Percutaneous Tibial Nerve Stimulation administered through the Urgent PC Neuromodulation System

Application 1399

Applicant Submitted Protocol

Applicant:	Endotherapeutics Pty Ltd
Application To:	Medical Services Advisory Committee
For Consideration By:	Protocol Advisory Sub-Committee (PASC)

October 2015

Table of Contents

Tables, Figures and Abbreviations

List of Tables:

List of Figures:

Abbreviations and Terms

Abbreviation	Term
ARTG	Australian Register of Therapeutic Goods.
AUD	Australian Dollars.
Botox therapy	Botulinum Toxin Type A injected into the bladder wall.
GBP	British Pounds.
MBS	Medicare Benefits Schedule.
OAB	Overactive Bladder Syndrome.
PBS	The Pharmaceutical Benefits Scheme.
PTNS	Percutaneous tibial nerve stimulation administered through the Urgent PC Neuromodulation System.
UK	United Kingdom.
USD	United States Dollars.

1 TITLE OF APPLICATION

Percutaneous tibial nerve stimulation (PTNS) administered through the Urgent PC Neuromodulation System for idiopathic overactive bladder syndrome (OAB).

2 PURPOSE OF APPLICATION

The purpose of the application is to request Medicare Benefit Schedule (MBS) listing for the therapeutic intervention percutaneous tibial nerve stimulation (PTNS) for the treatment of overactive bladder syndrome (OAB).

It is proposed that this protocol should guide the assessment of the safety, effectiveness and cost-effectiveness of PTNS therapy in the requested populations to inform MSACs decision-making regarding public funding of the therapeutic procedure.

The procedure is a minimally invasive form of neuromodulation which treats and manages the symptoms of OAB. There is a strong body of clinical evidence which supports the efficacy of PTNS providing OAB sufferers with symptom relief and supports the proposition that this minimally invasive treatment option is relatively safe and associated with minimal side-effects.

OAB is a symptom complex consisting of a number of symptoms affecting urinary control. Treatments for OAB include behavioural therapies which may be combined with pharmacotherapies available on the Pharmaceutical Benefits Scheme. The treatment options available for OAB currently on the MBS are botulinum toxin type A injected into the bladder wall (hereafter 'Botox therapy') and sacral nerve stimulation; both of which are invasive surgical procedures.

The PTNS procedure is an external form of neuromodulation which treats and manages the symptoms of OAB syndrome and is not currently listed on the MBS. The current proposal is to include the minimally invasive treatment option PTNS on the MBS to provide patients who may not be suitable candidates for the surgical interventions with a treatment option that is reimbursed. The PTNS procedure is not currently listed on the MBS, nor is the procedure reimbursed via alternate means of public funding.

The treatment involves administering electrical impulses to the sacral nerve complex via the posterior tibial nerve which produce an inhibitory effect on bladder activity. This provides OAB patients with symptom relief and improved quality of life with on-going sessions.

In the clinical treatment algorithm for OAB, PTNS is a second-line treatment option for patients who have failed to respond to first-line conservative therapies and are unsuitable candidates for either Botox therapy or sacral nerve stimulation.

Percutaneous tibial nerve stimulation is recommended for patients who have undergone conservative pharmacological treatments and have either failed to respond to the medication or have not been able to cope with the side-effects of the medication. The second-line treatment for OAB currently listed on the MBS is Botox therapy. Currently where Botox therapy is not recommended, contraindicated or the requirements for offering the therapy are not satisfied, the only alternative treatment listed on the MBS is sacral nerve stimulation. However, there is a gap in the treatment algorithm for patients who are not eligible for Botox therapy and are not suitable for surgery to undergo sacral nerve stimulation.

PTNS is a therapeutic option that fills the gap in the treatment algorithm for OAB patients who are not suitable for either Botox therapy or sacral nerve stimulation. In comparison to Botox therapy and sacral nerve stimulation, PTNS is a minimally invasive procedure which does not require the patient to be admitted to hospital, nor undergo any surgical intervention. Current clinical evidence supports the proposition that PTNS is a relatively safe and effective means of managing the symptoms of OAB (Burton, Sajja & Latthe, 2012). In May of 2014 the American Urological Association updated their guidelines for OAB treatment to recommend PTNS as a third-line treatment option for OAB in a carefully selected patient population (Gormley et al, 2014). In arriving at this recommendation the American Urological Association noted that in their view the benefits of using PTNS for treating OAB outweighed the risks and/or burdens associated with the procedure in a thoughtfully-selected and counselled patient who is highly-motivated to make the required visits for treatment (Gormley et al, 2014). Therefore, the purpose of the application is to achieve MBS listing for a therapeutic procedure which adds to the treatment algorithm of OAB by providing a treatment option for patients who would otherwise be excluded by OAB treatments currently listed on the MBS. Currently the provision of PTNS by qualified clinicians is cost prohibitive to patients, thereby reducing the availability of the treatment preventing patients who would benefit from PTNS from accessing treatment.

3 POPULATION AND MEDICAL CONDITION

3.1 Description of condition

Idiopathic OAB is a clinical diagnosis which is characterised by the presence of a number of symptoms affecting urinary control. The condition is caused by a dysfunction in the mechanisms which control the storage and voiding of urine which can lead to sudden urgency to urinate, which may be difficult to suppress, and sometimes leads to the involuntary loss of urine (incontinence). In patients with idiopathic OAB the cause of the bladder dysfunction is unknown (unlike neurogenic OAB where the cause is an underlying neurological condition). A diagnosis of idiopathic OAB is made in the absence of a urinary tract infection and obvious pathology and excludes patients with symptoms related to neurological conditions such as multiple sclerosis (Gormley et al, 2014).

OAB is defined as the presence of urinary urgency with or without urgency urinary incontinence, usually accompanied by frequency and nocturia, in the absence of urinary tract infection or other obvious pathology. OAB may be comprised of the following symptoms:

- Urinary urgency is the key symptom of OAB and is described as the complaint of a sudden compelling desire to urinate that is difficult to defer.
- Urinary frequency is defined by an above average number of urination episodes while awake. Up to seven micturition episodes during waking hours is considered normal, however this will vary on a case-by-case basis depending on a number of factors such as hours spent awake and daily fluid intake (Gormley et al, 2014). Urinary frequency is typically associated with many voids of a small urine volume.
- Nocturia is defined by the interruption of sleep due to the need to urinate.
- Urgency urinary incontinence is defined by a sudden compelling desire to urinate accompanied by the involuntary leakage of urine.

Overactive bladder has an estimated prevalence rate of 16% based upon an American population (Coyne et al, 2004). The cited prevalence rate is referenced in much of the available PTNS literature. However, there is currently no study and/or data available which assesses the prevalence rate of IOAB in the Australian population. Due to the absence of Australian IOAB data it is also unknown if there are any significant differences between the American and Australian IOAB patient population in terms of population characteristics and symptom presentation.

The rates in which OAB presents vary between males and females, although the symptom of urgency urinary incontinence has been reported to present at higher rates for females than it does for males (Gormley et al, 2014). The prevalence of OAB symptoms and symptom severity increases with age. Currently there are no data available demonstrating epidemiological differences between ethnic groups (Gormley et al, 2014).

3.2 Proposed patient population

The proposed patient population to be treated with PTNS are patients who have been diagnosed with idiopathic OAB and their condition has been shown to be refractory to conservative therapy. Currently in instances where first-line conservative therapies have failed to alleviate OAB symptoms patients may be considered candidates for Botox therapy or potentially sacral nerve stimulation. However, there is a subset of patients where either Botox therapy or sacral nerve stimulation would not be appropriate and/or suitable. Therefore it is proposed that PTNS be offered as a treatment option for patients who do not meet the requirements for Botox therapy and are unsuitable candidates sacral nerve stimulation.

The proposed patient population for PTNS for the treatment of overactive bladder includes, if:

- the patient is at least 18 years of age; and
- the patient has been diagnosed with idiopathic OAB; and
- the patient has been refractory to, or contraindicated/not suitable for, conservative treatments including anti-cholinergic agents; and
- the patient is contraindicated or otherwise not suitable for Botox therapy[1]; and
- the patient is contraindicated or otherwise not suitable for sacral nerve stimulation; and
- the patient is willing and able to comply with protocol.

