo et al., 2018; Vasavada, 2016). It can be partly from the type of birth, whether it was vaginal or caesarian. A vaginal birth will cause direct trauma to the muscles of the pelvic floor and a caesarian birth will cause damage to the lower abdominal muscles and surrounding fascia which in turn causes an impact on the pelvic floor muscles (Bo, 2004; Bo & Sherburn, 2005; Danforth, Townsend, Lifford, Curhan, Resnick, & Grodstein, 2006; Wilkinson, 2006). Typically, if any instrument such as forceps or vacuum recovery were used during a vaginal birth there is a much greater chance for the pelvic floor muscles to sustain greater damage (Bo, 2004; Leijonhufvud et al., 2011). Forceps were found to have significantly more damage to the pudenal nerve and perineum leaving a higher risk for SUI compared to vacuum recovery or cesarean deliveries (Leijonhufvud et al., 2011).

Other factors that can play a role in the prevalence of SUI in women is age, obesity, gynecological surgery, strenuous work or exercise, constipation, chronic coughing such as smokers

cough, or other actions that can increase abdominal pressure (Bo, 2004; Bo & Sherburn, 2005; Danforth, Townsend, Lifford, Curhan, Resnick, & Grodstein, 2006). Age unfortunately is a natural factor of developing SUI. As we age our muscles begin to lose strength. The brain is less able to detect the urge to urinate or know to contract the muscles surrounding the urethra during coughing or sneezing (Brooks et al., 2005; Danforth, Townsend, Lifford, Curhan, Resnick, & Grodstein, 2006; Wilkinson, 2006).

Obesity or BMI tends to put a large strain on the PFM leading to increased risk of developing SUI (Danforth, Townsend, Lifford, Curhan, Resnick, & Grodstein, 2006; Wilkinson, 2006). It was found that for every unit increase in BMI chances of developing SUI increased by 5 to 10 percent (Danforth, Townsend, Lifford, Curhan, Resnick, & Grodstein, 2006). BMI along with being a risk factor is also a contributor to SUI, due to the additional stress a high BMI can put on the muscles of the pelvic floor (Danforth, Townsend, Lifford, Curhan, Resnick, & Grodstein, 2006). High BMI puts causes an increase in intra-abdominal pressure and is known to fatigue the PFM's causing the inability to control urine loss (Danforth, Townsend, Lifford, Curhan, Resnick, & Grodstein, 2006).

2.2 Treatments for Urinary Incontinence

Due to the significant prevalence of PFD's among women many different forms of treatments have been investigated. New specialties within the fields of medicine have become dedicated to helping treat the PFD's and restore some form of normalcy back to many women around the world. The stigma surrounding the pathology has been reduced. Many are realizing it is a reality of life, and it can be treated. As reporting of SUI becomes more prevalent more treatment options have become available.

Therapeutic treatment options for PFD's began back in the early 1960's by Kegel (Freeman, 2004; Ghaderi & Oskouei, 2014; Shamliyan et al., 2008), he is responsible for the very common pelvic floor exercise called Kegels. However, it is known that there are other methods of strengthening the pelvic floor other than a Kegel. Surgery was also one of the early treatment options for SUI. In fact, surgery started as the standard method of care for those who struggled with SUI. That was before Kegel proved SUI could be treated with more conservative approach such as pelvic floor muscle strengthening (Arvonen et al., 2001; Freeman, 2004; Ghaderi & Oskouei, 2014).

2.2.1 Treatment History: Surgical and Physical Therapy

Before much was known about the role of pelvic floor muscles and how they help a person control their urinary and fecal tracts it was thought that surgery was the best option for treatment. The type of surgery depends on the specific type of UI a person is suffering. Typically for SUI a sling procedure is conducted by using strips of synthetic mesh, tissue, or donor tissue to create a sling to carry urine from the bladder to urethra. The sling helps with control of the urethra by keeping it closed during coughing or sneezing (Mayo, 2020). Surgery seemed like an efficient way to handle the issue at hand without subjecting people to weekly visits to a therapist. Surgery in severe cases can be a good treatment option but not always the best. It was quickly found that there was a high chance of morbidity, complications, and longer recovery times associated with surgeries addressing SUI (Basu et al., 2011; Ghaderi & Oskouei, 2014). Surgery can be useful in severe cases but does leave a higher risk for complications.

As the negative repercussions of surgical intervention became more known it was clear that a new form of treatment was necessary. Increased chances of morbidity or post-surgical complications was no longer acceptable. That is what helped Kegel discover the effectiveness of pelvic floor muscle strengthening to help treat SUI. It was a technique that really paved the way for the role of physical therapy in treating PFD's specifically, SUI (Freeman, 2004; Ghaderi & Oskouei, 2014). Not only has it been a solid treatment alternative, but it has allowed women to avoid undergoing surgery and any potential risks that come with surgery.

Since the 1960's the effectiveness of strengthening the muscle of the pelvic floor as a cure for SUI has grown exponentially (Arvonen et al., 2001; Murray, 2019). New methods have been found to not only help strengthen but also control the muscles of the pelvic floor (Arvonen et al., 2001). Physical therapists have begun to use techniques such as controlled contractions starting at 25 percent contraction up to 100 percent then back to 25 percent (Arvonen et al., 2001; Vasavada, 2016). However, the basic idea has remained the same, strengthen the muscles and increase control over muscle contractions to gain control over urethral function.

Over the years there have been many different modalities (dry needling, cupping, electrical stimulus and vaginal cones or wands) added to pelvic floor muscle strengthening (Ghaderi & Oskouei, 2014; Wilkinson, 2006). Recently studies have been produced to assess the effectiveness of the modalities. Currently, conflicting results still remain whether or not these modalities are any more effective than just pelvic floor muscle strengthening (Arvonen et al., 2001; Ghaderi & Oskouei, 2014). Each modality provides a different purpose; dry needling helps to depolarize the muscles that

are over firing whereas vaginal cones assist in functional training of the muscles of the pelvic floor (Arvonen et al., 2001; Murray, 2019; Tarukallo et al., 2018).

SUI can be treated and managed not only by therapy but with lifestyle changes as well. The physical therapy setting can be so beneficial in helping women develop a support system. They can offer insight into different lifestyle changes and resources for women who are looking to change. While physical therapy may take a bit longer than surgery to fix SUI, it has greater lasting benefits (Freeman, 2004; Ghaderi & Oskouei, 2014; Shamliyan et al., 2008).

Surgery is thought to be a quick fix solution; however, it is not always a long-term solution. SUI is caused when the muscles of the pelvic floor weaken and can no longer be properly controlled (Kim et al., 2011; Wilkinson, 2006). The muscles of the pelvic floor work to control the urethra and the sphincter that keeps the opening to the urethra from the bladder closed. As the muscles weaken the control over the sphincter decreases (Cundiff, 2004). As this happens anything that causes an increase in pressure either in the abdominals or pelvic floor muscles the urethral sphincter cannot maintain control causing a leakage of urine (Cundiff, 2004). SUI is uniquely different from other kinds of incontinence disorders as it directly involved the weakness of the pelvic floor muscles rather than a weakness of the muscles of the bladder (Norton & Brubaker, 2006; Wilkinson, 2006). As stated previously, surgery can be helpful, but muscle strengthening is imperative to treating SUI.

Basu and colleagues did a study interviewing different women to understand what the common preferences for PFD's were. They focused on women suffering from SUI or pelvic organ prolapse. The women answered questions based on if they preferred surgery or a conservative approach like physical therapy. The results were interesting, due to the nature of SUI and how big of a role it plays into a woman's everyday life many wanted the treatment that had the highest success rate no matter how invasive it might be. Women suffering from prolapse were more cautious and were more apprehensive about possible side effects (Basu et al., 2011).

One reason the women gave was the inconvenience of repeated visits to a physical therapy clinic (Basu et al., 2011). Women specifically with incontinence expressed a greater interest in treatments that would be the quickest fix rather than focusing on treatment outcomes (Basu et al., 2011). Based off interview the interest in a quick fix stemmed from the longing to resume activities the women no longer felt they could be a part of due to SUI (Basu et al., 2011). Surgery while it may have high immediate cure rates have been found to have lower long term cure rates of 33% effectiveness compared to conservative treatments such as physical therapy (Arvonen et al., 2001) .Specializations in physical therapy are becoming more common. One of those specialties is pelvic floor therapy and obstetrics. The physical therapists who specialize in pelvic floor therapy have an

advantage in treating women suffering from SUI compared to a general physical therapist. Pelvic floor physical therapy is a rapidly growing field (Vasavada, 2016).

Pelvic floor therapists utilize different approaches focusing on strengthening and restoring pelvic floor muscle function as SUI treatment. Manual exams assess how well a woman can contract her pelvic floor muscles. Therapists coach women on how to properly contract their pelvic floor muscles. Muscular strengthening programs mainly focus on the levator ani. The urethra runs through that muscle causing it to have direct impact on the lower urinary tract function, specifically the function of the urethra (Freeman, 2004; Ghaderi & Oskouei, 2014). The levator ani are comprised of type 1 and type 2 muscles fiber which contribute to endurance and quick contractions of the muscle (Brooks et al., 2005; Ghaderi & Oskouei, 2014). Training both fiber types is important when women are trying to stop urine leakage during coughing, sneezing, or exercising. Type 2 fibers help to control the urethral function during a cough or sneeze while type 1 fibers help to control during prolonged activity like exercise (Brooks et al., 2005). It is thought that through developing strength and coordination of the PFM's it will help to keep the sphincter closed.

Once a person learns to properly contract the muscles of the pelvic floor they can begin to work on proper timing and coordination of the contractions. A proper contraction of the PFM's has a few components; it is how well the person can coordinate the contraction, how well they can time to contractions, and how well they can contract the specific muscle groups. Typically, a physical therapist will work with someone to understand when to contract the muscles on demand. The therapist will also help the patient become aware of their bladder. Again, the role of physical therapy in treating SUI is not to only treat SUI but to bring awareness of lifestyle changes to help combat SUI as well (Ghaderi & Oskouei, 2014). Different lifestyle changes could include an exercise routine or dietary changes. Exercise will help to gain and maintain strength and coordination of the PFM's. Dietary changes may be necessary if the person needs to lose weight (Ghaderi & Oskouei, 2014). Some of the main modalities in helping to treat SUI are awareness of the muscles of the pelvic floor, assessment and exercises in functional positions, the use of anticipatory contractions prior to an activity that would cause an increase in pressure, a program of exercises to train both type 1 and type 2 muscle fibers (Ghaderi & Oskouei, 2014; Kim et al., 2011; Murray, 2019; Vasavada, 2016). Each time a patient is prescribed a series of exercises; they should be coached through them by the therapist. This will allow the patient to gain a better understanding of how to properly conduct the exercises (Freeman, 2004; Vasavada, 2016). For the greatest impact the exercises should be held until fatigue, several times a day for up to 5 months (Freeman, 2004; Ghaderi & Oskouei, 2014).

Other modalities such as the addition of biofeedback, electrical stimulation, and vaginal cones or balls have all been used (Arvonen et al., 2001; Hein et al., 2020). The effectiveness of each

of these modalities has been shown to be helpful, but not as effective as PFM exercises in evidencebased research (Arvonen et al., 2001). Vaginal cones are weighted cones used to stimulate a contraction of the pelvic floor muscles. They are inserted into the vagina then the patient is tasked to move around while maintaining control of the pelvic floor muscles. However, they are not a very functional form of training as they do not directly address the suppression of urine leakage (Arvonen et al., 2001; Bø et al., 1999; Ghaderi & Oskouei, 2014).

2.3 Role of Physical Therapy

Physical therapy is the conservative way of treating PFD's, specifically when compared to surgical treatment options. The use of physical therapy in treating PFD's is useful from a more holistic approach. While physical therapy assesses the direct issue at hand it also assesses potential other factors that can contribute to PFD's. One of the philosophies behind physical therapy is treating the body as a whole (Arvonen et al., 2001; Kim et al., 2011). Physical therapy treatment does directly treat PFD's, but it is done with multiple approaches such as working other muscles groups that can affect the role of the PFM's (Kim et al., 2011)

2.3.1 Time Requirements for Muscular Strength and Adaptations

Muscle strength and control are developed in stages. Initial responses to muscle training program are neuromuscular (Brooks et al., 2005; McArdle et al., 2015). Meaning the motor units, nerves that innervate specific muscles, allow the muscle to become more efficient at recruiting more muscle fibers, generating efficient motor patterns (McArdle et al., 2015). When training a set of muscles, neuromuscular control begins. Increased neural recruitment, neuron excitability, and motor unit synchronization and firing rates can be observed as early as four weeks into a training program (McArdle et al., 2015).

Once neural adaptations occur, overall muscular strength changes can be observed, typically around the 6-week mark (Brooks et al., 2005; McArdle et al., 2015). Around the 6-week mark is when neuromuscular control and strength start to affect the muscles (Brooks et al., 2005; McArdle et al., 2015) This allows for better control of the muscle contractions along with the ability to hold the contractions for longer durations (Brooks et al., 2005). Typically, it will take up to 20 weeks to see and experience significant muscular changes. Many people struggle with sticking to a regime long

enough to experience the changes. For those dealing with SUI that is why they have reoccurring issues with SUI (Freeman, 2004; Nygaard & Shaw, 2016).

2.3.2 Exercises to Strengthen the Abdominal Muscles

The muscles that comprise the pelvic floor are often thought to be the floor of the core. Therefore, the core plays a role in assisting in control of the pelvic floor muscles. The core muscles consist of two groups: local and global muscles (La Scala Teixeira et al., 2019). The local muscles are deep within the core they are the multifidi, transverse abdominus, internal obliques, quadratis lumborum, diaphragm, PFM's, iliocostalis and longissimus. The global muscles are superficial, they are the rectus abdominus, lateral fibers of external oblique, psoas major, erector spinae, and gluteus (La Scala Teixeira et al., 2019). A strong core is important for so many daily activities, so it only makes sense that it would be important in controlling to continence system. The continence system is comprised of the bladder, urethra, and surrounding PFM's (Ghaderi & Oskouei, 2014; Norton & Brubaker, 2006; Vasavada, 2016). Some muscles of the core that are of specific focus are the diaphragm, transverse abdominus and internal obliques (Kim et al., 2011). Muscular strength, the maximum amount of force a muscle can generate, or one repetition maximum, is so important (Brooks et al., 2005; Kim et al., 2011). Muscle strength is essential to proper function of different systems, such as the continence system (Ghaderi & Oskouei, 2014).

In order to control and maintain proper function of the abdominal muscles during different activities it is essential to be able to first contract from the pelvic floor. Giving light to why the core and floor should be working in conjunction with one another (Cundiff, 2004; Kim et al., 2011; Vasavada, 2016). Not only is proper control and strengthening of the pelvic floor important but so is proper control of the core. Proper control of the PFM's is being able to contract and control the contractions of the PFM's(Ghaderi & Oskouei, 2014; Vasavada, 2016). Learning proper control involves learning how to isolate contractions specifically of the PFM's (Freeman, 2004; Tarukallo et al., 2018) It is very common for the obliques to take over causing the transverse abdominus to under preform leading to weak contractions of the pelvic floor (Vasavada, 2016). Retraining the muscles to contract in proper order will help to break the overactivity of the obliques. The PFM's should contract first followed by the lower abdominals, transverse abdominus, the obliques and then the rest of the core (Cundiff, 2004; Kim et al., 2011; Vasavada, 2016).