This proposed patient population is a subset of the wider OAB patient population which is currently not covered by the MBS. As outlined in Section 3.1 the overall patient population is large with an estimated 16% of the general population affected by OAB (Gormley et al, 2014). However, the criteria for PTNS patient selection outlined above greatly limits the proportion of the OAB patient population which would be eligible for PTNS. The proposed

[1] This includes patients that would otherwise be suitable for Botox therapy by are unwilling and/or unable to self-catheterise (as urinary retention is a possible side-effect for Botox therapy).

patient population for PTNS is proposed to fall within the clinical management algorithm for OAB (Figure 3).

3.3 Evidence for proposed patient population

The American Urological Association has recommended PTNS in patients with idiopathic OAB with moderately severe incontinence and frequency symptoms (Gormley et al, 2014) where conservative and pharmacological treatments have either failed to produce the desired results or are contraindicated. Due to the minimally invasive, non-surgical, nature of the PTNS procedure, PTNS is typically recommended as a treatment option in circumstances where invasive surgical treatment options are either not suitable or are contraindicated.

Consultation with an expert urologist currently providing PTNS therapy in Australia has indicated that the therapy is best suited to patients who:

- have previously failed pharmacological treatments; or
- have an intolerance to the side-effects of the medication; or
- have a contraindication for medication.

The expert consultation revealed that the following subgroups of patients would likely benefit from, or be recommended, PTNS as a treatment for OAB:

- older patients, as they are more likely to be unsuitable for both Botox therapy (due to being unwilling or unable to meet the requirement of self-catheterise) and sacral nerve stimulation (due to being more likely to unsuitable for surgical procedures in general);
- patients that are unsuitable for Botox therapy due to urine retention being identified as likely to pose an issue;
- patients who are unsuitable or ineligible for sacral nerve stimulation.

A definitive proposed patient population for PTNS does not appear to have been established in the literature to date. The patient inclusion and exclusion criteria from the efficacy trials presented in Tables 2 and 3 below appear to be varied, including differences in diagnoses, duration of symptoms and definitions of symptoms.

3.4 Expected utilisation

The service is expected to be prescribed by urologists and urogynaecologists and administered by a practice nurse under supervision of a urologist or urogynaecologist. PTNS is expected to be provided in private clinics specialising in urology and/or continence, should PTNS be publicly funded. It is likely that the expected PTNS patient would be elderly and would likely have one or more co-morbid conditions which would preclude them from the currently available treatment options for OAB.

Table 1 provides a preliminary estimate of the prevalent pool of patients who are potential candidates for PTNS therapy, if PTNS becomes available on the MBS. The uptake of PTNS therapy has not been considered for the proposed population, and this analysis will be included in the MSAC evidence stage.

Since being listed on the MBS in November 2014, there have been 323 claims processed for item 18379 (Botulinum Toxin for urinary incontinence) during the 9-month period (November 2014 to July 2015) (Australian Government Department of Health Services 2015a). The effect of Botox therapy wears off over time and is intended to be delivered approximately every 9 months (1.33 times per year) (MSAC, 2012).

The number of claims processed for item 36663 (placement of sacral nerve leads) and 36666 (placement of pulse generator) for detrusor overactivity or non-obstructive urinary retention were 291 and 226 claims per calendar year in 2014, respectively (Australian Government Department of Health Services 2015b, 2015c). A total of 263 and 205 claims for these respective items were processed in 9-month period since the listing of Botox therapy for urinary incontinence on the MBS (November 2014 – July 2015) (Australian Government Department of Health Services 2015d, 2015e).

The number of claims processed for item 36667 (removal of sacral nerve leads) and 36668 (removal of pulse generator) was 91 and 55 claims, respectively, per 12-month calendar year in 2014 (Australian Government Department of Health Services 2015f, 2015g). These claims have increased slightly with a total of 77 and 53 claims for these respective items in the following 7-month period (January 2015 – July 2015) (Australian Government Department of Health Services 2015h, 2015i).

The Australian Institute of Health and Welfare (AIHW) hospital procedure data cubes show that from 2011 to 2012 there were 1,982 procedures of endoscopic administration of agent into the bladder wall performed (AIHW 2015). During this same time period, a total of 28 procedures were performed for the implantation of an electronic bladder stimulator and 5,680 cystotomy procedures for urinary indications (AIHW 2015).

A subset of patients who have permanent and severe incontinence that are offered best supportive care may be eligible for subsidies of some continence products under the Continence Aids Payment Scheme funded by the Department of Health. In 2012-14, a total of 31,776 applications for the Continence Aids Payment Scheme were processed (Australia Government Department of Human Services 2014). However, these patients have severe and

permanent incontinence (urinary and/or faecal) caused by neurological conditions or concession cardholders with non-neurological conditions.

Table 1. Estimation of prevalent pool of potential candidate patients for PTNS

PTNS inclusion criteria	Estimated prevalence	Number in Australia	Source
≥ 18 years of age		18,204,287	ABS (Sep 2014) 3101.0 Australian Demographic Statistics; Table 59
Idiopathic OAB	16%	2,912,686	Gormley et al (2014) ***(check reference)***
Fail conservative therapies	40%	1,165,075	Oerlemans and van Kerrebroeck (2008)
Contraindicated or otherwise not suitable for Botox therapy	TBA	TBA	TBA
Contraindicated or otherwise not suitable for sacral nerve stimulation	TBA	TBA	TBA

ABS = Australian Bureau of Statistics, OAB = overactive bladder syndrome, PTNS = percutaneous tibial neurostimulation, TBA = to be advised

4 INTERVENTION – PROPOSED MEDICAL SERVICE

4.1 Description of proposed intervention

The proposed intervention being requested is PTNS to treat the symptoms of OAB. The treatment is a minimally invasive neuromodulation system which involves electrical impulses to the sacral nerve complex via the posterior tibial nerve which has an inhibitory effect on bladder activity, thereby providing symptom relief for patients with OAB.

The PTNS neurostimulation protocol is administered through the Urgent PC Neuromodulation System. The device technology and proprietary clinical treatment protocol has been developed by *Uroplasty, Inc*. and is based on the Stoller's Afferent Nerve Stimulator (SANS) device. The Urgent PC Neuromodulation System is currently the only neuromodulation system capable of administering PTNS therapy available in Australia. The precursor SANS device is no longer available as it has been superceded by the Urgent PC Neuromodulation System. The SANS technology was acquired by *Uroplasty, Inc* and subsequently developed into the Urgent PC Neuromodulation System A single treatment session consists of 30 minutes of continuous neurostimulation. Repeated short duration stimulation induces a persistent post-stimulation inhibitory effect. The period of time in which the inhibitory effect will persist will extend over the course of treatment. However, the inhibitory effect will deteriorate over time if a patient were to cease PTNS therapy.

The course of treatment has been developed for 30 minute sessions with a treatment interval of one week for a period of 12 weeks; thereafter the duration between treatment sessions is tapered until symptom relief can be maintained by one PTNS treatment session per month. The tapering period is recommended to last for three months, where the treatment interval is slowly increased from one week out to one month.

It is important to note that individual patients will respond differently to the PTNS treatment. As a result it can be expected that the treatment interval will vary between patients. The treatment interval during the tapering period must be assessed on a case-by-case basis by the treating physician, and adjusted according to the individual patient's response to therapy and the needs of the patient.

4.2 Administration of proposed intervention

In order to administer PTNS an Urgent PC Neuromodulation System is required. The Urgent PC Neuromodulation System is comprised of two components, the Urgent PC Stimulator and Urgent PC needle electrode lead-sets. Details of the components include:

1. Simulator: The Urgent PC Stimulator is a hand-held, battery-powered, external pulse generator device that generates electrical impulses; and
2. Lead set: The Urgent PC single-use Lead Set consists of the lead wire, needle electrode and alcohol pad. The proprietary needle electrode is sterile and disposable needle electrode specifically for use with the Urgent PC Stimulator. The needle electrodes are a 34 guage stainless steel needle which are contained within a plastic guide tube with a stop plug. Each lead set contains two needle electrodes, in case of incorrect placement necessitating the use of a second needle electrode, which was supplied sterile in an individual peel-open package.

The Urgent PC Stimulator is connected to the patient via the needle electrode.

The intervention performed by a trained physician involves:

- Ensuring the patient is seated comfortably for the duration of the treatment session.
- Locating the insertion site for the needle electrode on the lower inner aspect of either of the patient's legs. The insertion site is approximately 5cm cephalad to the medial malleolus and approximately 2cm posterior to the tibia.
- Cleaning the insertion site with an alcohol pad.
- Correctly positioning the needle electrode onto the insertion site with a 60-degree angle between the shaft of the needle and the skin of the patient's leg (Figure 1).

- Inserting the needle electrode into the insertion site on the patient's leg.
- Connecting the needle electrode to the Urgent PC Stimulator (Figure 1).
- Placing a surface electrode on the patient's leg, near the medial aspect of the calcaneus on the same leg as the needle electrode.
- Determining the appropriate stimulator current setting by placing the Urgent PC Stimulator into Test mode and starting at 0mA slowly increasing the current delivered to the patient while observing the patient's foot for a response. The patient's foot will typically flex and the patient may report experiencing a tingling sensation.
- At this point the current should be reduced by one level and the therapy mode can commence. The treatment protocol is pre-programmed in the Urgent PC Stimulator unit.
- The PTNS treatment is to be administered for 30 consecutive minutes.
- Once the programmed treatment protocol has been completed the patient is disconnected from the Urgent PC Stimulator and the needle electrode is removed from the patient's leg and disposed of.
- Debriefing the patient after the cessation of the treatment session.
- The treatment is repeated in interval specified in Section 4.3 below.

It must be noted that no local anaesthetic or number agent is required prior to, or following, the insertion of the needle electrode.

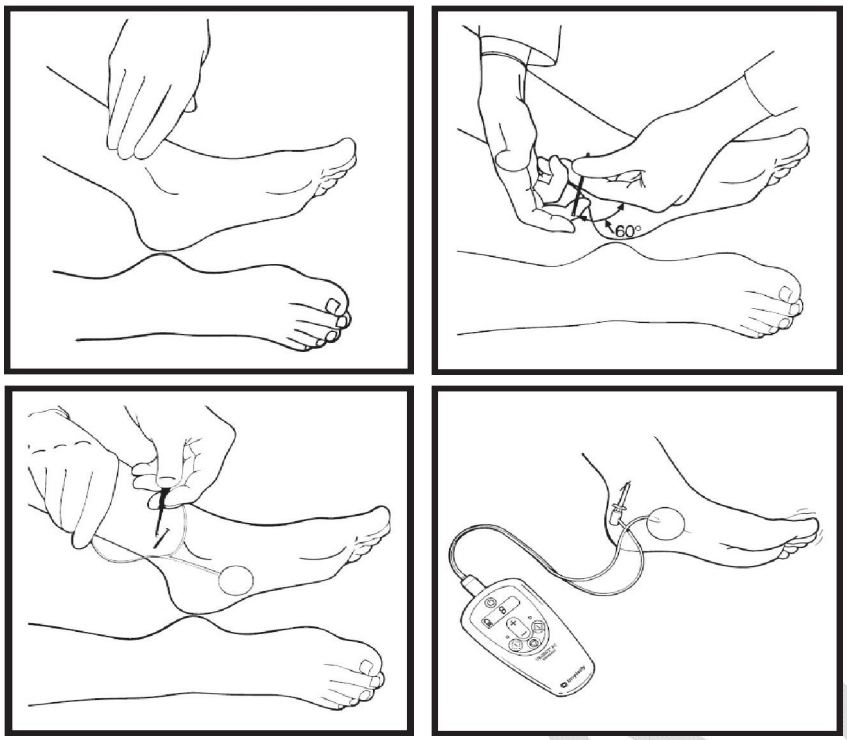

Figure 1: Clockwise from top left-hand side: (a) Locating insertion site, (b) inserting Urgent PC Needle Electrode, (c) connecting Urgent PC Neurostimulator to the needle electrode, (d) setup completed. (Source: Urgent PC Instructions for Use [Uroplasty, Inc])

4.3 Duration and interval of proposed intervention

Consultation with physicians currently providing therapy in Australia has determined that the appropriate length of a single PTNS session is 60 minutes. As such, each PTNS consultation will last 60 minutes which would allow time for the following:

- initial setting up and positioning of the patient;
- determining the appropriate stimulator current setting required for therapy prior to commencement of therapy;
- delivering 30 minutes of the PTNS therapy;
- disconnecting the patient from the Urgent PC Neuromodulation System; and
- debriefing the patient after the cessation of the treatment session.

PTNS consists of three phases of treatment:

1. Initial treatment protocol: The 30-minute treatment sessions occur once per week for a period of 12 weeks.
2. Tapering period: For patients responding to the initial treatment protocol, the intervals between treatment sessions are gradually increased over a three month period.

The rate at which the treatment intervals increase is determined at the discretion of the treating physician based upon the patient's symptom presentation and rate of recurrence. The aim of the tapering period is to extend the treatment interval to one session per month. The tapering protocol which was prescribed in the *STEP trial* (Peters et al, 2013) is recommended as the guideline for clinicians to follow when administering the tapering period. At the commencement of the tapering period patients will be treated with two PTNS treatment sessions at 14 day intervals, followed by two treatment sessions at 21 day intervals, followed by one treatment session at 28 days. Following this protocol the tapering period shall total five PTNS treatment sessions over the three month period.

3. Maintenance period: The 30-minute treatment sessions occur once per month, or as required. The patient is closely monitored for the return of symptoms of greater severity, and the frequency of treatment sessions are adjusted accordingly so that the interval between treatments will sustain therapeutic benefit (Peters 2013b). It is recommended in the instructions for use of the Urgent PC Neuromodulation System that the patient's treatment schedule should return to the last previously effective treatment schedule (Uroplasty Inc, 2006).

The average patient will show objective and subjective measures of OAB symptom improvement by the seventh week of treatment (Leong et al, 2011). In cases where a patient has shown no response to therapy by the eighth PTNS treatment session it is recommended that such a patient be classified as a non-responder and further PTNS treatment be discontinued. Therefore, in cases where a patient has not shown any objective or subjective measures of OAB symptom improvement by the time of the eighth PTNS treatment session, PTNS treatment should be deemed as having been unsuccessful for the patient and continued PTNS therapy should be abandoned. Consultation with clinicians currently providing PTNS services in Australia noted that if no OAB symptom improvement was detected by the eighth PTNS treatment session it is highly unlikely that continuing with PTNS treatment sessions will produce a successful therapeutic outcome. Continuing PTNS treatment in such a scenario would merely delay the administration of an alternate treatment while offering no benefit to the patient.

It is important to note that should a patient responding to PTNS treatment cease adherence to PTNS treatment, the inhibitory effect of the treatment will begin to deteriorate, and the patient will over a period of time return to baseline levels of incontinence. While PTNS produces persistent inhibitory effect on bladder functioning, the effect is not indefinite.

Keeping patients who are responding well to PTNS treatment in therapy over the tapering period and continuing on maintenance therapy is beneficial as it will prevent the deterioration of the benefits achieved through adherence to treatment. In addition to maintaining the benefits to the patient, it would also provide a cost saving by preventing the patient from reverting to baseline continence measures and thereby requiring either the recommencement of PTNS treatment or an alternate intervention. PTNS is a lifetime intervention requiring patients to attend ongoing treatments, most likely on a monthly basis, to maintain symptom relief.

- In cases where the patient does not demonstrate either objective or subjective measures of OAB symptom improvement by the eighth PTNS treatment session of the initial treatment protocol, therapy should be deemed unsuccessful and abandoned.
- During the first year of PTNS therapy the average patient can expect to undergo 23 PTNS treatment sessions, provided the patient responds to therapy during the initial treatment protocol. For the subsequent years of therapy the average patient can expect to undergo 12 treatment sessions per year.
- PTNS is a lifetime intervention which requires patients to attend treatment ongoing treatment sessions to maintain OAB symptom relief.