Recent research is showing evidence that the pelvic floor muscles and truck muscles cocontract to control abdominal pressure, showing how both the PFM's and core muscles all work together (Chawathey, 2015; Cundiff, 2004). The effects of interventions on enhancing the core

musculature has shown improvement aiding in treatment of SUI (Ghaderi & Oskouei, 2014; Kim et al., 2011). Improper timing and stimulation of the core muscles affects the pelvic floor muscles ability to contract, impeding the ability to control the urethral sphincters (Ghaderi & Oskouei, 2014; Kim et al., 2011; Shamliyan et al., 2008). The addition of trunk stabilization exercises to pelvic floor muscle training increased strengthening outcomes compared to just pelvic floor muscle training, within the participants of the study (Kim et al., 2011). The increased effect of the intervention was associated with the synergistic relationship between trunk and pelvic floor muscles to control the functions of the lower urinary tract (Kim et al., 2011; Knezevic et al., 2014). One important note from the study was the group who worked closely with a therapist who is specifically trained in women's health had better outcomes as well (Kim et al., 2011). It was thought that the group had better outcomes due to the specific training the therapists have undergone to specialize in women's health. The training gives the therapists a better knowledge base of how to treat PFDs such as SUI (Kim et al., 2011).

For many, incorporating a new exercise routine is difficult. That is why better outcomes are found when patients work consistently with a therapist or partake in some form of group exercise. Again, physical therapists can play a vital role in helping their patients implement the lifestyle changes necessary to fix their SUI. It is th that women suffering from SUI have a harder time activating and strengthening their core. This could be due to a trauma such as childbirth creating a weakness within the core (Kim et al., 2011; Vasavada, 2016; Wilkinson, 2006). So, it can be overwhelming and frustrating trying to find something that works or that they feel they can stick too. A patient's outcomes are only as good as their adherence to the program, which is why working with a therapist can help with adherence and ultimately lead to long term lifestyle changes (Arvonen et al., 2001; Duda et al., 2016; Wesch et al., 2012). The overall goal of a physical therapist to help their patients become self-sufficient and to not rely on the therapist. In addition to one-on-one training with a therapist, group exercise sessions can be very beneficial in adherence (Duda et al., 2016; Picha & Howell, 2018). Group exercise sessions provide structure, routine, and positive lifestyle changes for people which help to build confidence in themselves (Cox et al., 2010; Ghaderi & Oskouei, 2014; Milne et al., 2005).

2.3.3 Pure Barre: Core and Pelvic Floor Strength and Control of Musculature

In order to strengthen the core, it is important to find exercises that target not only the superficial abdominals but the deep abdominals like the transverse abdominus and internal obliques. Strengthening those muscles specifically is important due to their interactions with the pelvic floor

muscles (Ghaderi & Oskouei, 2014; Kim et al., 2011). Learning how to really control muscle movements takes time. Which is why having a physical therapist or even a personal trainer assisting in teaching the patient how to contract those muscles is so beneficial.

Pure Barre is a type of group fitness that has been designed specifically for women. The entire workout is centered upon having a strong core to stabilize the body as participants work different muscle groups. Pure barre was created to provide amazing barre workouts, strengthen the body and mind connection, and empower women. It was created back in 2001 by a dancer who opened the first studio in the basement of an office building in Michigan (*The Best Full Body Barre Workout | Pure Barre*, 2021) he created the method behind Pure Barre because she believed the workouts should be about how women feel not how the look. From there the workouts began to take off and soon the franchise was started in 2009. Now Pure Barre is a nationwide company.

The workouts are targeted at strengthening the muscle groups women have a hard time strengthening like the core. Due to the specific nature of the workout, it allows women to focus on the areas other types of workouts may not focus on. Pure Barre works on small isometric contractions of the muscle then working the muscle to fatigue to really gain strength in the muscle. The whole premise of the workout is focused on moving from the core, even while working on other muscle groups. Not only do the workouts work the core, but they really work to target the deep muscles of the core. Adding a specific targeted group workout to a patient's pelvic floor training can be greatly beneficial to their recovery, quality of life, and overall health.

During a typical class there are a few sections that work to directly target the core. There is a planking series, three core inserts that utilize various types of crunches, leg lifts, and lower body curls. The movements are all specific in which area of the core they are working whether it be upper or lower abdominals. The workout also focuses on strength and endurance, which in turn helps to target both type 1 and 2 muscle fibers (Brooks et al., 2005). This ensure that the muscle is being worked and fatigued to its full potential. Combining Pure Barre with pelvic floor therapy could be so beneficial to women struggling with SUI. They will get the proper guidance they need to stick to a program to help the stay motivated and on track. They will also be given the chance to really become comfortable in their new lifestyle changes adding to their overall quality of life.

Pure Barre workouts work to isolate different muscle groups and work them to fatigue. It is thought that you can gain better neuromuscular control with specific small movements (Filipa et al., 2010; Khayambashi et al., 2012). Currently there is no research regarding Pure Barre specifically. However, there is some research that has focused on isolating muscle groups to help gain strength and prevent injury. One study investigated the use of isolated hip adductor and external rotator muscles to help alleviate pain in females suffering from patellofemoral pain. It was found that the isolated

exercises significantly helped to decrease pain for the females with patellofemoral pain (Khayambashi et al., 2012). The authors discussed the importance of isolated movements in gaining better control over different muscle groups along with building strength within specific muscle groups (Khayambashi et al., 2012).

Pilates is a comparable workout to Pure Barre. Both workouts focus on targeted muscle groups. Both exercises also utilize small, isolated movements to target each muscle group (Chmielewska et al., 2019; Culligan et al., 2010; Hein et al., 2020). Incorporating a Pilates workout has provided favorable outcomes when treating SUI over an eight to twelve week training (Chmielewska et al., 2019; Hein et al., 2020). Women who participated in a Pilates program led by either a certified Pilates instructor or a physiotherapist combined with physical therapy treatment for SUI showed improvements in PFM strength and coordination (Chmielewska et al., 2019; Culligan et al., 2010; Hein et al., 2020). Currently there is no literature investigating the effects of a Pure Barre workout on the treatment outcomes of physical therapy for SUI. The goal of this study is to examine whether Pure Barre may have similar effects on SUI as Pilates due to their similarity.

2.3.4 Possible Deterrents of Receiving Physical Therapy Treatments

Insurance and cost of physical therapy can be factors that influence a person's ability to attend physical therapy (Washington et al., 2011). Depending on the type of insurance a person has can directly affect the cost of each physical therapy session, the amount of physical therapy sessions allowed, co-pay costs and if the deductible has to be met or not before an insurance company will help with payment (Washington et al., 2011). Recommended amount of physical therapy visits therefore can possibly heavily depend on a person's financial abelites and insurance allowances for physical therapy visits (Culligan et al., 2010; Washington et al., 2011).

Other factors that can influence frequency of physical therapy visits are access to therapy whether it be the office location or personal schedule and availability. Participant one had just had their first child, so adjusting to being a new mom can be a lot and could have some impacts on ability to get to physical therapy sessions.

2.4 Improving Self Efficacy with Treatment

One very major concern with SUI is the negative impacts it has on a woman's life. It affects their social interactions, physical activities, relationships, and sexual abilities can cause a woman to

draw back into self-isolation (Basu et al., 2011; Norton & Brubaker, 2006; Wilkinson, 2006). It is commonly reported that women struggling with SUI have a very low rating of self-efficacy (Basu et al., 2011; Danforth, Townsend, Lifford, Curhan, Resnick, & Grodstein, 2006; Nygaard et al., 2015; Nygaard & Shaw, 2016). Women who report low self-efficacy typically report a lack of wanting to socialize due to fear of leakage, lack of intimacy due to fear of leakage, and a general perception of being unable to control their body (Basu et al., 2011; Danforth, Townsend, Lifford, Curhan, Resnick, & Grodstein, 2006; Nygaard et al., 2015; Nygaard & Shaw, 2016). Bandura defines self-efficacy as one's perceived ability to complete a specific task (Bandura, 1977; Olmedilla et al., 2018). Assessing self-efficacy is very easy and every physical therapy office usually has a variety of questionnaires that will assess a person's self-efficacy.

If a patient's self-efficacy is established and monitored throughout the rehabilitation process, potential negative psychological factors can be identified and countered. Being able to catch possible factors that could cause a patient to suffer a setback can be very beneficial to the patient. Keeping the patient and the therapist aware of self-efficacy would be beneficial to the rehabilitation process in order to keep the patient on track how recovery is progressing. Many studies have found positive relationships between self-efficacy and rehabilitation (D. K. Chan et al., 2009; Duda et al., 2016; Milne et al., 2005; Wesch et al., 2012). Maintaining high self-efficacy has been shown to increase adherence to the rehabilitation process along with adherence to at home exercises, which many people leave to the wayside (Evans & Hardy, 2002; Wesch et al., 2012) Increasing adherence will only benefit the patient throughout the long rehabilitation process.

Maintaining self-efficacy also helps the patient to maintain their sense of competency (Picha & Howell, 2018; Wulf & Lewthwaite, 2016). The patient needs to know and feel that they are able to complete any task required of them. If the patient does not feel able to complete the required tasks during the rehabilitation process, they cannot be expected to feel confident as they return to daily and social activities (Duda et al., 2016; Fields et al., 1995). Establishing self-efficacy during the rehabilitation process is key to building a foundation for the patient. However, it should not stop there. Since it can be difficult for the therapist to maintain regular follow ups, a program like Pure Barre may help a patient maintain self-efficacy as they return to more social activities. Pure Barre instructors, staff, and any relationships formed with other members can help the patient navigate their way through any low times.

Self-efficacy and performance are positively related to each other (Halper & Vancouver, 2016; Harrison et al., 1997; Wulf & Lewthwaite, 2016). A recent study chose to examine the relationship between self-efficacy and strength performance (Halper & Vancouver, 2016; Harrison et al., 1997; Wulf & Lewthwaite, 2016). They observed that a strong self-efficacy had positive impacts

on strength performance and the subjects who possessed a strong self-efficacy were able to lift greater amounts than those who had a low self-efficacy. Understanding the impacts self-efficacy can have on performance is essential among women struggling with SUI (Baretta et al., 2017; Gayton et al., 1986; Thomeé et al., 2006; Wells et al., 1993). It will allow for physical therapists, friends, and trainers to better understand how and why a woman struggling with SUI is having a hard time falling into a new routine. Therefore, it is proposed that helping women understand how self-efficacy and performance are related will also be very beneficial. If they are not performing well, they could blame it on a number of things potentially not realizing that they are suffering from low self-efficacy. Once selfefficacy has been assessed and understood, patients have the ability to work to improve their selfefficacy then work to improve their performance (Baretta et al., 2017; Wells et al., 1993).

. As women's health therapy becomes a more well-known practice hopefully the reporting of PFD's will increase. Women need to know they do not have to suffer forever. They need to know there are therapies and exercised they can partake in to regain confidence and control over their lives. This will ultimately lead to a greater quality of life for women as they give birth and age.

2.5 Motivation and Adherence to treatment

2.5.1 Types of Feedback

When performing different tasks, feedback is essential to help master the task. Many different types of feedback exist such as performance feedback, external focus feedback, and internal focus feedback. All of these can be used to effect a person's motivation about completing a task (Badami et al., 2011; Karl et al., 2016; Tolli & Schmidt, 2008). These types of feedback can be used together to help a person master a task. Feedback can be a very helpful tool in building and maintaining motivation. Not only can someone be motivated, but it can also help them develop their own motivation. Motivation is a broad and inclusive term for things influencing and encompassing the direction and intensity of behavior (Shea & Wulf, 1999; Wulf & Lewthwaite, 2016). Understanding how different types of feedback can affect a patient's motivation will be beneficial for a physical therapist as they treat patients.

Motivation exists in two types: extrinsic and intrinsic. Extrinsic motivation is caused by some sort of external source, usually due to some sort of reward, trying to gain approval, or because the person was told to do so. Intrinsic motivation comes from within the person. It is a drive from the love of the task, the feeling someone gets from the task, and the satisfaction they feel once they task is completed (D. K. C. Chan & Hagger, 2012; Ryan & Deci, 2000; Tolli & Schmidt, 2008). Selfefficacy

and intrinsic motivation are highly correlated and help to build each other (Halper & Vancouver, 2016; Ryan & Deci, 2000; Tolli & Schmidt, 2008). Commonly those with strong intrinsic motivation also have a high self-efficacy. In using motivation as a form of feedback, it can greatly help a person develop their own intrinsic motivation (Ryan & Deci, 2000; Tolli & Schmidt, 2008).

2.5.2 Motivation and Performance

Using motivation can help to increase performance in physical therapy patients. However, if external motivation is misused it can cause a person to not feel the want to perform or could cause them to perform poorly (Barbaranelli et al., 2018; Tolli & Schmidt, 2008). External motivation if used incorrectly can cause a person to become outcome oriented. If that happens it can put too much stress on the person to obtain a certain outcome. Once the enjoyment of the task is gone, it can potentially put a person at an increased chance to fall off the plan of care. The use of intrinsic motivation is extremely helpful (Barbaranelli et al., 2018; Chua et al., 2019; Tolli & Schmidt, 2008). It helps person to gain a sense of ownership over how their actions. Once they possess the feeling of ownership of the task, they will feel the drive to push themselves in a safe way and improve their performance.

While many studies have investigated these topics individually, very few have examined all three in conjunction. Understanding how each of the topics correlate to each other and play a role in an person's recovery is essential. Investigating possible relationships between the different variables will allow for physical therapists and their patients to gain a better understanding of the entire recovery process. Hopefully the results of the current study will help understand how each of the variables work together to influence a person. The results should shed light on how to improve selfefficacy and motivation among women suffering from SUI.

Chapter 3: Methodology

3.1 Purpose of the Study

The purpose of this study was twofold; 1) to investigate if the Pure Barre workout program would more efficiently improve SUI symptoms combined with physical therapy treatment. 2) To examine if the Pure Barre workout had any effect on self-efficacy of women diagnosed with SUI. It was hypothesized that including Pure Barre in physical therapy treatment will have an acute effect on recovery scores and self-efficacy in patients with SUI compared to patients only seeking physical therapy treatment.

3.2 Participants

The participants of this study were current patients of a North Idaho PT clinic (Hayden, Idaho) and were recruited through collaboration with the clinic's PT. Participants in this study were all postpartum females in physical therapy due to a diagnosed Stress Urinary Incontinence (SUI) condition. The diagnosis was given by the licensed physical therapist at Inland Pelvic Health and Physical Therapy. Each participant was diagnosed by the same physical therapist. In situations where the therapist did not originally diagnose SUI, the therapist confirmed diagnosis during an initial examination consisting of questionnaires and physical examinations. Each participant had been cleared for exercise by the physical therapist.

Participants recruited by the PT were categorized into two groups: control versus Pure Barre intervention. The control group was comprised of patients who did not want to partake in the Pure Barre intervention but were still seeking treatment for SUI. The control group underwent the standard physical therapy treatment done by the physical therapist or physical therapist assistant. The intervention group included current patients of the physical therapist who were prescribed Pure Barre sessions 2 – 3 times a week in addition to their PT sessions. There was no restriction on the current number of physical therapy sessions received for treatment to be included in the intervention group. Both groups received physical therapy from the same physical therapist focused on the same treatment design.

Participants were excluded from the study if they exhibited any of the following: 1) unable to complete a Pure Barre session without experiencing pain, which caused an unsuccessful completion of class 2)unable to attend at least two Pure Barre class a week 3)had any exposure to Pure Barre since the SUI diagnosis 4) had been a patients for longer than two months prior to the start of the study and 5) have been post-partum for longer than a year.

3.2.1 Protecting Participants

All participants were given a written explanation of the study and the option to participate. Each participant gave their written informed consent upon deciding to participate. All data was deidentified prior to storing the data in a locked cabinet or password protected computer.

3.3 Pure Barre Intervention

The participants were engaged in a plan of care with the same physical therapist at Northern Idaho PT clinic. General treatment structure for patients with SUI consists of 1-2 weekly visits of 50 minutes at the clinic. Once at the clinic the patient underwent manual internal therapy performed by the physical therapist or physical therapist assistant. The manual therapy treatment targets training the patient's ability to control their pelvic floor muscles through a series of contractions and relaxations. Once the manual therapy was completed the patient did a series of targeted exercises focused on engaging the pelvic floor and abdominal core muscles. The exercise included, lower abdominal crunches, leg raises, or wall sits while squeezing a ball between the legs. Typically, the exercises imitate functional movements a patient may encounter in their daily living.