4.4 Setting and resources required for proposed intervention

In order to administer PTNS an Urgent PC Neuromodulation System is required which consists of the the Urgent PC Stimulator and Urgent PC needle electrode lead-sets. The Urgent PC Stimulator is a battery-powered device which produces the electrical impulses administered to the patient for the delivery of the therapy. The Urgent PC needle electrode lead-sets are sterile disposable needle electrodes which are required to deliver the electrical impulses from the stimulator to the patient. The Stimulator is powered by 9V alkaline batteries and a new 9V battery will perform approximately 12 treatments at a current setting of 5mA (level 11) (Uroplasty Inc, 2012).

In order provide PTNS to the patient, the patient must be allocated a private consultation room. Due to the nature of the condition being treated it is inappropriate to provide PTNS treatment in a public and/or open space. The room must include a seat and an object on which the patient can place the leg receiving the PTNS treatment. The patient's leg must be raised in order for the therapy to be delivered, therefore the room must include facilities to facilitate this. The time to be allocated for the room will be 60 minutes.

A sterile field is not required in order for PTNS to be administered as the procedure is not a surgical intervention. The procedure is minimally-invasive, with only a sterile needle electrode penetrating the patient's skin. The patient does not need to be admitted to hospital in order to receive PTNS. It is proposed that the treatment will be delivered in private practice and/or a physician's consulting rooms, outpatient clinics, and/or a day surgery centres.

The PTNS procedure requires a private room in which the patient can be comfortably seated for a period of time of up to 60 minutes. A physician's private practice and/or consulting rooms would therefore be an appropriate venue to facilitate treatment. As patients receiving PTNS treatment are required to attend one PTNS session per week during the 12 week initial treatment protocol, having treatment available at a patient's local physician's rooms would aid in promoting adherence to therapy. This is due to the majority of the PTNS patient population likely to be elderly and therefore issues relating to the mobility of patients and the patient's ability to travel to attend treatment sessions may impede adherence to therapy.

There are a number of investigations and interventions that patients may require at different stages of the diagnosis and treatment of OAB. These may include:

- Urinalysis
- Urine culture, post-void residual (if diagnosis is unclear or additional information is needed for diagnosis)
- Consultation for patient education
- Behavioural treatments
- Pharmacological management
- Consultation to re-assess and/or refer (possibly a urine culture, post-void residual)
- Botox therapy

4.5 Professional experience required for proposed intervention

In order to offer PTNS, a physician must be adequately qualified to first diagnose OAB and be capable of prescribing anticholinergic agents to treat the condition. The physician must be a specialist in the field of urology, continence and/or gynaecology. The specialist physician must also be qualified to offer the patient all relevant treatment options for their OAB symptom presentation, including more invasive treatment options such as Botox therapy and sacral nerve stimulation. The reason for restricting the proposed service to specialist urologists and urogynaecologists is for the benefit of the patient. Should a patient present as a candidate for an alternate second-line OAB treatment the patient should not be forced to

delay treatment in order to seek a qualified clinician. Restricting the proposed service to urologists and urogynaecologists aims to reduce inefficiencies in the provision of treatment, while ensuring the patient is capable of accessing and receiving treatment.

The ability to prescribe PTNS as a treatment should be restricted to urologists and urogynaecologists. The service can be administered by a practice nurse acting under the supervision of a qualified urologist or urogynaecologist. In such a scenario close specialist supervision is necessary as incorrect administration, such as incorrect placement of the Urgent PC needle electrode or the selection of an inappropriate current setting on the Urgent PC Neurostimulator, will result in the operational failure leading to treatment failure.

5 CO-DEPENDENT INFORMATION

Percutaneous tibial nerve stimulation is not a co-dependent intervention. In order to administer percutaneous tibial nerve stimulation a medical device, the Urgent PC Neuromodulation System, is required. This medical device is not a prosthesis. In the United States the term 'Urgent PC' is a registered trademark of *Uroplasty, Inc*, the manufacturer of the medical device.

6 COMPARATOR – CLINICAL CLAIM FOR THE PROPOSED MEDICAL SERVICE

6.1 Comparator

As shown by the current and proposed management algorithms in Figure 2 and Figure 3, the most appropriate comparator is sacral nerve stimulation. The clinical effectiveness, safety and cost-effectiveness of PTNS compared to sacral nerve stimulation will need to be examined. Based on the proposed clinical management algorithm in *Figure* 3 and the positioning of both PTNS and sacral nerve stimulation as second-line treatment options for OAB, sacral nerve stimulation is recommended as the comparator for PTNS.

Sacral nerve stimulation is currently offered as a second-line treatment option and is listed on the MBS to manage detrusor overactivity or non-obstructive urinary retention where urethral obstruction has been urodynamically excluded. Under MBS, the sacral nerve stimulation is a two-stage process of testing and treatment to ensure suitability for sacral nerve stimulation.

2. Testing phase, involves acute and sub-chronic testing which includes peripheral nerve evaluation. Patients who achieve greater than 50% improvement in urinary incontinence or retention episodes during testing are eligible to receive permanent sacral nerve stimulation treatment.
3. Treatment phase, involves the surgical implantation of a permanent pulse generator and permanent sacral leads and provide continuous electrical stimulation to the sacral nerve complex which produces an inhibitory effect upon bladder function. These permanent prostheses remain inside the patient for the duration of the patient's life in order to be effective. The devices may be explanted due to the treatment becoming ineffective, adverse events requiring removal, or the patient and/or medical practitioner electing to discontinue treatment for another reason. A re-operation to replace the simulator battery is required every 3 to 7 years.

The following MBS items are required to deliver sacral nerve stimulation:

Specialist consultation (Item 104)

104	SPECIALIST, REFERRED CONSULTATION - SURGERY OR HOSPITAL (Professional attendance at consulting rooms or hospital by a specialist in the practice of his or her specialty where the patient is referred to him or her) **- INITIAL** attendance in a single course of treatment, not being a service to which ophthalmology items 106, 109 or obstetric item 16401 apply. **Fee:** $85.55 **Benefit:** 75% = $64.20 85% = $72.75 Extended Medicare Safety Net Cap**:** $256.65

Pre-surgery consultation with anaesthetist (Items 17610 or 17625; depends on time with patient)

17610	ANAESTHETIST, PRE-ANAESTHESIA CONSULTATION (Professional attendance by a medical practitioner in the practice of ANAESTHESIA) – a BRIEF consultation involving a targeted history and limited examination (including the cardio-respiratory system) - *AND of not more than 15 minutes s duration,* not being a service associated with a service to which items 2801 - 3000 apply *(See para T6.1 of explanatory notes to this Category)* **Fee:** $43.00 **Benefit:** 75% = $32.25 85% = $36.55 Extended Medicare Safety Net Cap: $129.00
17625	- a consultation on a patient undergoing advanced surgery or who has complex medical problems involving an exhaustive history and comprehensive examination of multiple systems , the formulation of a written patient management plan following discussion with relevant health care professionals and/or the patient, involving medical planning of high complexity documented in the patient notes - AND of more than 45 minutes duration, not being a service associated with a service to which items 2801 – 3000 apply (See para T6.1 of explanatory notes to this Category) Fee: $150.90 Benefit: 75% = $113.20 85% = $128.30 Extended Medicare Safety Net Cap: $452.70

Initiation of management of anaesthesia (Item 20690 or Item 21110) AND Anaesthesia time units (relative value guide) (Item 23010 to 24136)

20690	INITIATION OF MANAGEMENT OF ANAESTHESIA for percutaneous spinal procedures, not being a service to which another item in this Subgroup applies (5 basic units) Fee: $99.00 Benefit: 75% = $74.25 85% = $84.15
21110	INITIATION OF MANAGEMENT OF ANAESTHESIA for procedures on the skin, its derivatives or subcutaneous tissue of the pelvic region (posterior to iliac crest), except perineum (5 basic units) Fee: $99.00 Benefit: 75% = $74.25 85% = $84.15
23051-24136	XX:XX HOURS TO X:XX HOURS (X basic units) Fee: $XX.XX Benefit: 75% = $XX.XX 85% = $XX.XX

Local anaesthesia (Item 18274)