For the intervention, the participants were encouraged to attend Pure Barre classes 2 times per week. In order to observe physical benefit from the workout, Pure Barre suggests participating in a minimum of 2 classes per week. Participants attended the Pure Barre studio in Coeur d'Alene, Barre Tab LLC, Idaho, which provided free classes to participants for the duration of the study. The structure of the class participants attended was an introductory class followed by the classic classes. Each class was led by a certified Pure Barre instructor. The Pure Barre workout was chosen based on the type of exercises conducted during a class. Pure Barre targets core exercises including planks, crunches focused on upper, middle, and lower abdominals, and pushups. Participants expected to exercise the upper body and lower body as well.

Pure Barre Introductory Class:

Purpose: The introductory class focuses on introducing and familiarizing participants to the Pure Barre workout, focusing on technique and form development. Participants are encouraged to ask questions regarding the skill technique and form.

General structural: Prior to exercising, the Pure Barre instructor introduces the terminology used in class to cue different body movements. Following the introduction of terminology, the instructor takes the participants through a modified class. The introductory class is a shortened version of the classic class. The class includes warm up, arms, thighs, seat (glutes), and core exercises that are used in classic classes.

Classic Class:

Purpose: The classic class was Pure Barre's original class format. The classic class focuses on small, isometric contraction movements focusing on not only the large muscle groups, but the small muscles of the body, as well. The movement patterns are focused on small and controlled movements with minimal equipment, targeting the isolation of different muscle groups. The class trains participants to utilize proper contraction of the core to properly stabilize through dynamic movement patterns. All movement initiates through proper integration of the core musculature.

General structure: A classic class is a total body workout. The class is organized in blocks, with each block targeting different regions. Each class begins with a generalized, full-body warm-up. The blocks following the warm-up, the class is broken up into three blocks with focused attention: upper body, lower body and core. Instructors continuously cue participants to engage their core throughout the entire workout.

Participants in both the control and intervention group were asked to keep a physical activity log throughout their Pure Barre intervention and physical therapy treatment. They reported what date they worked out, the type of exercise, intensity of the exercise and duration of the exercise. Participants were provided an excel sheet in order to log their physical activity data. Intensity was defined as low, moderate or high intensity. Low intensity was when the participant could talk or sing with no extra effort, moderate intensity was when the participant could talk but not sing during the activity, and high intensity was the participant could not say more than a few words without stopping for breath (*Measuring Physical Activity Intensity | Physical Activity | CDC*, 2020).

3.4 Data Collection

Once participants expressed interest in participating in the study an informed consent was retrieved from every participant. Following the completed informed consent participants were emailed a link to answer the self-efficacy questionnaire and data from the initial evaluation was obtained. The study was a quasi-experimental study design. Participants were placed into two groups: control and Pure Barre intervention. Participants were able to choose whether they wanted to participate in Pure Barre classes. If participants chose not to attend Pure Barre classes, they were placed into the control group. If participants wanted to attend Pure Barre classes, they were placed into the experimental group. Participants in the Pure Barre intervention group were given 24 Pure Barre sessions. Data was collected for 2 progress notes for each participant. The progress notes were collected within a 2-month time span and the Pure Barre classes were completed within the same time frame.

Progress notes were conducted by the physical therapist every 10-12 physical therapy sessions. Data ended up being collected every two months from the initial visit to the end of the study. At each progress note data was collected for the manual muscle test (MMT), quick contraction test, endurance test, urinary distress index 6 (UDI-6), and self-efficacy.

Subjective data from the MMT, UDI-6 and self-efficacy questionnaire along with objective data from the endurance test and quick contraction test were obtained and used for assessment. The physical therapist assessed the strength of the PFM's for each participant through a series of controlled contractions and relaxations and rated the strength on a scale of 0-5. The quick contraction test was reported by the PT; the patient was tasked to complete as many contractions as possible of the PFM's possible within ten seconds, the total number of contractions was reported. The endurance test tasked the patient with holding a contraction of the PFM's for as long as they could. The result was reported in total seconds. The UDI-6 data came from a portion of the PFDI-20 questionnaire. Participants answered a binary response of yes or no. If yes was answered, participants rated they symptom on a scale of 1-4. The UDI-6 score assessed urine leakage. The self-efficacy questionnaire assessed how SUI impacted the participants quality of life and their ability to control their PFM's during different activities. Self-efficacy was self-reported data from each participant. The selfefficacy questionnaire was the ICIQ-UI short form (Avery et al., 2004). Participants subjectively reported their answers on a scale of 0-5 for questions 3-4 and 0-10 on question 5. Question 6 was a list of questions that applied to each person. Participants were prompted to answer all that applied to them. The ICIQ-UI form has been used to assess one's perceived severity of SUI. It is comprised of a series of questions that are answered on a scale of frequency and amount of SUI a person experiences in a day (Avery et al., 2004; Chmielewska et al., 2019). Questions 3-5 on the form are summed to assess a person's leakage and are graded on a numbered scale. Question six assess when urine leaks for a person. The overall score does not have much of a change for participant one for the first set of questions, however question 6 does show improvement at the 8-week mark. Participants then were asked to rate additional question using a Likert scale to assess how capable of controlling their SUI during different activities, such as exercise. The scale ranged from 1) feeling not at all capable to 7) totally capable. The questionnaires were completed upon entering the study, at week four and at week eight. The questions are listed below:

1. *How capable do you feel you are able to control your SUI during exercise?*
2. *How capable to do you feel you can anticipate a sneeze, cough, or laugh and control your SUI?*
3. *How capable do you feel you can control your SUI throughout your daily tasks?*

4. *How capable to do you feel you can control your SUI during an unexpected sneeze, cough, or laugh?*

3.5 Data Analysis

Once each participant completed the UDI-6 questionnaire the mean value of all answered items was calculated then multiplied by 25 to obtain a score (range 0 to 100). The MMT was subjectively rated by the physical therapist on a scale of 0-5. The quick contraction test data was reported in total number of contractions completed within 10 seconds with the goal being 7 contractions. The endurance test data was reported in total seconds the participant could hold a contraction of their PFM's. The sum of questions 3-5 from the ICIQ-UI form was reported. Each additional question rating was reported and used for assessment.

3.5 Case Study Comparisons

Recruiting participants proved to be more difficult than expected. The inclusion criteria for the study narrowed the participant pool drastically. This changed the study from having two groups: a control and intervention group, to only having two participants. Therefore, the study shifted to being a case study with two participants.

Originally the study was to follow a traditional investigation with two groups compared using a statistical analysis. Changes in the all the dependent variables between the intervention group and control group would have been determined using Mixed Model Analysis of Variance (ANOVA). If a significant interaction was reported data was then ran using a repeated measures ANOVA for each group. Independent t-tests were run for each individual time point. If results were significant a Bonferroni post-hoc analysis was run. Significance was set at $a = 0.05$. All data was reported as mean ± SD. Many potential participants that were interviewed failed to meet all inclusion criteria. Another limitation to the study was not being directly involved with the physical therapy clinic. Recruitment relied on referrals from the staff at the physical therapy clinic. Lapses in communication between the clinic and researchers also made participant recruitment difficult. The proximity of the Pure Barre studio to the physical therapy clinic was a limiting factor for participants as well, it was difficult for participants to make it to the studio.

Chapter 4: Results

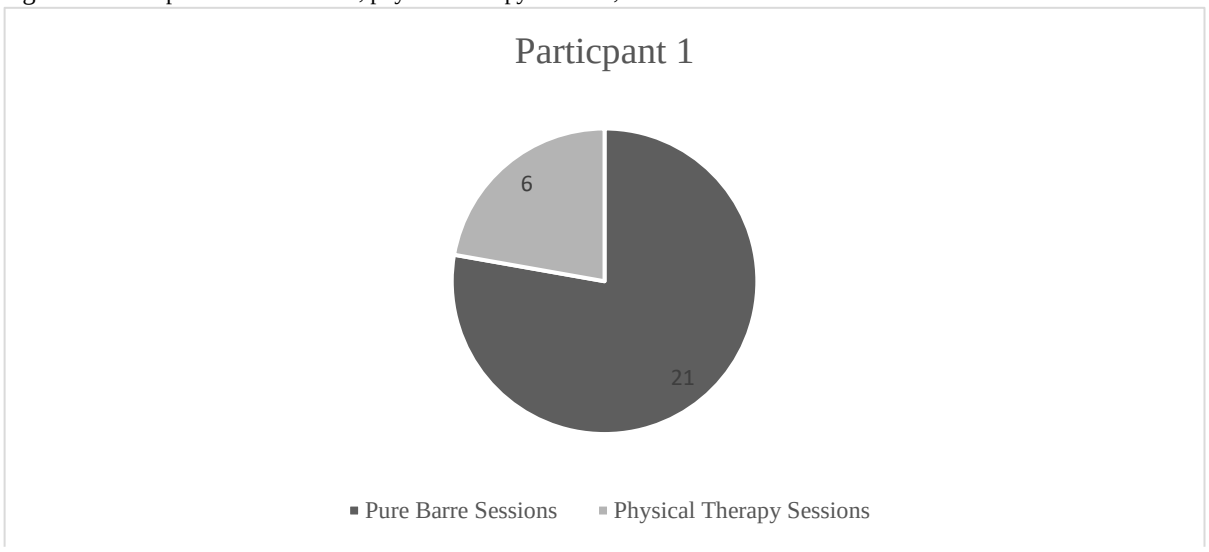
4.1 Participant Overview

The study recruitment process allowed for two participants to join the study. A total of 12 inquiries came through from patients of the clinic to participate in the study, but they did fit the inclusion criteria for the study. Both participants were tasked to complete a minimum of 2 Pure Barre classes a week for 8 weeks. They were also tasked to comply with the plan of care given to them by the physical therapist. The amount of physical therapy visits was a suggestion given to them.

4.1.1 Participant 1

Participant 1 was a 31 one year old female. She started with physical therapy after the birth of her first-born son. Participant one had a vaginal birth and presented with urinary complications postpartum requiring the use of a catheter for a short period of time after delivery. Participant 1 started physical therapy for her SUI 13 weeks post-partum and completed a total of 6 physical therapy sessions (Figure 1) during participation in this study. Participant 1 was able to complete a total of 21 Pure Barre sessions with a consistent and dedicated routine.

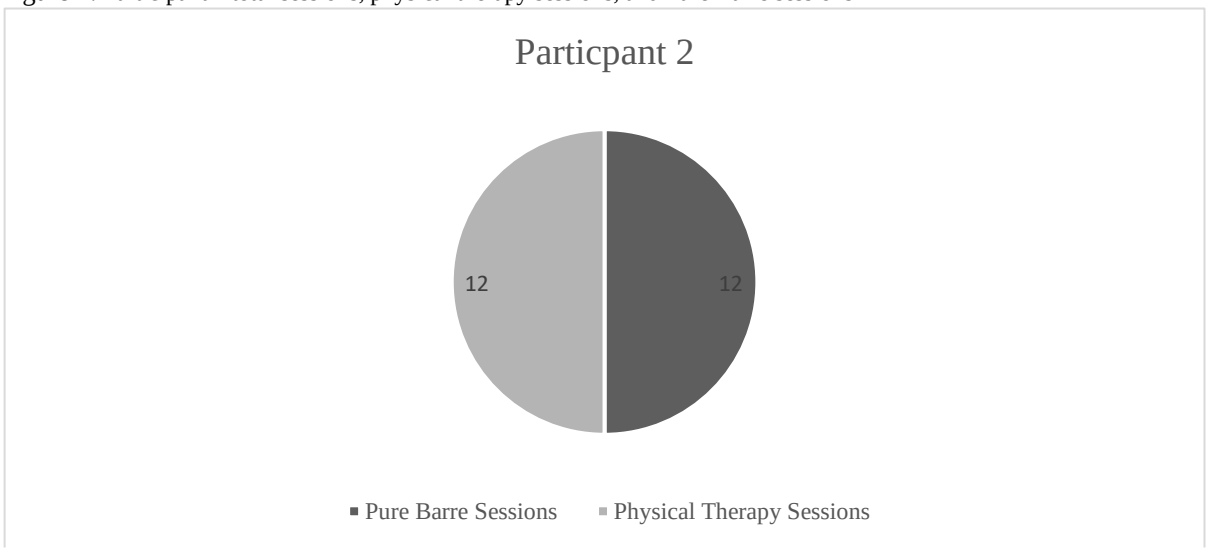
Figure 1. Participant 1 total sessions, physical therapy sessions, and Pure Barre sessions



4.1.2 Participant 2

Participant 2 was a 31-year-old female seeking physical therapy treatment for SUI after the delivery of her second baby (both vaginal birth). She participated in pre-partum physical therapy treatment to help prepare for her birth. The program was focused on core and PFM strength and awareness. Her first birth had a few complications that caused increased tearing and pelvic floor dysfunction. It was not specified in her chart notes if treatment was received post-partum. Her second birth did not have as many complications as the first but her pelvic floor dysfunction, specifically SUI remained. Participant 2 completed a total of 12 Pure Barre sessions. At weeks 3 and 6 of the 8 weeks the participant experienced some life challenges that prohibited the completion of Pure Barre sessions. However, participant 2 was able to complete 21 physical therapy sessions amidst the life challenges (Figure 2).

Figure 2. Participant 2 total sessions, physical therapy sessions, and Pure Barre sessions



4.2 Physical Therapy

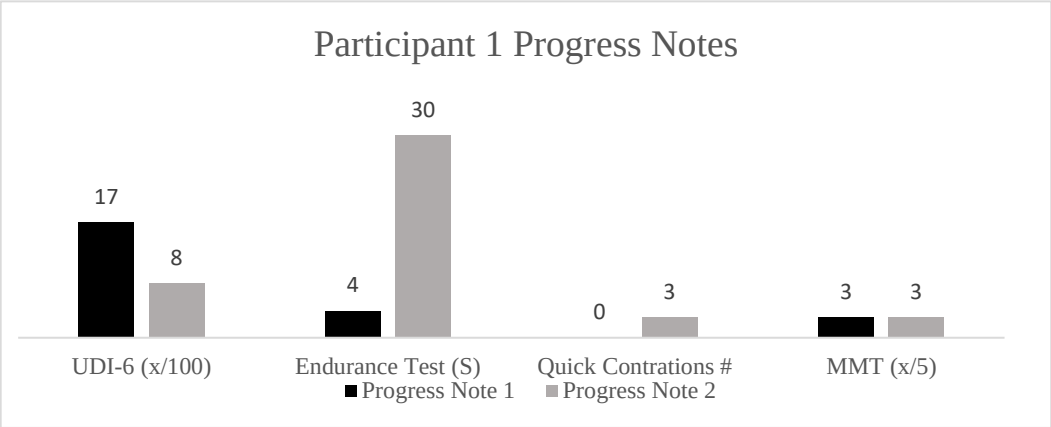
4.2.1 Participant 1

Over the duration of the study participant 1 completed 9 physical therapy sessions starting with an initial evaluation and ending with a progress. Participant 1 started with 1 visit a week and tapered down to about 1 visit a month. Patient 1 was only allowed 20 visits total from the insurance which could be a limiting factor to overall number of visits.

4.2.1.1 Participant 1 Progress Notes

Participant showed increases in three measures of the progress notes. At the initial progress note participant one scored a 17 out of 100 on the UDI-6 form, 4 seconds on the endurance test, 0 contractions for the quick contraction test, and a 3 on the MMT. After about four months and 6 physical therapy sessions another progress note was taken. This progress note showed a decrease in the UDI-6 scores, with a score of 8/100. There were increase in both the endurance test scores (4 to 30 seconds) and the quick contraction test (0 to 3 contractions), but the MMT scores showed no change. The changes can be seen in figure 3.

Figure 3. Participant 1 Progress Note Scores



4.2.2 Participant 2

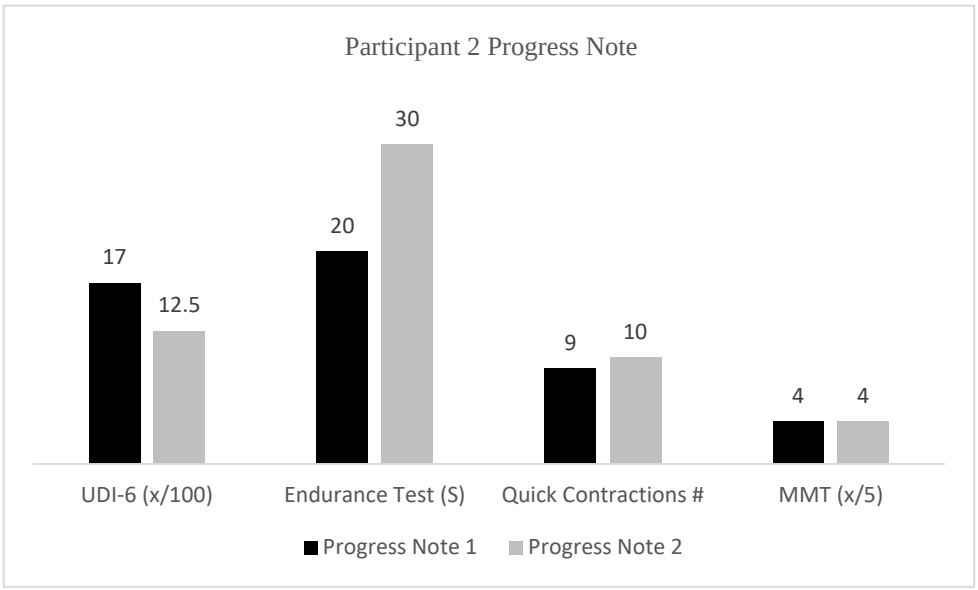
Participant two was able to complete a total of 12 physical therapy sessions averaging once a week. During the study duration participant two was unable to complete the required Pure Barre sessions, however she was able to still complete the required physical therapy sessions.

4.2.2.1 Participant 2 Progress Notes

Participant two showed changes in three of the four assessments taking during the progress notes. The initial progress note for participant 1 reported a 17 out of 100 for the UDI-6, a 20 second

hold for the endurance test, 9 quick contractions, and a 4 on the MMT. After four months and twice the amount of physical therapy visits in the same period compared to participant one, 12 physical therapy sessions had been completed at the time of the second progress note. This progress note showed a decrease in the UDI-6 score, with a score of 12.5/100. There was an increase in both the endurance test (20 to 30 seconds), and quick contraction scores (9 to 10 contractions), but the MMT scores showed no change. The data can be seen in figure 4. Participant two had started physical therapy about one month before being recruited for the study, which fell within the inclusion criteria of the study. The second progress note for participant two was also late due to outside factors causing the participant to delay physical therapy visits.

Figure 4. Participant 2 UDI-6 and endurance test scores



4.2.3 Participant 1 and 2 Differences

Each participant had different experiences with physical therapy. Participant 1 only completed 6 physical therapy sessions where participant 2 completed 12 physical therapy sessions. The frequency of sessions each week differed between the two participants as well. Participant 1 attended a physical therapy session every 1-2 weeks. Participant 2 attended physical therapy sessions once a week for the entire duration.

4.3 Self Efficacy

4.3.1 Participant 1 Self-efficacy

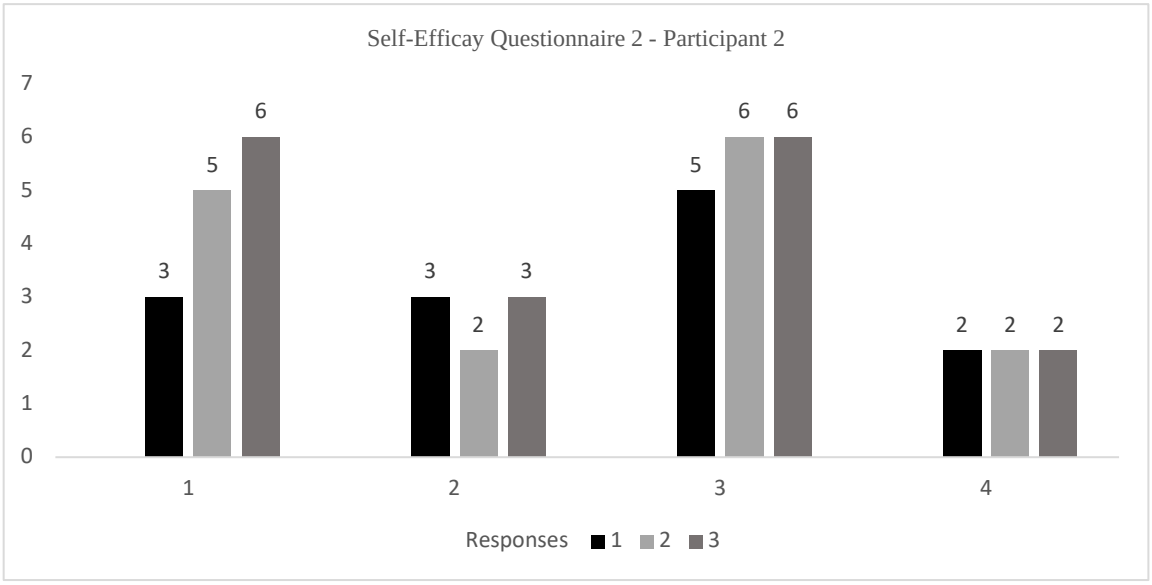
Participant one completed a total of 3 self-efficacy questionnaires. Increases in self efficacy were observed with each questionnaire. The biggest increase in reported scores were seen with the third questionnaire, specifically for question four. Question four asked, how capable you feel you can control your SUI during an unexpected sneeze, cough, or laugh. For the first two assessments the participant reported no change, then on the third assessment the participant reported a 6. The third questionnaire was taken after she had been doing three Pure Barre classes a week for four weeks. The responses from participant one can be seen in figure 5.

Figure 5. Self-Efficacy questionnaire responses from participant 1

4.3.2 Participant 2 Self-Efficacy

Participant two reported increases in scores for questions one and three for each of the three questionnaire time points in self-efficacy over the 8 weeks. Question one asked, how capable do you feel you can control your SUI during exercise. Question three asked, how capable you feel you can control your SUI through your daily tasks. The results for participant two can be seen in figure 6.

Figure 6. Self-efficacy questionnaire 1 responses for participant 2



The responses from participant two showed an increase in self-efficacy reported scores in questions 1 and 3. However questions 2 and 4 showed some or no increase in reported scores. Question 2 asked, how capable do you feel you can anticipate a cough, sneeze, or laugh and control your SUI. Participant two's reported scores could have been affected by extraneous life circumstances that occurred during the 8 weeks.

4.4 ICIQ-UI Short Form

4.4.1 Participant 1

Participant one reported no changes in the frequency (question 3) and amount (question 4) of urine leakage on the ICIQ-UI response times. The response to urine leakage interfering with her everyday life fluctuated but showed no changes from response time 1 and 3.

Table 1. Participant 1 ICIQ-UI Questions 3-5 Responses

Participant 1 ICIQ-UI	**R1**	**R2**	**R3**
Question:			
3. How often do you leak urine?	1	1	1
4. We would like to know how much urine you think leaks. How much urine do you usually leak (whether you wear protection or not?)	2	2	2
5.Overall, how much does leaking urine interfere with your everyday life?	3	2	3

Question 3: a response of 1 – about once a week or less often. Question 4 a response of 2 – a small amount. Question 5 – a response on a scale of 0 (not at all) to 10 (a great deal).

During the final assessment for the ICIQ-UI question 6 reported leakage for only one instance, when she could not get to the toilet. Weeks 1 and 4 both reported multiple scenarios of when leakage would occur.

Table 2. Participant 1 ICIQ-UI Question 6 Responses

When does urine leak?	W1	W4	W8
Leaks before you can get to the toilet	X	X	X
Leaks when you cough or sneeze	X	X	/
Leaks when you have finished urinating and are dressed	X	X	/

X indicates urine leaked during that time. A / indicates that urine no longer leaked at that time.

4.4.2 Participant 2

Participant two reported a decrease in frequency (question 3) and a decrease in amount (question 4) of urine leakage. The response to urine leakage interfering with her everyday life fluctuated over each response time but showed no change.

Table 3. Participant 2 ICIQ-UI Questions 3-5 Reponses

Participant 2 ICIQ-UI	R1	R2	R3
Question:			
3. How often do you leak urine?	2	1	0
4. We would like to know how much urine you think leaks. How much urine do you usually leak (whether you wear protection or not?)	2	2	0
5.Overall, how much does leaking urine interfere with your everyday life?	3	5	4

Question 3: a response of 0- never, 1 – about once a week or less often, 2 – two or three times a week. Question 4 a response of 0 – none, 2 – a small amount. Question 5 – a response on a scale of 0 (not at all) to 10 (a great deal).

Question 6 for participant two showed no changes, however it is believed that more needs to be known about participant two and their leakage. Participant two answered to no leakage on week eight for questions three and four, but for question 6 on week eight still marked two boxes. The responses to question 6 indicate the need for further investigation on leakage for participant two.

Table 4. Participant 2 ICIQ-UI Question 6 Responses

When does urine leak?	W1	W4	W8
Leaks when you cough or sneeze	X	X	X
Leaks when you are physically active/exercising	X	X	X

X indicates urine leaked during that time

4.5 Pure Barre and Physical Activity

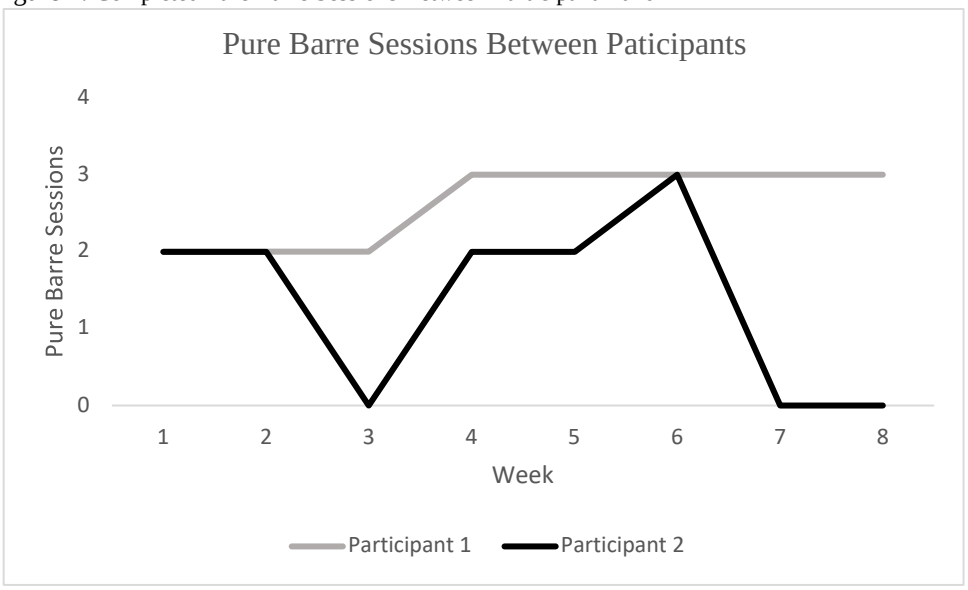
4.5.1 Participant 1

Participant one was more consistent and adhered to her Pure Barre program, she was able to complete at least two classes a week. She started off with 2 sessions a week then after week 3 she increased to 3 Pure Barre sessions a week. A total of 21 Pure Barre sessions were completed for participant 1 over the course of eight weeks. Participant one indicated that she only participated in the Pure Barre program for the duration of the study. Therefore, she did not complete the physical activity log for any other physical activity completed throughout the study.

4.5.2 Participant 2

Participant two completed a total of 12 Pure Barre sessions. During weeks one and two the participant completed 2 classes a week. Week 3 no classes were completed due to an illness. Weeks 4-6 classes were completed with a maximum of 3 classes completed in a week. Participant two then had another two weeks of no completed Pure Barre classes, due to an emergency trip to Teas. Figure 7 shows the difference between participants. Participant 1 did partake in other planned physical activity and was reported in the physical activity log (appendix 1). Participant one reported exercise in the 'other' category of the physical activity log. She said that she was using the Pure Barre Go app. The Pure Barre Go app is an online streaming service of classes from Pure Barre. These classes were not counted in the study because they were not held in the Pure Barre Coeur d'Alene studio lead by an instructor.

Figure 7. Completed Pure Barre Sessions Between Participant 1 and 2



Chapter 5: Discussion

5.1 Overview of Study Findings

This study investigated adding a Pure Barre exercise program to the physical therapy treatment for two participants that had been receiving physical therapy treatment for SUI. Both participants completed the study and saw increases in a number of metrics, while having two very different experiences in the study during the eight-week Pure Barre exercise program intervention.

5.2 Progress Notes

5.2.1 Participant 1 Progress Notes

Participant one showed increases in most of the measures taken during the second progress note. The responses on the UDI-6 of the PFDI-20 section decreased from an initial score of 17/100 down to an 8/100, showing a decreased amount of urine leakage over the duration of the study. Based on current research assessing an 8-week Pilates intervention to treat SUI, it was hypothesized that participants would experience a decrease in amount and frequency of urine leakage over the course of an 8-week Pure Barre intervention (Chmielewska et al., 2019; Culligan et al., 2010). An increase in PFM endurance was seen in participant one. The first progress note reported a four second contraction and the second progress note reported a thirty second contraction. With participant one's adherence to both the physical therapy treatment and the Pure Barre program the increase in PFM endurance can be related to muscular endurance (Brooks et al., 2005; Kim et al., 2011). Pure Barre is focused on the muscular endurance of the PFM's and Participant one benefited from her strict adherence and increased attendance to the completion of Pure Barre classes (Kim et al., 2011) Participant one's progress note scores were consistent with findings from studies investigating the effects of a Pilates intervention (Kim et al., 2011).

She did note after her second progress note she was expecting the scores to be better than they were. She reported she had been feeling good from adding in the Pure Barre sessions. She was still happy with her overall progress though. The final self-efficacy scores reflected participant one's feelings, however. She showed increased in feelings of control over her SUI, increases in her capability to stop leakage during a unexpected increase in pressure, i.e. sneeze or cough. While she didn't feel her scores were as good as she hoped she had still seen improvements in self-efficacy.

5.2.2 Participant 2 Progress Notes

Participant two showed increases in reported scores in two measures of the progress note data. Her score on the UDI-6 portion of the PFDI-20 Index went down between the initial progress note and the second progress note. She went from an initial score of 17/100 down to a 12.5/100. She was able to report an overall decrease in the amount and frequency of urine leakage. Participants two's final progress notes showed a better control over her SUI leakage, as a decrease in the UDI -6 scores was to be expected after introducing the Pure Barre exercise program (Chmielewska et al., 2019; Culligan et al., 2010). While participant two did not complete as many Pure Barre classes the change in the UDI-6 score could have been due to the additional physical therapy sessions. The other change in participant two's progress note data was the increase in her ability to hold a PFM contraction. From the initial progress note a 20 second contraction was recorded and at the final note a 30 second contraction was recorded; showing an increase in strength and control over an 8-week intervention (Chmielewska et al., 2019; Hein et al., 2020). Participant two did not complete as many Pure Barre classes that fit the criteria of the study, but she did complete Pure Barre Go classes. Pure Barre Go is an online streaming service from Pure Barre, all Pure Barre classes focus on increasing the strength and endurance of the PFM and core musculature. Participant two's adherence to her physical therapy sessions and the addition of a Pure Barre exercise allowed her to see an increase in PFM endurance (Brooks et al., 2005; Kim et al., 2011).

5.3 Self-Efficacy

Changes in self-efficacy are typically tracked through the usage of self-reported questionnaires that assess a person's feelings on their ability to complete a specific task. Both participants of this study were tasked to complete two self-efficacy questionnaires that assessed their feelings on their ability to control their SUI during different tasks and how they felt SUI impacted their daily life. An increase in self-efficacy for the first questionnaire was determined based on how the participants reported how capable they felt at controlling their SUI by answering the questions on a scale of totally uncapable (1) to totally capable (7). The ICIQ-UI questionnaire indicated an increase in self-efficacy if the overall score of questions 3-5 decreased at each assessment and if they indicated fewer times they experience leakage.