18274	PARAVERTEBRAL, CERVICAL, THORACIC, LUMBAR, SACRAL OR COCCYGEAL NERVES, injection of an anaesthetic agent, (single vertebral level) *(See para T7.5 of explanatory notes to this Category)* **Fee:** $88.65 **Benefit:** 75% = $66.50 85% = $75.40

Fluoroscopy (Item 60503)

60503	FLUOROSCOPY, without general anaesthesia (not being a service associated with a radiographic examination) (R) *(See para DIQ of explanatory notes to this Category)* **Fee:** $29.75 **Benefit:** 75% = $22.35 85% = $25.30

Sacral Nerve Stimulation (items 36663, 36666)

36663	Sacral nerve lead(s), percutaneous placement using fluoroscopic guidance (or open placement) and intraoperative test stimulation, to manage: a) detrusor overactivity; or b) non obstructive urinary retention that has been refractory to at least 12 months medical and conservative treatment in a patient 18 years of age or older. (Anaes.) **Fee:** $660.95 **Benefit:** 75% = $495.75
36666	Pulse generator, subcutaneous placement of, and placement and connection of extension wire(s) to sacral nerve electrode(s), for the management of a) detrusor overactivity; or b) non obstructive urinary retention that has been refractory to at least 12 months medical and conservative treatment in a patient 18 years of age or older. (Anaes.) **Fee:** $334.00 **Benefit:** 75% = $250.50

Sacral nerve stimulation – Management and adjustment (items 36665)

36665	Sacral nerve electrode or electrodes, management and adjustment of the pulse generator by a medical practitioner, to manage detrusor overactivity or non obstructive urinary retention – each day **Fee:** $125.40 **Benefit:** 75% = $94.05 85% = $106.60

Follow-up specialist consultation (Item 105)

105	Each attendance SUBSEQUENT to the first in a single course of treatment **Fee:** $43.00 **Benefit:** 75% = $32.25 85% = $36.55 Extended Medicare Safety Net Cap: $129.00

Sacral nerve stimulation - repositioning or removal (items 36664, 36667, 36668)

36664	Sacral nerve lead(s), percutaneous surgical repositioning of, using fluoroscopic guidance (or open surgical repositioning) and intraoperative test stimulation, to correct displacement or unsatisfactory positioning, if inserted for the management of: a) detrusor overactivity; or b) non obstructive urinary retention that has been refractory to at least 12 months medical and conservative treatment in a patient 18 years of age or older, not being a service to which item 36663 applies (Anaes.) **Fee:** $593.55 **Benefit:** 75% = $445.20
36667	Sacral nerve lead(s), removal of, if the lead was inserted to manage: a) detrusor overactivity; or b) non obstructive urinary retention that has been refractory to at least 12 months medical and conservative treatment in a patient 18 years of age or older. (Anaes.) **Fee:** $156.30 **Benefit:** 75% = $117.25
36668	Pulse generator, removal of, if the pulse generator was inserted to manage: a) detrusor overactivity; or b) non obstructive urinary retention that has been refractory to at least 12 months medical and conservative treatment in a patient 18 years of age or older. (Anaes.) **Fee:** $156.30 **Benefit:** 75% = $117.25

Botox therapy is unlikely to be considered a comparator. Like PTNS and sacral nerve stimulation, Botox therapy is also a second-line treatment for OAB. However, Botox therapy is a more complete treatment for OAB and therefore PTNS should only be recommended for patients who are not suitable or are ineligible for Botox therapy.

6.2 Clinical claim and expected use for service

PTNS administered via the Urgent PC Neuromodulation System is intended to manage the symptoms of OAB. Clinical data demonstrates that PTNS can significantly reduce the symptom presentation of clinical of OAB when compared against baseline measures (Peters et al, 2010; Finazzi-Agro et al, 2010). While PTNS has been shown to significantly reduce the occurrence of OAB symptoms, some OAB symptoms may still persist at lower rates than experienced prior to treatment.

It is expected that PTNS services will be provided in private clinics specialising in urology and/or continence services. The expected PTNS service providers are likely already offering the proposed comparator treatment/s to OAB patients. It is expected that these specialist clinics will offer PTNS as a treatment option for OAB in addition to the comparator services. Percutaneous tibial nerve stimulation is expected to be offered to patients who may not be suitable and/or are ineligible for Botox therapy or sacral nerve stimulation.

7 EXPECTED HEALTH OUTCOMES RELATING TO THE MEDICAL SERVICE

7.1 Expected patient-relevant health outcomes

Health outcomes will be measured in order to assess the safety and effectiveness of the proposed PTNS intervention as a treatment for OAB. A non-exhaustive search has found five RCTs comparing PTNS to a sham procedure (Peters 2010), to a placebo (Finazzi-Agro 2010), and to anticholinergic agents (Vecchioli-Scaldazza 2013; Peters 2009; Sancaktar 2010). There are also a number of prospective observational studies for PTNS. Characteristics of the clinical trials and observational studies are presented below in Tables 2 and 3, respectively. The duration of follow-up ranged from 1 to 21 months with two longer-term studies of follow-up at 24- and 36-months (Peters 2013a; Peters 2013b). Several systematic reviews assessing PTNS (Biemans 2013; Burton 2012; Gaziev 2013; Levin 2012; Moossdorff-Steinhauser 2013), one of which includes a meta-analysis (Burton 2012), have been published. This application is likely to include clinical efficacy data from these trials.

Table 2. Characteristics of clinical trials of PTNS

Author (year)	Country	N	Design (int vs. comp)	Primary outcomes	Safety
Peters (2010), SUmiT	USA	220	RCT (PTNS vs. Sham)	GRA[a]	9 mild/mod AEs[b]
Finazzi-Agro (2010)	Italy	35	RCT (PTNS vs. Placebo)	Percent responders[c]	No serious AEs
Vecchioli-Scaldazza (2013)	Italy	40	RCT, crossover (PTNS vs. SS)	Voiding diary, QoL, urgency intensity, global improvement	
Peters (2009), ORBIT	USA	100	RCT (PTNS vs. Tol)	Voids per 24h, GRA	Moderate adverse events = 8/49[d]
Sancaktar (2010)	Turkey	40	RCT (Tol vs. PTNS+Tol)	7 day void diaries, IIQ	

AE = adverse event; comp = comparator; GRA = Global Response Assessment; h = hours; IIQ = Incontinence Impact Questionnaire; int = intervention; mod = moderate; ORBIT = Overactive Bladder Innovative Therapy trial; oxy = oxybutynin; PTNS = percutaneous tibial nerve stimulation; Tol = tolterodine; SS = solifenacin succinate; SUmiT = Study of Urgent® PC vs Sham Effectiveness in Treatment of Overactive Bladder Symptoms

a Percent moderately or markedly improved OAB symptoms

b The 9 mild/moderate treatment-related adverse events included ankle bruising, discomfort at the needle site and tingling in the leg.

c Response defined as 50% or greater reduction in UUI episodes

d Moderate adverse events included generalised swelling, worsening incontinence, headache, haematuria, inability to tolerate stimulation, leg cramps, intermittent foot/toe pain, vasovagal response to needle placement.

Table 3. Characteristics of prospective observational studies of PTNS

Author (year)	Country	N	Outcomes	Adverse events
STEP study (Peters 2013a)	USA	50	GRA at 24-month follow-up[a]	TR=0; unknown=5.
STEP study (Peters 2013b)	USA	50	GRA at 3-year follow-up[a]	TR=2 mild; unknown = 11 mild, 1 mod.
Vandoninck (2003)	Netherlands, multicentre	90	At least 50% reduction in leakage episodes	No AEs reported
Van Balken (2001)	Netherlands, multicentre	37	Treatment success[b], 24 h voiding diary, Leakage severity scale 0–3. SF36; I-QoL	Minor bleeding, temp pain at insertion site
Van Balken (2006)	Netherlands, multicentre	83	Treatment success (objective)[c], (subjective)[b]; void diaries, SF36; I-QoL; MPQ	No AEs reported
Van der Pal (2006)	Netherlands	30	Correlation (QoL, voiding); freq, VV, UUI episodes, pads; QoL; FV chart, SF36, I-QoL	Minor bleeding, pain at insertion site/foot
Congregado Ruiz (2004)	Spain	51	Voiding diary, QoL, patient evaluation	No AEs reported
Govier (2001)	USA, multicentre	53	Daytime freq, safety, 3 days voiding diary; QoL; IIQ; SF-MPQ; voiding/pain SF36	Pain: 1 at needle site, 1 foot, 1 stomach
Nuhoglu (2006)	Turkey	35	Complete recovery[d], no UUI; 3 days voiding diary, SEAPI, QoL, Cystometry	No AEs reported
Klingler (2000)	Austria	15	Response to treatment; Frequency/volume chart; UDS Pad test; VAS pelvic pain	1 minor haematoma at puncture site

AE = adverse event; FV = 24 hr frequency/volume; freq = frequency; GRA = Global Response Assessment; h = hours; IIQ = Incontinence Impact Questionnaire; I-QoL = urinary incontinence quality of life scale; mod = moderate; MPQ = MacGill pain questionnaire; QoL = Quality of Life questionnaire; SF36 = short form health survey 36-items; SEAPI = SEAPI incontinence score; SF-MPQ = short form MacGill pain questionnaire; TR = treatment-related; UDS = urodynamics; UUI = urgency urinary incontinence; VAS = visual analogue scale; VV = voided volume

a Percent moderately or markedly improved OAB symptoms

b Treatment success as defined by the request for on-going treatment

c Treatment success as defined by > 50% reduction in symptoms/24 hr (frequency or UUI) or in VAS for pain

d Complete recovery as defined by < 8 voids/24 hr, 0–1 urgency episodes/day

The efficacy of PTNS in managing the symptoms of OAB has been demonstrated in randomised controlled trials, where PTNS has been shown to be effective in treating OAB symptoms when compared to either a sham or placebo treatment (Peters et al, 2010; Finazzi-Agro et al, 2010) and in producing comparable, if not superior, clinical outcomes when compared to pharmacological treatments for managing OAB symptoms (Peters et al, 2009; Vecchioli-Scaldazza et al, 2013). Clinical data have demonstrated that PTNS, as a result of reducing the occurrence of OAB symptom presentation, increases a patient's voluntary urinary void volume (Peters et al, 2010). The expected outcome of the PTNS intervention for OAB is an increase in the patient's ability to control their urinary voiding. This results from an improvement in bladder control.

A meta-analysis of PTNS found initial treatment success rates between 37% to 82%. Objective success rates, defined as a 50% reduction in OAB symptom occurrence, were 60.6%. Subjective success rates, defined as patient request for ongoing treatment or a perceived moderate/great improvement in symptoms, were 61.4% (Burton, Sajja & Latthe, 2012). These definitions of treatment success indicate that PTNS is likely to reduce the symptom presentation but is unlikely to result in the patient being completely dry.
Objective measures of OAB symptom improvement show that different OAB symptoms will take different amounts of time to show significant improvements. However, overall improvements are commonly reported by the seventh week of therapy (Leong et al, 2012). Continuing with treatment beyond the initial treatment protocol should maintain OAB symptom improvements gained during the initial treatment protocol for as long as the patient remains in therapy (Peters et al, 2012).

In addition to providing improvements to OAB symptom presentation PTNS has been demonstrated to result in significant improvements on quality of life measures (Peters et al, 2013). Urinary incontinence and associated conditions such as OAB can adversely impact upon a patient's ability to carry on with their daily lives and can drastically impact upon a patient's ability to function in society. It has been noted that the symptoms of OAB can significantly impact upon a patient's social, sexual and job functioning (Martinson, MacDiarmid & Black, 2013). The impact which OAB symptoms have on a patient's quality of life has a flow on effect which can result in lost productivity and a further burden on the healthcare system as the patient seeks additional resources to cope with their condition (Peters et al, 2013). By providing OAB patient with symptom relief it is expected that OAB patient's overall quality of life will improve. This proposition is supported by clinical data which has

reported improvements in patient quality of life following PTNS therapy (Peters et al, 2013; Govier et al, 2001).

In general, the studies have demonstrated the benefits of PTNS as a treatment for OAB, with beneficial outcomes including decreased OAB symptoms, objective and subjective success and improvement in quality of life.

It is anticipated that if the application proceeds to the evidence stage, it will present the results of the following effectiveness outcomes for the proposed PTNS intervention as a treatment option for OAB:

- Proportion of patients classified as responders
  - defined as patients reporting bladder symptoms as moderately to markedly improved on a 7 level Global response assessment (GRA) scale; or
  - defined as patients with at least a 50% reduction in urge incontinence episodes.
- Objective success
  - defined as the proportion of patients reporting >50% reduction in symptoms.
- Subjective success
  - defined as the proportion of patients requesting ongoing treatment.
- Reduction in frequency of urinary urgency episodes, measured by voiding diary.
- Reduction in urinary frequency (number of daily voids/episodes), measured by voiding diary.
- Reduction in frequency of nocturia, measured by voiding diary.
- Reduction in urinary incontinence episodes (number/percentage reduction per day).
- Increase in voluntary urinary void volume.
- Improvement in patient quality of life outcomes, measured by Incontinence Impact Questionnaire (IIQ-7), Overactive Bladder Questionnaire (OAB-q), Incontinence quality of life (IQOL), Short form 36-item Health Survey (SF36).

7.2 Potential risks to patients

Adverse events and side-effects

PTNS is a minimally invasive intervention which has been associated with few adverse events, side-effects and/or risks (see Tables 2 and 3 above). PTNS does not require a surgical procedure in order for the patient to receive the treatment.

A meta-analysis of 16 clinical studies of PTNS found no serious adverse events and showed that PTNS was associated with occasional transient side-effects occurring in approximately

8.5% of the patients. Side-effects included pain, bruising, tingling and/or bleeding at the needle electrode insertion site and leg cramp and numbness/pain under the sole of the foot (Burton, Sajja & Latthe, 2012). Single adverse events were reported in one study including headache, hematuria, generalised swelling, worsening incontinence, and vaso-vagal response to needle placement (Preyer 2007). There has been no risk of serious of harm and/or death relating to PTNS reported in the currently available literature.

The SUmiT trial reported 5.5% (6/110) of patients had nine mild to moderate treatment-related adverse events including ankle bruising, discomfort at the needle site and tingling in the leg (Peters 2010). The ORBIT trial reported 16% (8/49) of patients had reported moderate adverse events including generalised swelling, worsening incontinence, headache, haematuria, inability to tolerate stimulation, leg cramps, intermittent foot/toe pain, vasovagal response to needle placement (Peters 2009).

Based on the available clinical literature assessing the efficacy and safety of PTNS (Burton 2012; Peters 2010; Peters 2009; Uroplasty Inc 2012) the following side-effects are associated with the PTNS treatment:

- Discomfort and pain at, or near, the stimulation site. This may include the patient's lower leg and foot;
- Ankle bruising;
- Tingling in the patient's leg;
- Leg cramps;
- Numbness of the sole of the foot and/or toes;
- Bleeding at the needle site;
- Redness/inflammation at, or near, the stimulation site; and/or
- Stomach ache.

Other adverse events may include:

- headache;
- haematuria;
- generalised swelling;
- worsening incontinence;
- vaso-vagal response to needle placement; and/or
- inability to tolerate stimulation.

The potential side-effects of PTNS are usually transient in nature and typically only present during the procedure (Burton 2012). The available literature describing the efficacy of PTNS does not report any serious adverse event having resulted from the procedure.

Contraindications for PTNS therapy

According to the instructions for use of the Urgent PC Neuromodulation System (Uroplasty 2006):

1. PTNS is contraindicated for use on patients who have the following conditions or medical history:
    - Patients with pacemakers or implantable defibrillators.
    - Patients prone to excessive bleeding.
    - Patients on anti-coagulants.
    - Patients with nerve damage that could impact either percutaneous tibial nerve or pelvic floor function.
    - Patients who are pregnant or planning to become pregnant while receiving PTNS.
2. The Stimulator is not intended for intra-cardiac or trans-thoracic use.
3. Concurrent use of medical monitoring equipment during stimulation is not recommended.
4. This device is not suitable for use in the presence of a flammable anaesthetic mixture with air or with oxygen or nitrous oxide.