5.3.1 Participant 1 Self-Efficacy

Participant 1 showed increases in both self-efficacy assessments over the course of the 8 weeks. For the first set of questions at the end of the 8 weeks all answers had increased to a feeling of 'mostly capable' (6) in controlling SUI. Question 4 of the assessment, how capable do you feel you can control SUI throughout your daily tasks, showed the biggest increase in self-reported scores. The first assessment a score of 2 was reported for question 4 – mostly uncapable and by the final assessment a score of 6 was reported for question 4 – mostly capable. She also reported that she felt that she was feeling much better about controlling her SUI and thought that Pure Barre was helping.

The second self-efficacy assessment was the completion of the ICIQ-UI short form. This form was comprised of two elements. The first set of questions were answered on a scale and the last question assessed times at which a person experiences leakage. Participant one showed no change in the first three questions at each time period. The only difference was the reported score at week 4 on question 6. The question asked the participant to report how much leakage interfered with everyday life. On week 4 participant one reported a 2 instead of a 3 as was reported at the initial and final assessments. She could have reported a two at the week four assessment because the previous week she had just bumped to taking three Pure Barre classes within a week. Perhaps she was feeling extra motivated at the time of answering the questions. The limitation to this questionnaire was being able to understand the differences between a 2 and a 3 on the scoring scale. It is hard to say how meaningful the difference in answers truly is but it does show the way a person's self-efficacy could be impacted by different things that happen within a day (Olmedilla et al., 2018; Wulf & Lewthwaite, 2016).

The final question, however, did show a decrease in scenarios when participant one would experience leakage. At the final week eight assessment she went from four scenarios of when urine would leak to only one scenario. These findings seem to be consistent with findings of a research group out of Poland who looked at the use of Pilates to treat SUI over the course of 8 weeks. One of the measurements used was the ICIQ-UI short form. The group found significant changes in the results of the ICIQ-UI form in the Pilates group during the eight weeks (Chmielewska et al., 2019). The participants from that study did have a higher average starting ICIQ-UI score compared to the two participants of this study, so while the changes in participant one's assessments are small, they are still consistent with current research.

5.3.2 Participant 2 Self-Efficacy

Participant 2 showed an increase in reported scores on two questions in the first self-efficacy assessment. No changes were reported in the other two questions. The self-efficacy data reported by participant 2 were thought to be possibly due to the life circumstances that caused challenges in participating in the study. Participant two's family became ill with the flu during the study and had some family emergencies that caused them to have to go to Texas. These other factors could have greatly contributed to the lack of change in feelings of self-efficacy. Current research shows that external factors and the way they are perceived can have effects on self-efficacy. A couple of the factors that can have an impact on self-efficacy is low motivation and family input (Olmedilla et al., 2018; Weinberg et al., 2016). Participant two expressed that it was hard to get back to Pure Barre classes after her family became ill. She felt it was harder to leave her children to make time for the Pure Barre class. Having the pressures of being a mom and being there for her family could have negatively impacted her motivation to complete the Pure Barre classes and could have had an impact on her self-efficacy as she progressed through the study (D. K. C. Chan & Hagger, 2012; Weinberg et al., 2016).

Participant 2 did report a steady decline in leakage over the eight weeks when answering the ICIQ-UI form. At week eight no urine leakage was reported for questions three and four. Participant two did report leakage for two instances for question 6 though. The difference in participant two's reporting for the two sections on the ICIQ-UI form was interesting. Further information was needed to understand why for two questions she reported no leakage and for the last she reported instances of leakage. It is possible that she did not understand the question on the form. For future research it would be beneficial to follow up with interviews with participants to clarify certain answers to gain a better understanding of self-efficacy and ensure the participant understands what is being asked.

5.4 Pure Barre Sessions

5.4.1 Participant 1 Pure Barre Sessions

Participant one started with about two classes a week but very quickly bumped up to three classes a week and sustained three classes a week for the duration of the study. She was very diligent to schedule out her classes at the beginning of the study and be sure to attend them. She was able to begin to see and feel the positive effects of consistent exercise. Her physical therapy scores showed the benefit of consistent exercise on PFM endurance as she was able to hold a longer contraction at the end of the 8-weeks. For many exercise programs improvements in strength and control of the

musculature can be seen during different performance tasks (Brooks et al., 2005; McArdle et al., 2015). For participant one her performance tasks were the completion of each measure of the progress note testing strength, endurance, and control while experiencing increases in almost each measure. Once the eight weeks were completed, she did end up purchasing a membership to Pure Barre to be able to continue with classes. It is hypothesized that as participant one continues on with physical activity, she will continue to see the benefits of exercise. Participant one did not partake in any other exercise outside of the Pure Barre classes throughout the eight weeks either. Due to only participating in Pure Barre she did not fill out the physical activity log, so we do not have solid data showing for any other potential exercise. Since participant one did not do any other exercise, it could help in understanding the potential benefit adding Pure Barre to physical therapy treatment could have. The adherence to the program displayed by participant one could be affected by her enjoyment in partaking in the Pure Barre classes rather than seeing them as a burden.

5.4.2 Participant 2 Pure Barre Sessions

Participant two completed a total of 12 Pure Barre classes. For the first two weeks participant two completed two classes a week, followed by week three of zero completed classes, which was about the time of her having the flu. Weeks 4-6 classes were completed then the participant went to Texas and failed to complete classes during weeks 7-8. Consistency is important, especially when it comes to working muscles (Brooks et al., 2005). Perhaps the inconsistency in Pure Barre sessions coupled with physical therapy contributed to a lack of changes in certain progress note scores. It is impossible to say however without having any statistically significant data.

Participant two shared, “having two kids made getting places more difficult than when she just had one. Pure Barre seemed to be one of those things I was having a hard time getting to”. The motivation to complete Pure Barre classes for participant two was different from participant one and could have been a contributing factor to a lesser amount of total completed classes. While participant two didn’t complete as many Pure Barre sessions she did complete other low intensity exercise throughout the duration of the study. Most of the workouts were either less than 30 minutes or 30-45 minutes long. Participant two did note however that the exercise bouts indicated as ‘other’ on the physical activity log were Pure Barre Go classes. These were classes taken from the streaming service offered by Pure Barre. Those sessions completed did not count towards her Pure Barre classes required for participant in the study. We specified that the only approved Pure Barre classes for the study were those physically held at the Coeur d’Alene, Idaho Pure Barre studio. It was worth noting however that she did continue to do Pure Barre from home.

5.5 Benefit of Physical Activity

The changes in reported scores for both participants one and two could have also been attributed to the inclusion of consistent planned exercise. Participant one had not been engaging in consistent planned exercises before entering the study. By adding planned exercise to participant one's daily routine we expected to see skeletal muscle adaptations to exercise (Brooks et al., 2005; Kim et al., 2011; Nygaard & Shaw, 2016). Participant one displayed the skeletal muscle changes in the endurance test of the progress note.

Participant two also engaged in consistent planned exercise throughout the study. She did not complete the Pure Barre training program that was outlined for this study, but she did still engage in planned physical activity throughout the intervention. She also displayed skeletal muscle adaptations to exercise as well during her reported endurance test scores (Brooks et al., 2005; Kim et al., 2011; Nygaard & Shaw, 2016). Both participants showed increase in neuromuscular control of the pelvic floor and core muscles in their abilities to hold a longer contraction. Participant one's greater magnitude of change in her endurance test score showed expected increases in muscular strength and control with the addition of planned exercise from a no participation in planned exercise. Participant one had been engaging in planned exercise even before the study, therefore we did not expect as large of an increase in her reported scores since she had already undergone skeletal muscle adaptations to exercise. Her scores could have reflected a greater ability in her mind-body awareness and ability to contract the correct muscles (Brooks et al., 2005; Kim et al., 2011)

5.6 Participant Connections and Differences

Both participants shared many similarities throughout the study. However, they both had very different journeys in their pursuit of treatment during the study. Participant one demonstrated a better adherence to the Pure Barre intervention while following her physical therapy plan of care. Adherence to a program whether it be physical therapy or physical activity is known to increase and maintain self-efficacy (Sacomori et al., 2013; Wesch et al., 2012). Understanding self-efficacy and how a person is feeling throughout treatment can help avoid setbacks in treatment outcomes (D. K. Chan et al., 2009; Duda et al., 2016). Participant two could have been struggling with self-efficacy around the time she became inconsistent with Pure Barre classes, between weeks 3-4. It was around the time she reported a 5 out of 10 on how severely she felt that SUI impacted her daily life. Looking at the same time points for participant one who reported a two on overall severity of SUI impacting her daily life,

and she had just increased her Pure Barre session frequency to three classes a week. It is important, especially for physical therapists to be able to monitor and understand how patients are feeling to try and avoid negative self-efficacy as best as possible.

Anecdotally, participant one had stated that Pure Barre had become her happy place and that she had started to feel so strong from the workouts. Adding in a specific targeted exercise program could be very useful for women struggling with SUI. It could allow them to focus on specific muscle groups and the mind-body connection allowing them to feel like they have better control over their bodies. Establishing the mind-body connection while also building strength in the specific musculature could be helpful to women as they progress through their SUI physical therapy treatment. An establishment like Pure Barre also creates a way for women who were feeling social anxiety because of their SUI to become social again. By the end of the eight weeks, participant one had started to make friends through the classes attended at Pure Barre and even felt comfortable enough at Pure Barre to refer a couple friends to try out the Pure Barre workout. Participant two had really drawn back from the Pure Barre, she had not experienced the same socialization compared to participant one.

5.7 Limitations to the Study

The inclusion criteria made recruiting participants very difficult. Many potential participants that were interviewed failed to meet all inclusion criteria. Another limitation to the study was not being directly involved with the physical therapy clinic. Recruitment relied on referrals from the staff at the physical therapy clinic. Lapses in communication between the clinic and researchers also made participant recruitment difficult. The proximity of the Pure Barre studio to the physical therapy clinic was a limiting factor for participants as well, it was difficult for participants to make it to the studio. Recruiting participants to complete the study was also made difficult due to COVID-19. People were less inclined to partake in group activities, specifically a group exercise class like Pure Barre. The sample size was a limiting factor to this study as well. A bigger sample size, control group, and a comparison to a group that combines the Pure Barre exercise and physical therapy would have been better to gain a better understanding on if the data reported for the two participants holds any significance.

5.8 Direction for Future Research

Now that we have data for two case studies it is important to complete this study on a larger scale. A future study containing both a Pure Barre intervention group and a control group will allow for more data to be collected and for statistics to be run to determine if the addition of a workout like

Pure Barre has a true impact on self-efficacy and physical therapy outcomes or if just physical activity in general has the same impacts. Continuing this research will be important especially for understanding ways to keep patient self-efficacy high and improve physical therapy treatment. The findings of both participants support the potential that there may be a benefit of adding the Pure Barre exercise program with physical therapy treatment to improve the variables in this study.

5.9 Conclusions

We were able to observe potential benefit of adding a physical activity and exercise to standard SUI physical therapy treatment. It is possible that something like Pure Barre can help to increase self-efficacy which in turn helps to increase patient adherence to the physical therapy treatment. However, just the addition of physical activity and exercise could have benefitted the participants in this study as they progressed through physical therapy. We saw that the addition of the physical activity and exercise could potentially have an impact on improving the efficiency of the physical therapy treatment as well. We also found that with future research it might be worth broadening the inclusion criteria to assist with gaining a bigger sample size.

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Appendix A

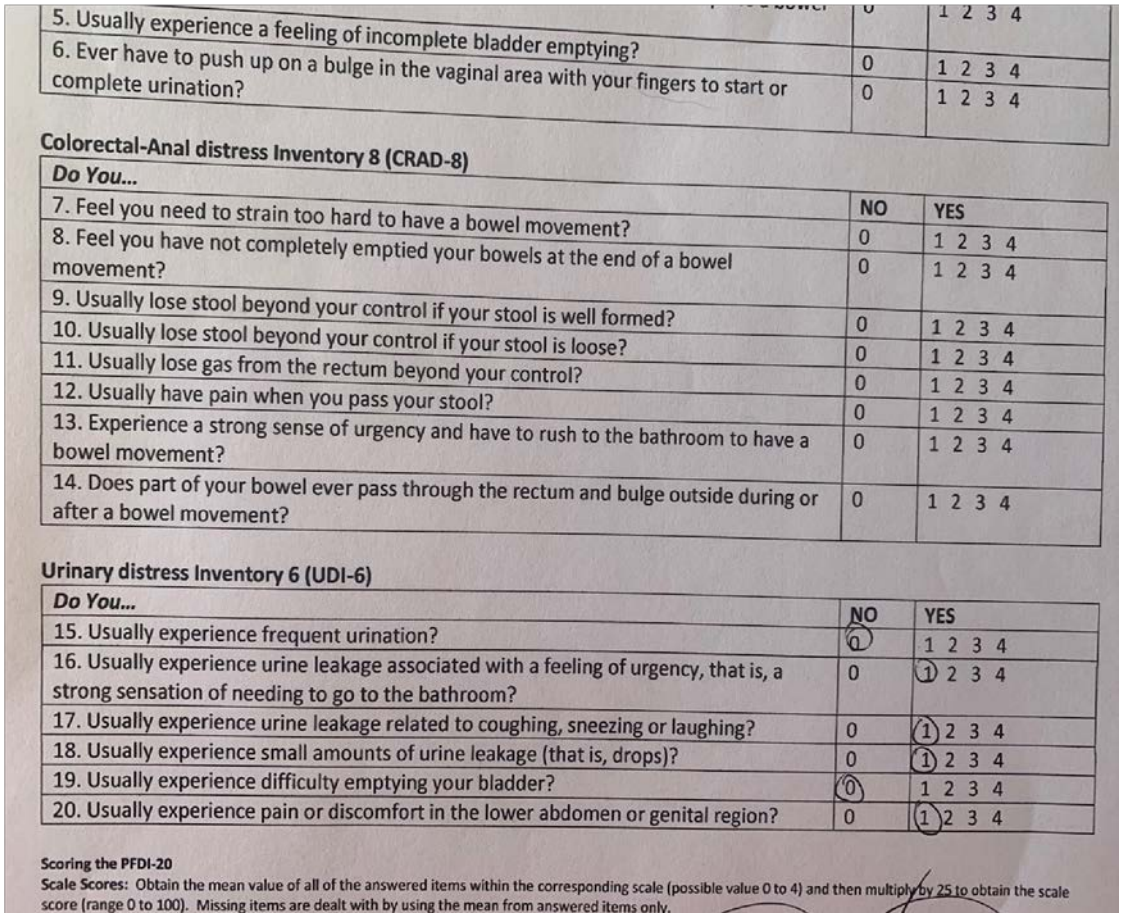
Participant Two Physical Activity Log

Participant 2 Workout Log			
Name Box	Type of Activity	Duration of Acvitiy	Estimated Intensity of Acvitity
2/18/21	Pure Barre	30-45	low
2/19/21	Other	30-45	low
2/22	Pure Barre	45 -60	moderate
2/24	Pure Barre	45 -60	moderate
2/26	Other	< 30	low
3/1	Pure Barre	45 -60	low -moderate
3/3	Pure Barre	45 -60	moderate
3/5	Other	30-45	low
3/8	Pure Barre	45 -60	moderate
3/10	Pure Barre	45 -60	low -moderate
3/12	Other	30-45	low
3/15	Pure Barre	45 -60	moderate
3/16	Yoga	< 30	low
3/17	Pure Barre	45 -60	moderate
3/20	Other	< 30	low
3/22	Pure Barre	45 -60	moderate
3/23	Other	< 30	low
3/24	Pure Barre	45 -60	moderate
3/29	Pure Barre	45 -60	moderate
3/31	Other	< 30	low
3/31	Pure Barre	45 -60	moderate
4/6	Other	30-45	low
4/7	Other	< 30	low -moderate
4/9	Other	< 30	low
4/10	Other	< 30	low
4/12	Other	30-45	low -moderate
4/15	Other	< 30	low
4/28	Pure Barre	45 -60	moderate
4/30	Pure Barre	45 -60	low -moderate