Risk comparison

The rare occurrence of side-effects and the type of side-effects associated with PTNS compare favourably with the side-effects of the comparator and other OAB treatments in the clinical management algorithm.

Sacral nerve stimulation requires invasive surgery to implant the neurostimulator and sacral leads. A main drawback of sacral nerve stimulation is a high probability of surgical revision, with up to 67% of patients requiring surgical revision of the implant and leads within five

years of implantation (Staskin et al, 2012). The requirement for surgery to implant the neurostimulator and sacral leads introduces the possibility of post-operative infection. In addition to potential surgical complications, sacral nerve stimulation has an estimated adverse event rate of 16% per annum (Martinson, MacDiarmid & Black, 2013). Typical adverse events associated with sacral nerve stimulation include sacral lead migration, neurostimulator failure and pain (Burton, Sajja & Latthe, 2012). In contrast PTNS does not require the implantation of an active medical device and is not associated with the risks which stem from either the surgery to implant the device or from the implanted device.

Urine retention is a possible side-effect of Botox therapy which may require the patient to be willing and able to self-catheterise. Urine retention has not been identified nor reported as being a side-effect of PTNS. The PTNS intervention is best positioned in the OAB algorithm as an alternative for patients who would not satisfy the requirements of self-catheterisation for Botox therapy or for whom Botox therapy would not be appropriate.

The risks associated with PTNS compare favourably with the side-effects of antimuscarinic drugs. These side-effects include dry mouth and nausea and have been identified as a reason for discontinuation of treatment (Vecchioli-Scaldazza et al, 2013).

7.3 Type of economic evaluation

It is proposed that a cost effectiveness analysis assessing the costs of PTNS therapy against the patient relevant outcomes be conducted. The cost impact of OAB can be expressed as the cost of treating the disorder and the cost resulting from the impact of the symptoms on the patient's ability to function (Martinson, MacDiarmid & Black, 2013). The costs of providing PTNS services includes the time required of a specialist physician to provide and/or oversee the treatment session, the Urgent PC Neuromodulation System required to administer the therapy, and the administrative costs to cover the incidental expenses associated with providing the treatment. In contrast, the cost impact of OAB symptoms on OAB suffers can include social withdrawal, decreased sexual functioning, decreased workforce participation and productivity (Martinson, MacDiarmid & Black, 2013). The costs of PTNS should also be weighed against the alternate treatment option, sacral nerve stimulation.

One of the primary costs of OAB is due to the significant impact OAB symptoms have upon patients' ability to function in their daily lives, which can lead to lost productivity. It was estimated that approximately 545,000 adult Australians suffered from severe urinary and faecal incontinence in 2003, while moderate incontinence effected an additional 723,100

(AIHW, 2006). Although these figures are not specific to OAB, they do demonstrate that incontinence, which is closely related to OAB, is a significant issue impacting upon a large number of adult Australians. Given the estimated prevalence rate of OAB in the general population of 16% (Leong et al, 2011), the impact of OAB on the Australian population is significant.

Research into the impact of OAB on the American economy estimated the cost of the disorder to exceed US$9 billion per annum as a result of lost productivity and the burden the disorder places on the healthcare system (Peters et al, 2013). The impact of OAB on the Australian economy is unknown. However, assuming the OAB patient population characteristics of America and Australia are similar a cost impact of OAB on the Australian economy can be estimated to be approximately AU$500 million per annum. An analysis assessing the impact of incontinence generally on the Australian economy determined the impact to be AU$1.5 billion in 2003, with an expected increase of 110% by the 2030-31 financial year (AIHW, 2006). While the OAB patient population is a subset of persons who present with incontinence, based on the estimated prevalence rate of 16%, figure based on an American patient population (Coyne et al, 2004), and the negative impact OAB has on a person's ability to function, OAB represents a sizeable burden on the Australian economy.

Treating the symptoms of OAB can present a cost saving due to reducing impact of the disorder on the Australian health-economy. The cost saving can be expressed as a reduced reliance on incontinence aids for the management of the medical condition, thereby requiring less expenditure on these products. Additionally, treating the symptoms of OAB would decrease patient dependence on medical professionals in order to cope with the condition.

Percutaneous tibial nerve stimulation offers a minimally invasive treatment option which does not require surgical intervention, thereby saving costs incurred in the form of operating theatre time, theatre staff, the need for anaesthetic and an anaesthetist and finally the need for a surgeon. Patients undergoing PTNS treatment do no need to be admitted to hospital, which in turn avoids hospitalisations for this condition. A cost analysis assessing the cost per treatment per patient between PTNS and the proposed comparator, sacral nerve stimulation, determined that the cost per patient for sacral nerve stimulation is five times more than that of PTNS after one year of therapy (Martinson, MacDiarmid & Black, 2013). The high cost of sacral nerve stimulation is attributable to the initial costs of the implants and surgery, as well as the potential costs for ongoing surgery to maintain, repair or remove the implants. The high probability of surgical revision associated with sacral nerve stimulation, estimated at 67% within five years of implantation of the sacral generator and leads (Staskin et al., 2012), also

adds to the cost of sacral nerve stimulation as a treatment option for OAB. In contrast to sacral nerve stimulation, PTNS does not require surgical implantation and as a result the costs of surgical and ongoing maintenance that are associated with sacral nerve stimulation are not applicable to PTNS.

8 FEE FOR THE PROPOSED MEDICAL SERVICE

8.1 Proposed funding type

The current application requests the listing of two new 'Category 3 – Therapeutic Procedures' items on the MBS for PTNS. Table 4 shows the proposed MBS item descriptor for the initial treatment protocol. Table 5 shows the proposed MBS item descriptor for the tapering and maintenance treatment.

Table 4. Proposed MBS item descriptor for PTNS (initial treatment protocol) for the management of OAB

Category 3 – Therapeutic Procedures
MBS XXXX1 Percutaneous Tibial Nerve Simulation, neuromodulation initial treatment protocol, for the treatment of overactive bladder, if: (a) the patient is at least 18 years of age; and (b) the patient has been diagnosed with idiopathic OAB; and (c) the patient has been refractory to, or contraindicated/not suitable for, conservative treatments including anti-cholinergic agents; and (d) the patient is contraindicated or otherwise not suitable for Botox therapy; and (e) the patient is contraindicated or otherwise not suitable for sacral nerve stimulation; and (f) the patient is willing and able to comply with protocol. For each patient—applicable not more than once except if the patient achieves at least a 50% reduction in overactive bladder symptoms from baseline at any time during the treatment period A session should last for a minimum of 45 minutes, of which neurostimulation should last for 30 minutes per session. These sessions are intended to be delivered once per week, for 12 weeks. Claims for this item may not exceed 12 sessions in a calendar year. Fee: $425.00 [Relevant explanatory notes]

Table 5. Proposed MBS item descriptor for PTNS (tapering and maintenance treatment) for the management of OAB

Category 3 – Therapeutic Procedures
MBS XXXX2 Percutaneous Tibial Nerve Simulation, neuromodulation tapering and maintenance treatment, for the treatment of overactive bladder, if: (a) the patient responded to neuromodulation initial treatment protocol and achieved at least a 50% reduction in OAB symptoms. A session should last for a minimum of 45 minutes, of which neurostimulation should last for 30 minutes per session. The interval between sessions should be adjusted with the aim of sustaining therapeutic benefit and no more than XX sessions in a XX month period. Fee: $425.00 [Relevant explanatory notes]

8.2 Direct costs of medical service

The direct costs involved in providing PTNS relates to the time required for a specialist physician to provide the treatment, the cost of the equipment required to administer the treatment, and administrative costs of the facility to offer the treatment. The standard length of a PTNS session is between 45 and 60 minutes, this includes 30 minutes of continuous PTNS treatment, and between 15 to 30 minutes of setup time and post-treatment debriefing. In order to provide PTNS therapy an Urgent PC Neuromodulation System is required. The cost of a single PTNS session is estimated to be between $400.00 and $462.00. The following is a breakdown of the estimated costs of providing PTNS.