Appendix B-F

Participant One's UDI-6 and ICIQ-UI Scores

Participant One UDI-6 Assessment 1



5. Usually experience a feeling of incomplete bladder emptying?	0	1 2 3 4
6. Ever have to push up on a bulge in the vaginal area with your fingers to start or complete urination?	0	1 2 3 4

Colorectal-Anal distress Inventory 8 (CRAD-8)

Do You...	NO	YES
7. Feel you need to strain too hard to have a bowel movement?	0	1 2 3 4
8. Feel you have not completely emptied your bowels at the end of a bowel movement?	0	1 2 3 4
9. Usually lose stool beyond your control if your stool is well formed?	0	1 2 3 4
10. Usually lose stool beyond your control if your stool is loose?	0	1 2 3 4
11. Usually lose gas from the rectum beyond your control?	0	1 2 3 4
12. Usually have pain when you pass your stool?	0	1 2 3 4
13. Experience a strong sense of urgency and have to rush to the bathroom to have a bowel movement?	0	1 2 3 4
14. Does part of your bowel ever pass through the rectum and bulge outside during or after a bowel movement?	0	1 2 3 4

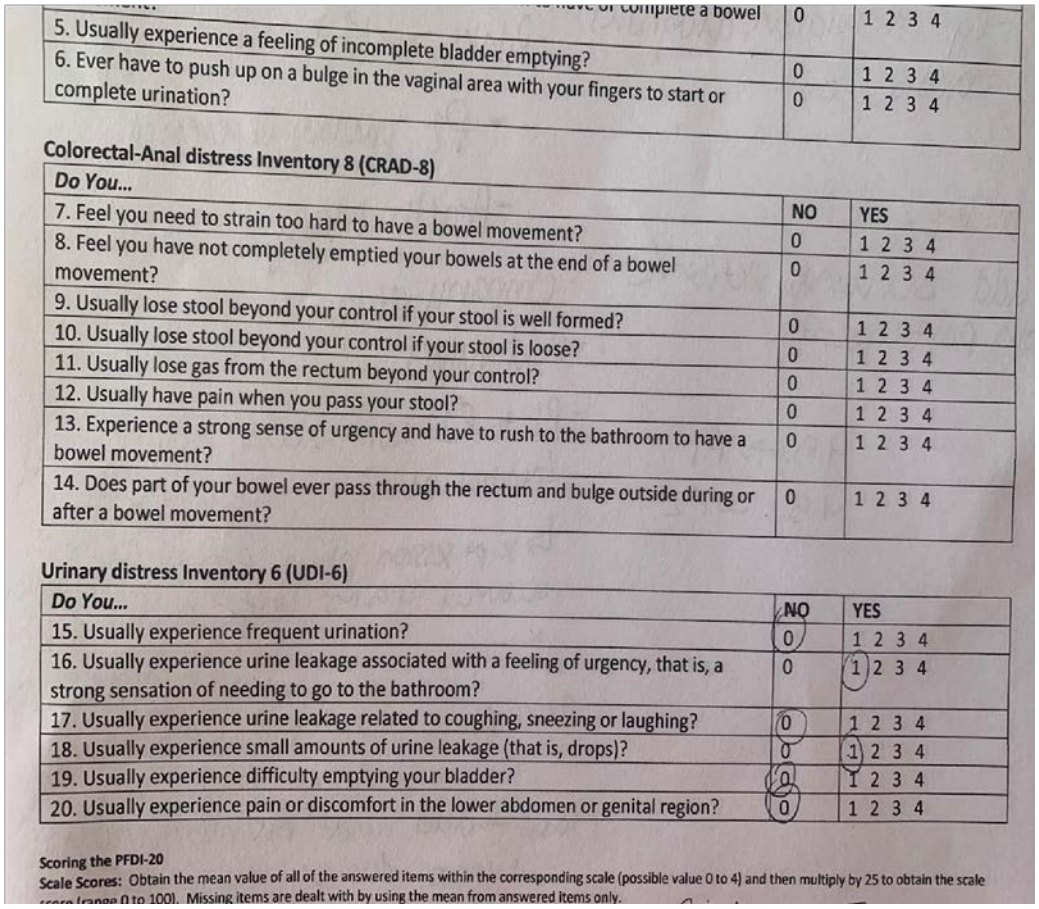
Urinary distress Inventory 6 (UDI-6)

Do You...	NO	YES
15. Usually experience frequent urination?	(0)	1 2 3 4
16. Usually experience urine leakage associated with a feeling of urgency, that is, a strong sensation of needing to go to the bathroom?	0	(1) 2 3 4
17. Usually experience urine leakage related to coughing, sneezing or laughing?	0	(1) 2 3 4
18. Usually experience small amounts of urine leakage (that is, drops)?	0	(1) 2 3 4
19. Usually experience difficulty emptying your bladder?	(0)	1 2 3 4
20. Usually experience pain or discomfort in the lower abdomen or genital region?	0	(1) 2 3 4

Scoring the PFDI-20

Scale Scores: Obtain the mean value of all of the answered items within the corresponding scale (possible value 0 to 4) and then multiply by 25 to obtain the scale score (range 0 to 100). Missing items are dealt with by using the mean from answered items only.

Participant 1 UDI-6 Assessment 2



...complete a bowel	0	1 2 3 4
5. Usually experience a feeling of incomplete bladder emptying?	0	1 2 3 4
6. Ever have to push up on a bulge in the vaginal area with your fingers to start or complete urination?	0	1 2 3 4

Colorectal-Anal distress Inventory 8 (CRAD-8)

Do You...	NO	YES
7. Feel you need to strain too hard to have a bowel movement?	0	1 2 3 4
8. Feel you have not completely emptied your bowels at the end of a bowel movement?	0	1 2 3 4
9. Usually lose stool beyond your control if your stool is well formed?	0	1 2 3 4
10. Usually lose stool beyond your control if your stool is loose?	0	1 2 3 4
11. Usually lose gas from the rectum beyond your control?	0	1 2 3 4
12. Usually have pain when you pass your stool?	0	1 2 3 4
13. Experience a strong sense of urgency and have to rush to the bathroom to have a bowel movement?	0	1 2 3 4
14. Does part of your bowel ever pass through the rectum and bulge outside during or after a bowel movement?	0	1 2 3 4

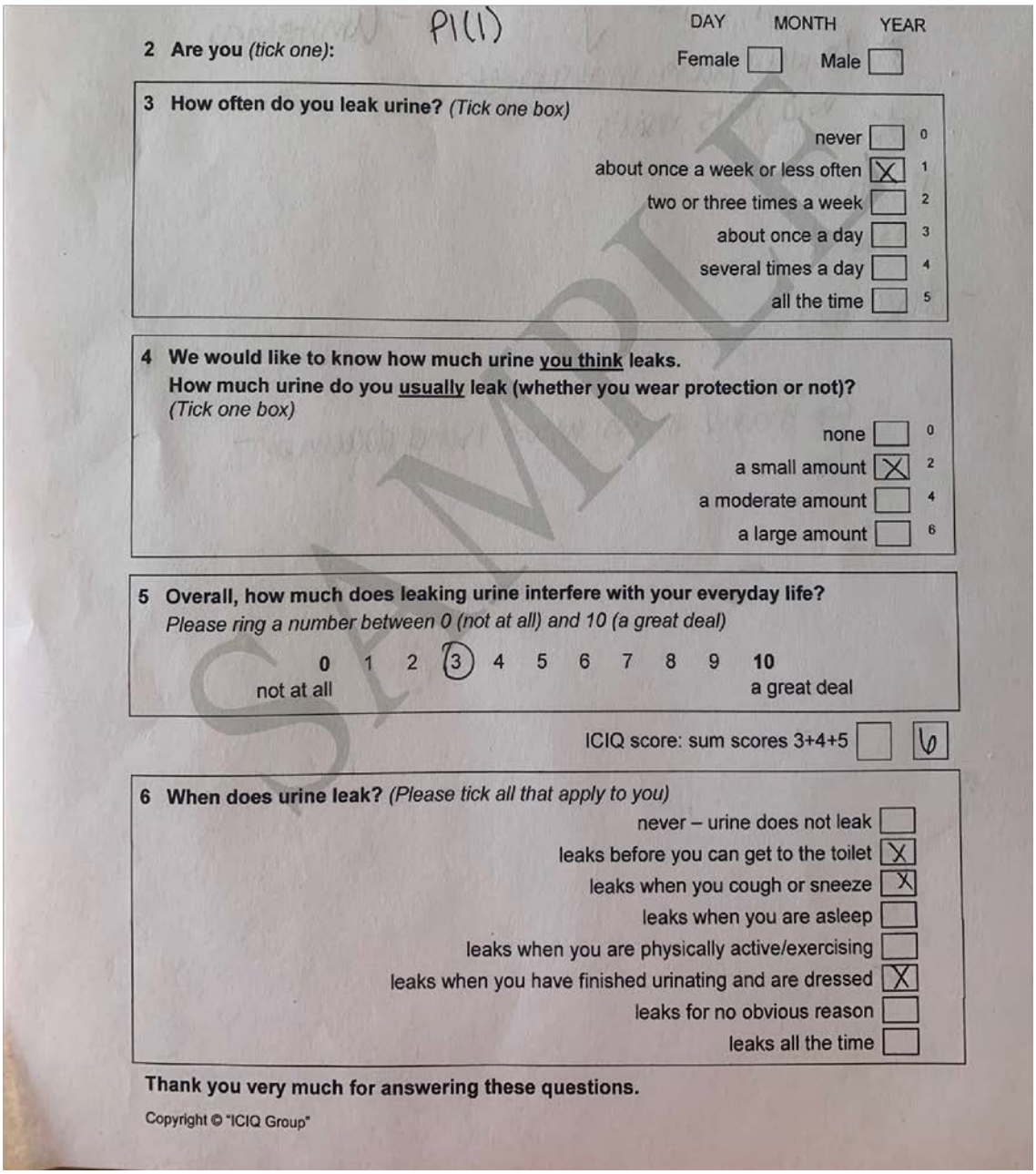
Urinary distress Inventory 6 (UDI-6)

Do You...	NO	YES
15. Usually experience frequent urination?	0	1 2 3 4
16. Usually experience urine leakage associated with a feeling of urgency, that is, a strong sensation of needing to go to the bathroom?	0	1 2 3 4
17. Usually experience urine leakage related to coughing, sneezing or laughing?	0	1 2 3 4
18. Usually experience small amounts of urine leakage (that is, drops)?	0	1 2 3 4
19. Usually experience difficulty emptying your bladder?	0	1 2 3 4
20. Usually experience pain or discomfort in the lower abdomen or genital region?	0	1 2 3 4

Scoring the PFDI-20

Scale Scores: Obtain the mean value of all of the answered items within the corresponding scale (possible value 0 to 4) and then multiply by 25 to obtain the scale score (range 0 to 100). Missing items are dealt with by using the mean from answered items only.

Participant 1 ICIQ-UI Assessment 1



P1(1)

DAY MONTH YEAR

2 Are you *(tick one)*: Female ☐ Male ☐

3 How often do you leak urine? *(Tick one box)*

never ☐	0
about once a week or less often ☒	1
two or three times a week ☐	2
about once a day ☐	3
several times a day ☐	4
all the time ☐	5

4 We would like to know how much urine you think leaks.
How much urine do you usually leak (whether you wear protection or not)?
(Tick one box)

none ☐	0
a small amount ☒	2
a moderate amount ☐	4
a large amount ☐	6

5 Overall, how much does leaking urine interfere with your everyday life?
Please ring a number between 0 (not at all) and 10 (a great deal)

0 1 2 (3) 4 5 6 7 8 9 **10**
not at all — a great deal

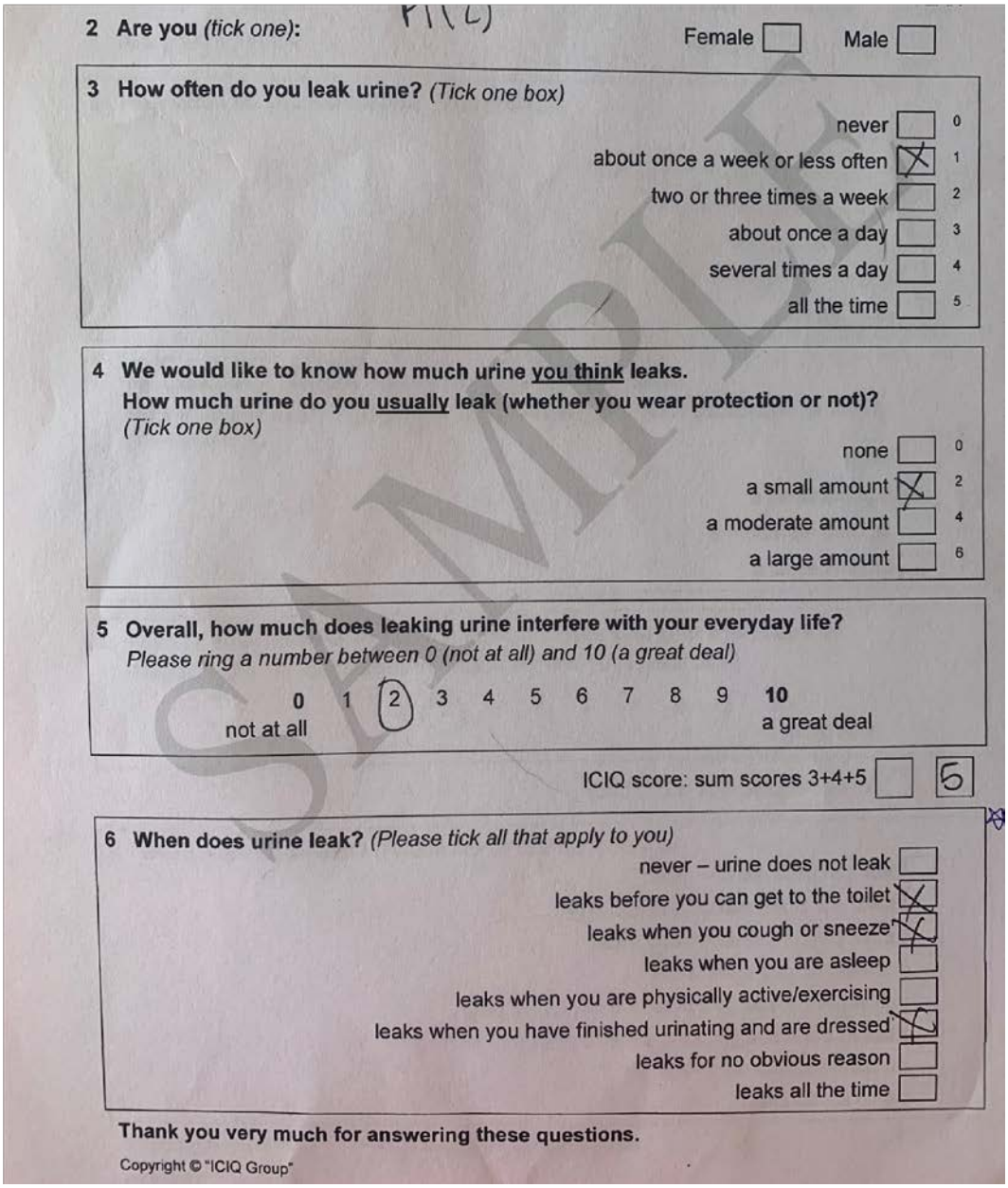
ICIQ score: sum scores 3+4+5 ☐ 6

6 When does urine leak? *(Please tick all that apply to you)*

never – urine does not leak	☐
leaks before you can get to the toilet	☒
leaks when you cough or sneeze	☒
leaks when you are asleep	☐
leaks when you are physically active/exercising	☐
leaks when you have finished urinating and are dressed	☒
leaks for no obvious reason	☐
leaks all the time	☐

Thank you very much for answering these questions.

Participant 1 ICIQ-UI Assessment 2



2 **Are you** *(tick one)*: P1(2) Female ☐ Male ☐

3 **How often do you leak urine?** *(Tick one box)*

never ☐	0
about once a week or less often ☒	1
two or three times a week ☐	2
about once a day ☐	3
several times a day ☐	4
all the time ☐	5

4 **We would like to know how much urine <u>you think</u> leaks.**
How much urine do you <u>usually</u> leak (whether you wear protection or not)?
(Tick one box)

none ☐	0
a small amount ☒	2
a moderate amount ☐	4
a large amount ☐	6

5 **Overall, how much does leaking urine interfere with your everyday life?**
Please ring a number between 0 (not at all) and 10 (a great deal)

0 1 (2) 3 4 5 6 7 8 9 **10**
not at all — a great deal

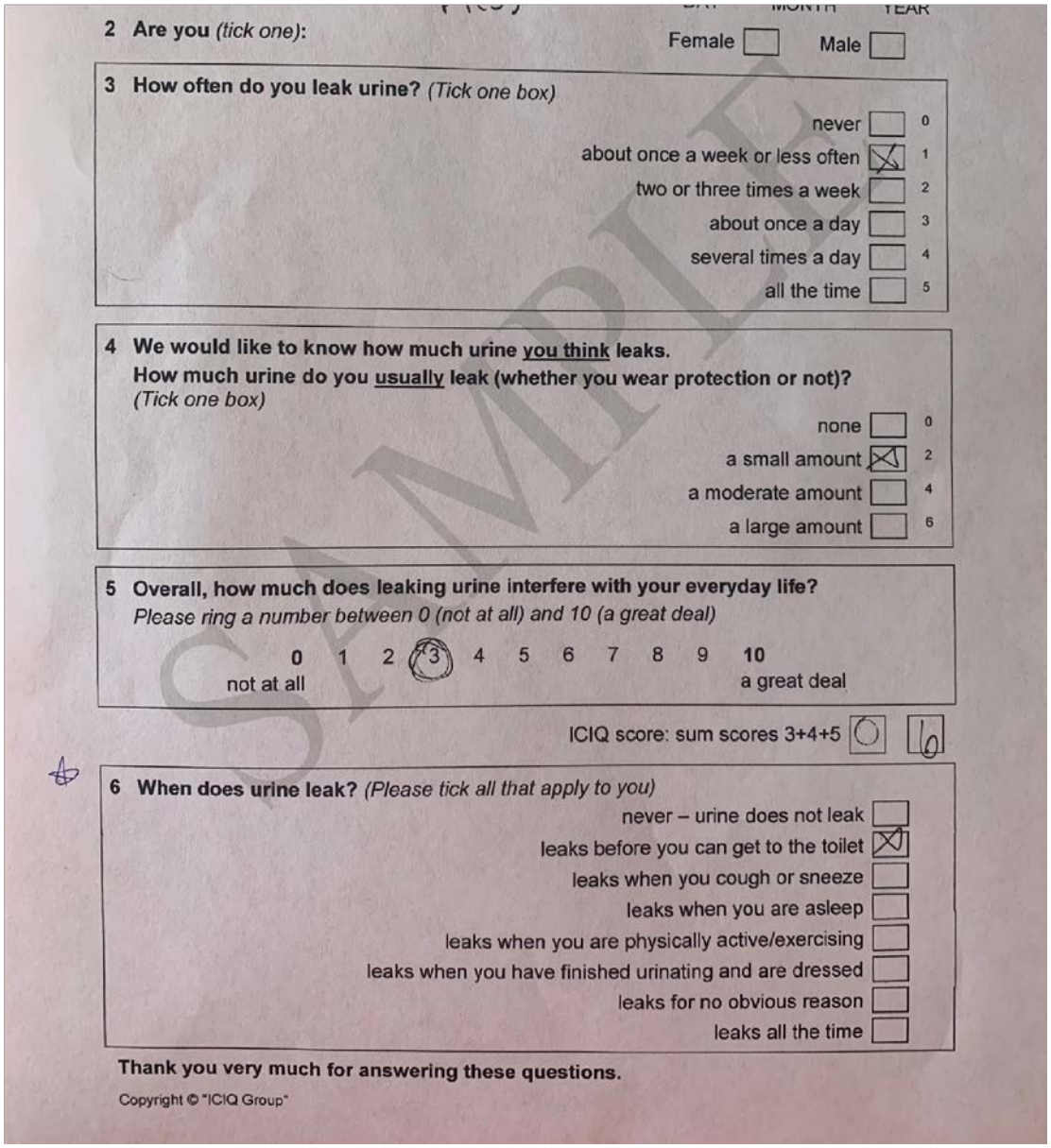
ICIQ score: sum scores 3+4+5 ☐ 5

6 **When does urine leak?** *(Please tick all that apply to you)*

never – urine does not leak	☐
leaks before you can get to the toilet	☒
leaks when you cough or sneeze	☒
leaks when you are asleep	☐
leaks when you are physically active/exercising	☐
leaks when you have finished urinating and are dressed	☒
leaks for no obvious reason	☐
leaks all the time	☐

Thank you very much for answering these questions.

Participant 1 ICIQ-UI Assessment 3



DAY MONTH YEAR

2 **Are you** *(tick one)*: Female ☐ Male ☐

3 **How often do you leak urine?** *(Tick one box)*

never ☐	0
about once a week or less often ☒	1
two or three times a week ☐	2
about once a day ☐	3
several times a day ☐	4
all the time ☐	5

4 **We would like to know how much urine <u>you think</u> leaks.**
How much urine do you <u>usually</u> leak (whether you wear protection or not)?
(Tick one box)

none ☐	0
a small amount ☒	2
a moderate amount ☐	4
a large amount ☐	6

5 **Overall, how much does leaking urine interfere with your everyday life?**
Please ring a number between 0 (not at all) and 10 (a great deal)

0 1 2 (3) 4 5 6 7 8 9 **10**
not at all a great deal

ICIQ score: sum scores 3+4+5 [0] [6]

6 **When does urine leak?** *(Please tick all that apply to you)*

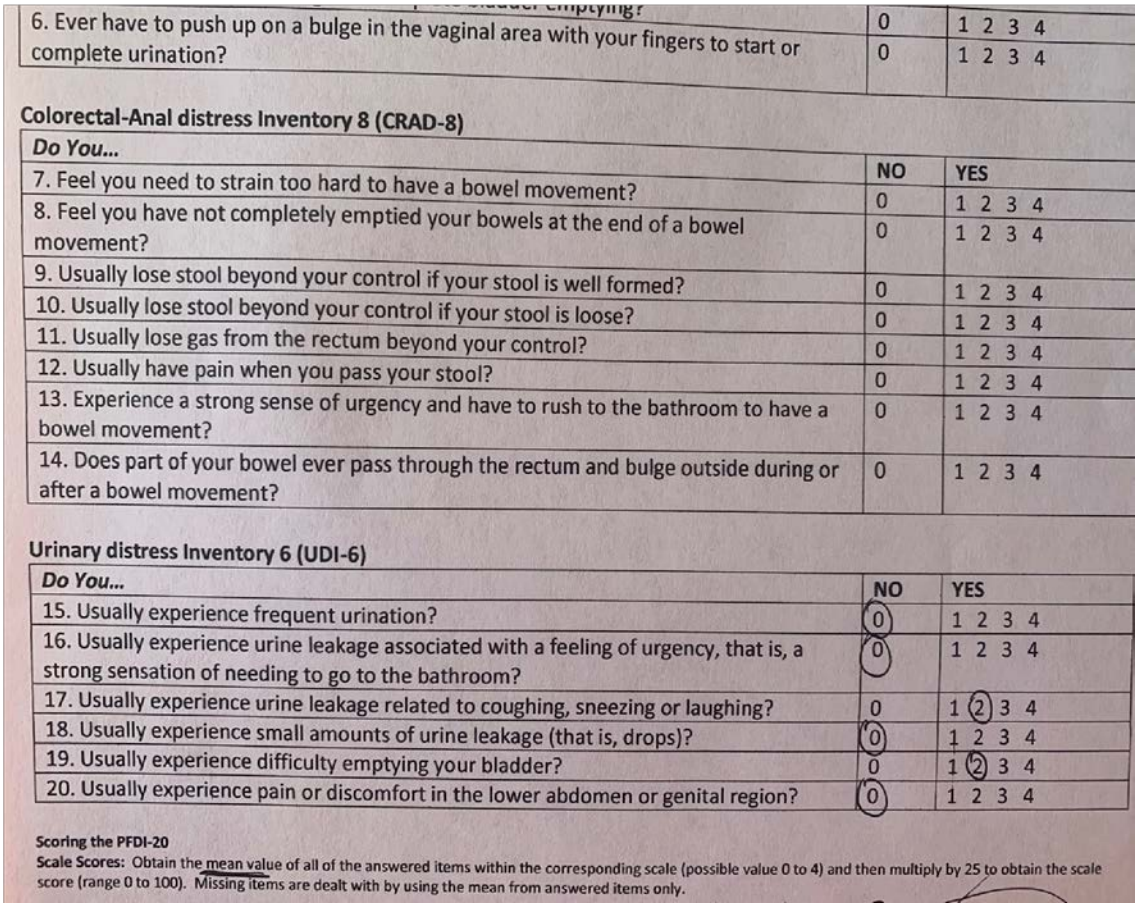
never – urine does not leak ☐	
leaks before you can get to the toilet ☒	
leaks when you cough or sneeze ☐	
leaks when you are asleep ☐	
leaks when you are physically active/exercising ☐	
leaks when you have finished urinating and are dressed ☐	
leaks for no obvious reason ☐	
leaks all the time ☐	

Thank you very much for answering these questions.

Appendix G-K

Participant 2 UDI-6 and ICIQ-UI Assessments

Participant 2 UDI-6 Assessment 1



6. Ever have to push up on a bulge in the vaginal area with your fingers to start or complete urination?	0 0	1 2 3 4 1 2 3 4

Colorectal-Anal distress Inventory 8 (CRAD-8)

Do You...	NO	YES
7. Feel you need to strain too hard to have a bowel movement?	0	1 2 3 4
8. Feel you have not completely emptied your bowels at the end of a bowel movement?	0	1 2 3 4
9. Usually lose stool beyond your control if your stool is well formed?	0	1 2 3 4
10. Usually lose stool beyond your control if your stool is loose?	0	1 2 3 4
11. Usually lose gas from the rectum beyond your control?	0	1 2 3 4
12. Usually have pain when you pass your stool?	0	1 2 3 4
13. Experience a strong sense of urgency and have to rush to the bathroom to have a bowel movement?	0	1 2 3 4
14. Does part of your bowel ever pass through the rectum and bulge outside during or after a bowel movement?	0	1 2 3 4

Urinary distress Inventory 6 (UDI-6)

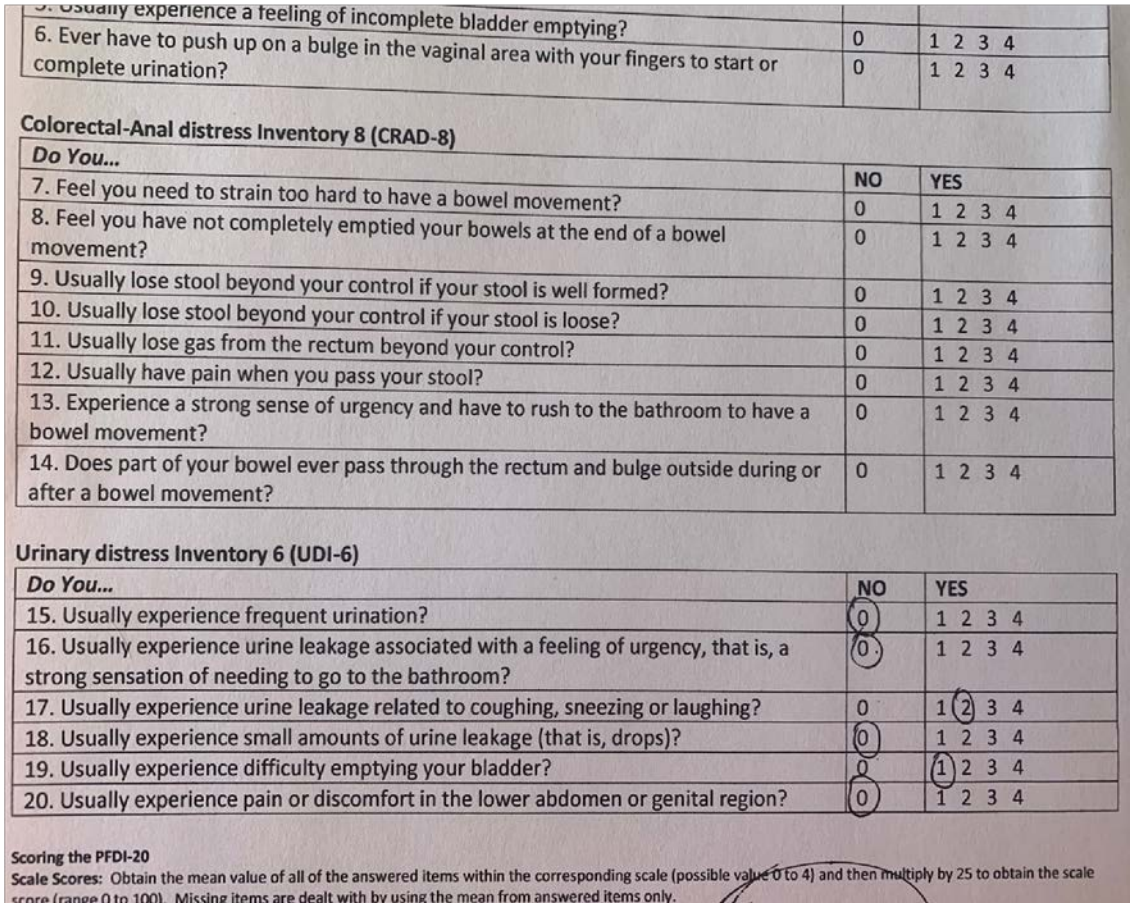
Do You...	NO	YES
15. Usually experience frequent urination?	(0)	1 2 3 4
16. Usually experience urine leakage associated with a feeling of urgency, that is, a strong sensation of needing to go to the bathroom?	(0)	1 2 3 4
17. Usually experience urine leakage related to coughing, sneezing or laughing?	0	1 (2) 3 4
18. Usually experience small amounts of urine leakage (that is, drops)?	(0)	1 2 3 4
19. Usually experience difficulty emptying your bladder?	0	1 (2) 3 4
20. Usually experience pain or discomfort in the lower abdomen or genital region?	(0)	1 2 3 4

Scoring the PFDI-20

Scale Scores: Obtain the mean value of all of the answered items within the corresponding scale (possible value 0 to 4) and then multiply by 25 to obtain the scale score (range 0 to 100). Missing items are dealt with by using the mean from answered items only.

-

Participant 2 UDI 6 Assessment 2



5. Usually experience a feeling of incomplete bladder emptying?	0	1 2 3 4
6. Ever have to push up on a bulge in the vaginal area with your fingers to start or complete urination?	0	1 2 3 4

Colorectal-Anal distress Inventory 8 (CRAD-8)

Do You...	NO	YES
7. Feel you need to strain too hard to have a bowel movement?	0	1 2 3 4
8. Feel you have not completely emptied your bowels at the end of a bowel movement?	0	1 2 3 4
9. Usually lose stool beyond your control if your stool is well formed?	0	1 2 3 4
10. Usually lose stool beyond your control if your stool is loose?	0	1 2 3 4
11. Usually lose gas from the rectum beyond your control?	0	1 2 3 4
12. Usually have pain when you pass your stool?	0	1 2 3 4
13. Experience a strong sense of urgency and have to rush to the bathroom to have a bowel movement?	0	1 2 3 4
14. Does part of your bowel ever pass through the rectum and bulge outside during or after a bowel movement?	0	1 2 3 4

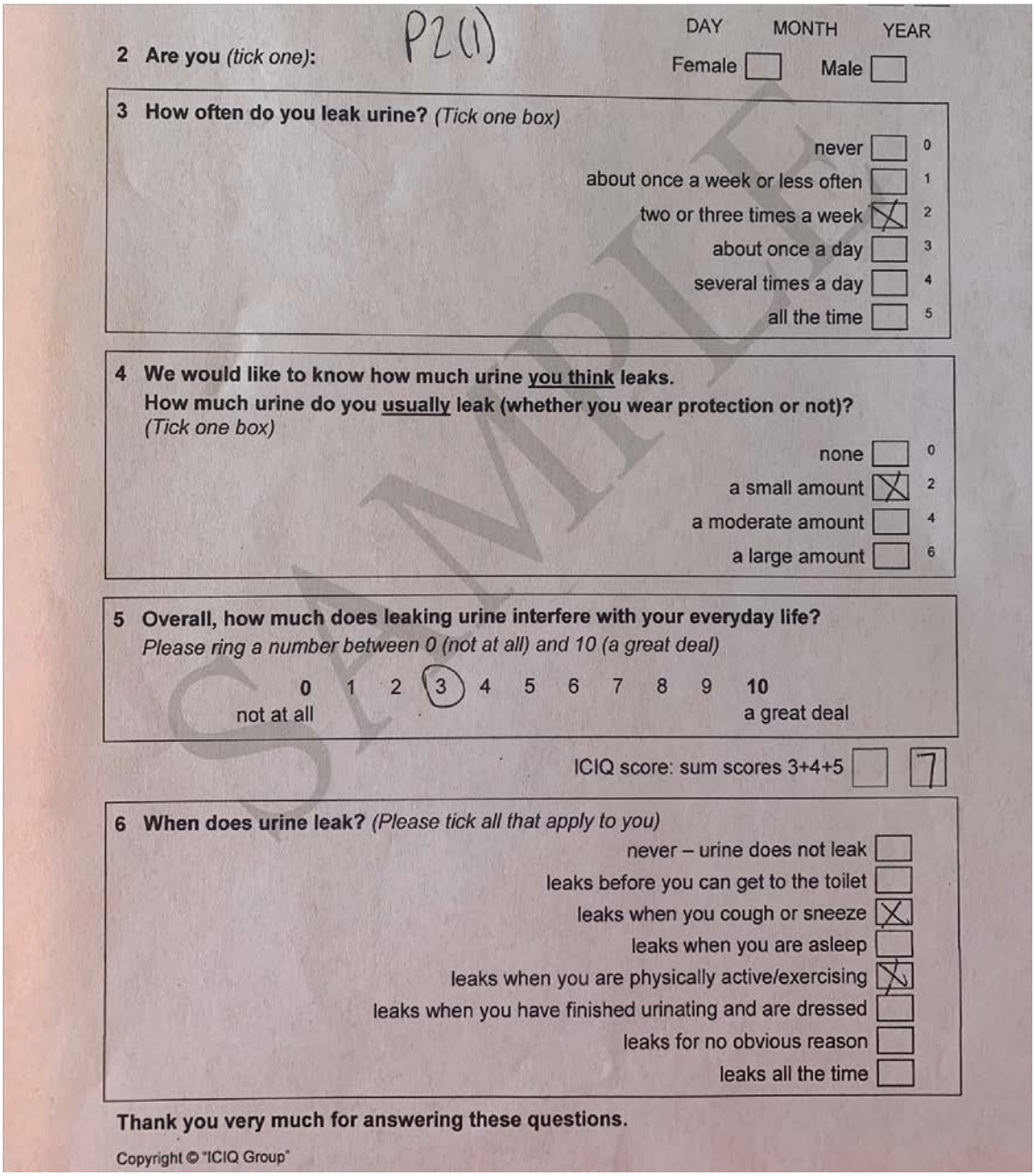
Urinary distress Inventory 6 (UDI-6)

Do You...	NO	YES
15. Usually experience frequent urination?	(0)	1 2 3 4
16. Usually experience urine leakage associated with a feeling of urgency, that is, a strong sensation of needing to go to the bathroom?	(0)	1 2 3 4
17. Usually experience urine leakage related to coughing, sneezing or laughing?	0	1 (2) 3 4
18. Usually experience small amounts of urine leakage (that is, drops)?	(0)	1 2 3 4
19. Usually experience difficulty emptying your bladder?	0	(1) 2 3 4
20. Usually experience pain or discomfort in the lower abdomen or genital region?	(0)	1 2 3 4

Scoring the PFDI-20

Scale Scores: Obtain the mean value of all of the answered items within the corresponding scale (possible value 0 to 4) and then multiply by 25 to obtain the scale score (range 0 to 100). Missing items are dealt with by using the mean from answered items only.

Participant 2 ICIQ-UI Assessment 1



P2(1)

DAY MONTH YEAR

2 Are you *(tick one)*: Female ☐ Male ☐

3 How often do you leak urine? *(Tick one box)*

never ☐	0
about once a week or less often ☐	1
two or three times a week ☒	2
about once a day ☐	3
several times a day ☐	4
all the time ☐	5

4 We would like to know how much urine <u>you think</u> leaks.
How much urine do you <u>usually</u> leak (whether you wear protection or not)?
(Tick one box)

none ☐	0
a small amount ☒	2
a moderate amount ☐	4
a large amount ☐	6

5 Overall, how much does leaking urine interfere with your everyday life?
Please ring a number between 0 (not at all) and 10 (a great deal)

0 1 2 (3) 4 5 6 7 8 9 **10**
not at all — a great deal

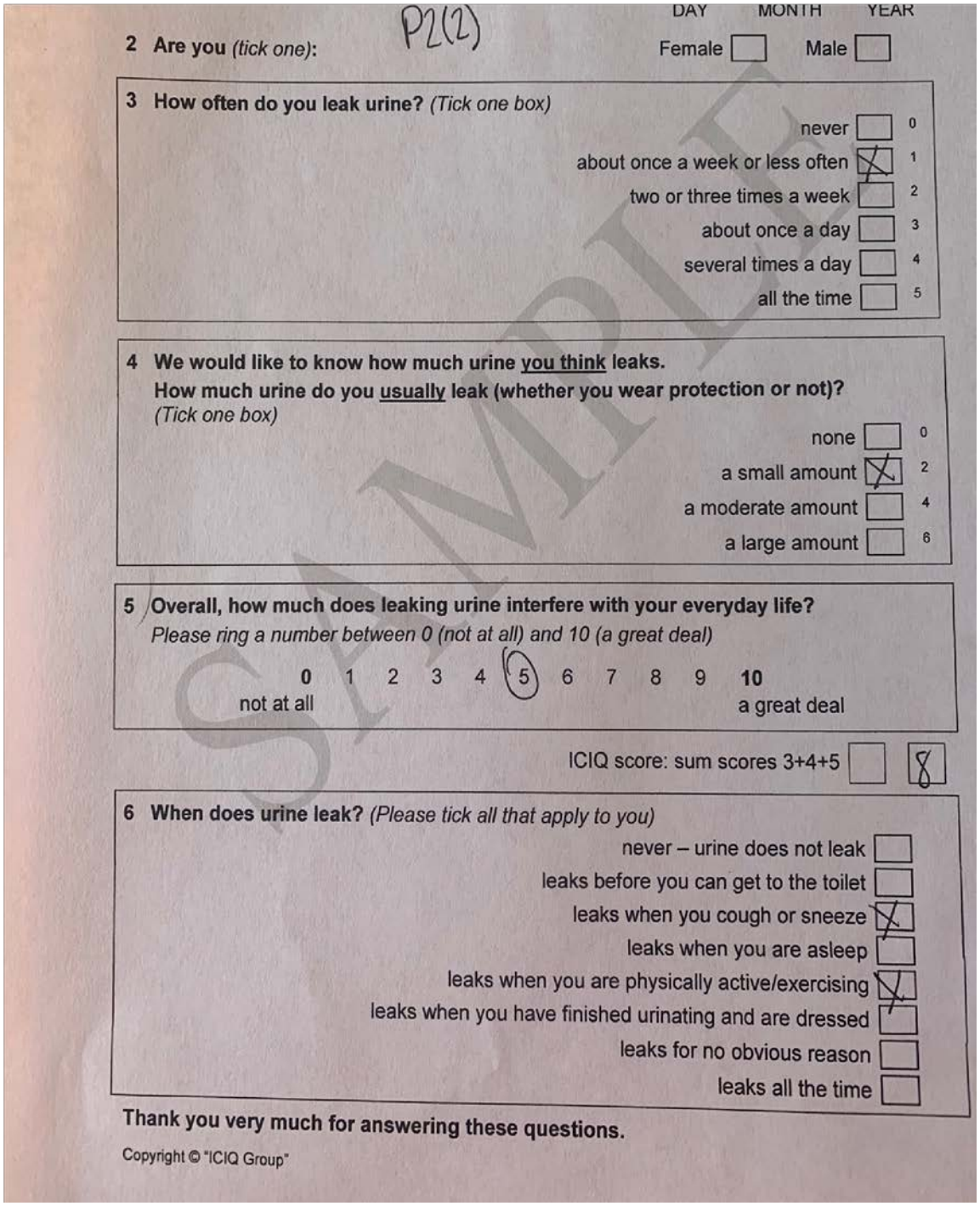
ICIQ score: sum scores 3+4+5 ☐ 7

6 When does urine leak? *(Please tick all that apply to you)*

never – urine does not leak	☐
leaks before you can get to the toilet	☐
leaks when you cough or sneeze	☒
leaks when you are asleep	☐
leaks when you are physically active/exercising	☒
leaks when you have finished urinating and are dressed	☐
leaks for no obvious reason	☐
leaks all the time	☐

Thank you very much for answering these questions.

Participant 2 ICIQ-UI Assessment 2



P2(2)

DAY MONTH YEAR

2 Are you *(tick one)*: Female ☐ Male ☐

3 How often do you leak urine? *(Tick one box)*

never ☐	0
about once a week or less often ☒	1
two or three times a week ☐	2
about once a day ☐	3
several times a day ☐	4
all the time ☐	5

4 We would like to know how much urine you think leaks.
How much urine do you usually leak (whether you wear protection or not)?
(Tick one box)

none ☐	0
a small amount ☒	2
a moderate amount ☐	4
a large amount ☐	6

5 Overall, how much does leaking urine interfere with your everyday life?
Please ring a number between 0 (not at all) and 10 (a great deal)

0 1 2 3 4 (5) 6 7 8 9 **10**
not at all a great deal

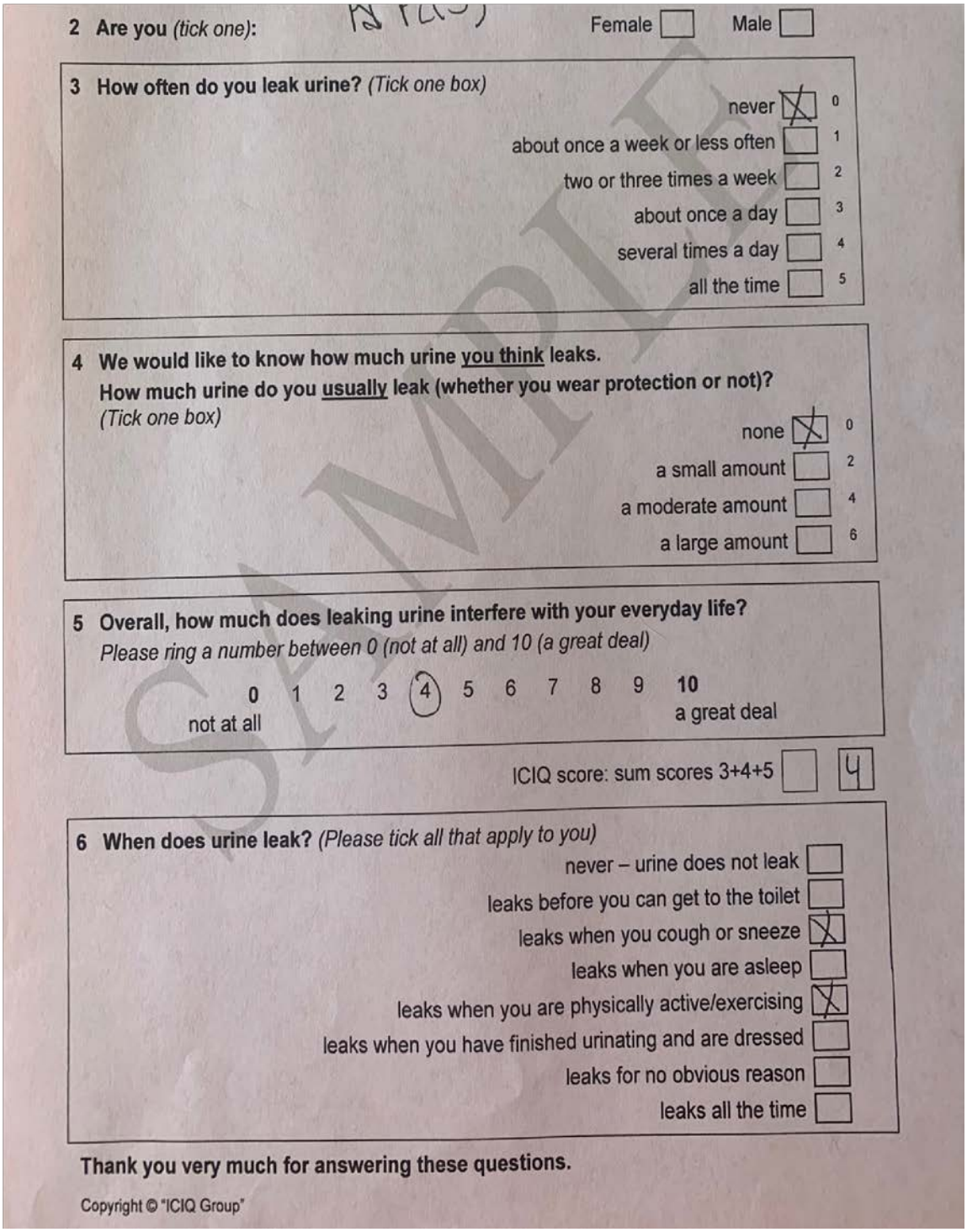
ICIQ score: sum scores 3+4+5 ☐ 8

6 When does urine leak? *(Please tick all that apply to you)*

never – urine does not leak	☐
leaks before you can get to the toilet	☐
leaks when you cough or sneeze	☒
leaks when you are asleep	☐
leaks when you are physically active/exercising	☒
leaks when you have finished urinating and are dressed	☐
leaks for no obvious reason	☐
leaks all the time	☐

Thank you very much for answering these questions.

Participant 2 ICIQ-UI Assessment 3



2 **Are you** *(tick one)*: Female ☐ Male ☐

3 **How often do you leak urine?** *(Tick one box)*

never ☒	0
about once a week or less often ☐	1
two or three times a week ☐	2
about once a day ☐	3
several times a day ☐	4
all the time ☐	5

4 **We would like to know how much urine <u>you think</u> leaks.**
How much urine do you <u>usually</u> leak (whether you wear protection or not)?
(Tick one box)

none ☒	0
a small amount ☐	2
a moderate amount ☐	4
a large amount ☐	6

5 **Overall, how much does leaking urine interfere with your everyday life?**
Please ring a number between 0 (not at all) and 10 (a great deal)

0 1 2 3 (4) 5 6 7 8 9 **10**
not at all — a great deal

ICIQ score: sum scores 3+4+5 ☐ 4

6 **When does urine leak?** *(Please tick all that apply to you)*

never – urine does not leak	☐
leaks before you can get to the toilet	☐
leaks when you cough or sneeze	☒
leaks when you are asleep	☐
leaks when you are physically active/exercising	☒
leaks when you have finished urinating and are dressed	☐
leaks for no obvious reason	☐
leaks all the time	☐

Thank you very much for answering these questions.