Cost of clinical staff

In order to administer PTNS to the patient a specialist physician, or continence nurse acting under the supervision of a urologist or urogynaecologist, will be required to allocate 45 to 60 minutes per treatment session. We estimate the cost for the time required by a specialist to administer PTNS to be $150.00. In instances where PTNS is administered by a continence nurse under the supervision of a urologist or urogynaecologst we estimate the cost to be $37.00 for the time of the continence nurse plus $150.00 for the time of the supervising specialist.

Administrative costs

In order to provide PTNS therapy an appropriate setting is required. As noted in section 4.4 the recommended setting for PTNS therapy is a private consulting/treatment room. The cost impost of utilising a private consulting/treatment for a period of 45 to 60 minutes, as required for PTNS, is estimated to be between $50.00 to $75.00. The costing includes the proportion of rent from premises which could be attributable to the room, which may vary greatly depending on the location of the practice or clinic, and other associated costs such as electricity.

Equipment costs

In order to provide PTNS therapy an Urgent PC Neuromodulation System is required. The Urgent PC Neuromodulation System is comprised of an Urgent PC Stimulator and Urgent PC Lead Sets.

8.3 Proposed fee

The proposed fee for a percutaneous tibial nerve stimulation session administered through the Urgent PC Neuromodulation System is $425.00. This fee remains the same for sessions during the initial protocol treatment phase, the tapering phase and maintenance phase.

The proposed fee of $425.00 accounts for the time impost, administrative required for a specialist physician to offer PTNS services. The proposed fee is also in line with the reimbursement currently available in the United Kingdom, where the UK government provides reimbursement for PTNS under Code A7081 for an amount of £210 GBP per treatment session.

9 CLINICAL MANAGEMENT ALGORITHM – CLINICAL PLACE FOR THE PROPOSED INTERVENTION

9.1 Current clinical management algorithm

Figure 2 provides an overview of the current clinical management algorithm for the OAB patient population. There is a wide range of first-line conservative treatment options for patients who present with OAB. The conservative therapies for treating OAB include behavioural therapies, pharmacologic management including use of oral anticholinergic medications.

Where first-line conservative therapies have failed to provide improvements in OAB symptom presentation patients may be offered either the second-line treatment of Botox therapy, or if they are not a suitable candidate for this treatment (e.g. patient is unwilling and/or unable to self-catheterise), the patient may be offered third-line treatment of sacral nerve stimulation. Currently if a patient has not responded to conservative treatments and is not suitable or eligible for either Botox therapy and/or sacral nerve stimulation the only alternate treatment is best supportive care.

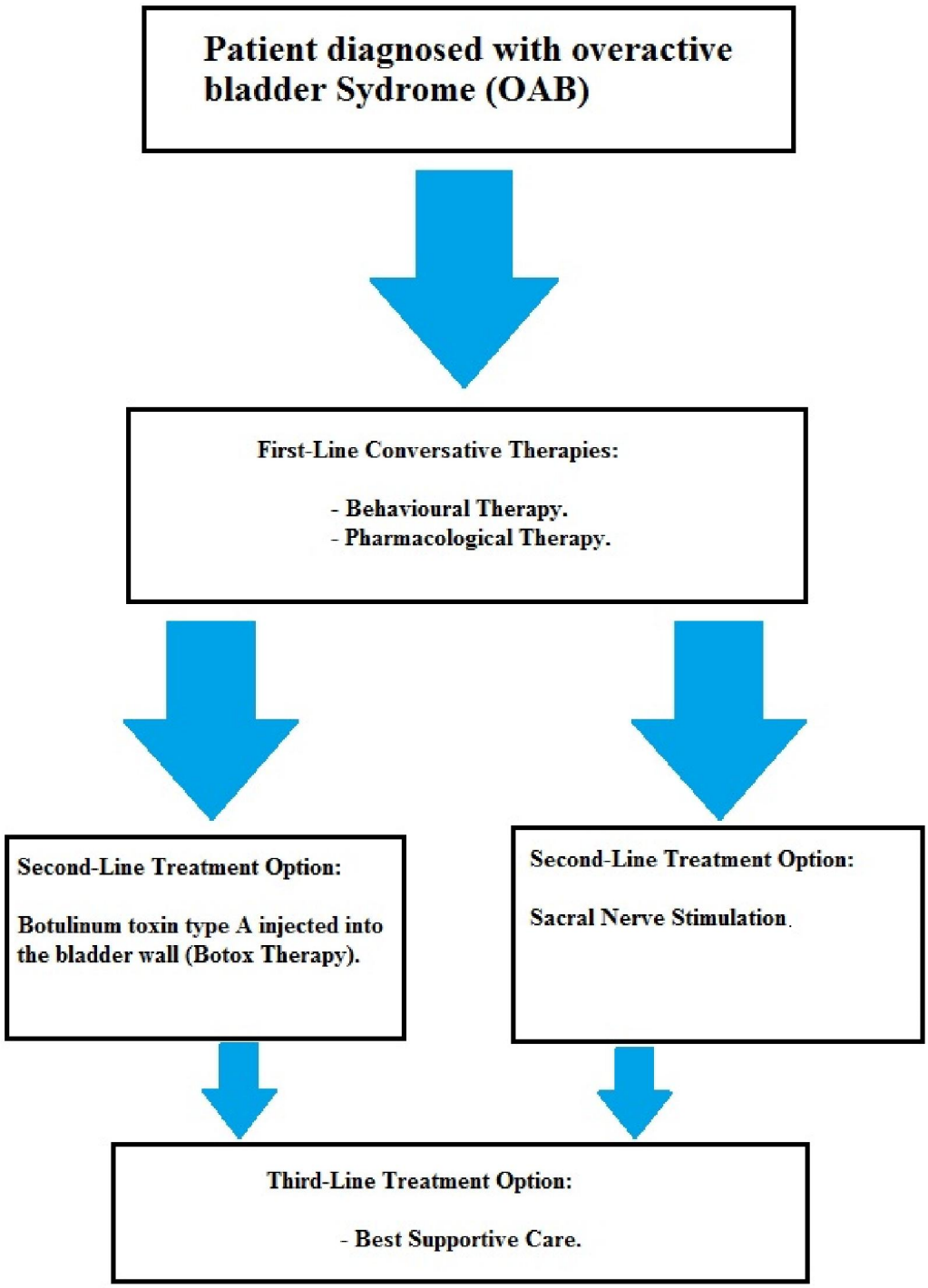

Figure 2: Current approach to the management of OAB

9.2 Proposed clinical management algorithm

The proposed clinical management algorithm for the OAB patient population is illustrated in *Figure 3*. The proposal includes the addition of PTNS therapy as a second-line treatment option for OAB in a patient population that is not suitable or eligible for the second-line treatment options of Botox therapy and/or sacral nerve stimulation.

Botox therapy is currently recommended as a second-line treatment for OAB where first-line conservative pharmacological treatments have failed. The patient selection criteria for PTNS is also recommended for patients who have failed first-line conservative pharmacological treatments. Botox therapy is likely to be recommended before PTNS in the clinical management algorithm due to Botox therapy being a more complete treatment for OAB. The clinical data demonstrates that PTNS will significantly reduce the occurrence of OAB symptom presentation, but the patient may still experience some OAB symptoms. Therefore, PTNS should be recommended for patients who are not suitable or are ineligible for Botox therapy.

Due to the minimally invasive nature of the PTNS procedure it is proposed that PTNS be offered for patients who are either not suitable or eligible to undergo sacral nerve stimulation. In addition, where a patient may be a borderline case for sacral nerve stimulation it may be appropriate to recommend PTNS as a treatment option prior to attempting sacral nerve stimulation. The clinical literature has noted that there is no inherent benefit in providing sacral nerve stimulation without first attempting PTNS, as PTNS is a less invasive and safer treatment option for OAB than sacral nerve stimulation (Staskin, Peters & MacDiarmid, 2012).

PTNS is not expected to replace currently available OAB interventions. Rather, PTNS is expected to add to the OAB treatment algorithm. The MBS listing of PTNS is not expected to replace or be offered as a substitute for either Botox therapy or sacral nerve stimulation; however, there may be some overlap with the patient population in patients who may be considered borderline candidates for either treatment. The reason PTNS is not expected to replace or substitute these treatment options is due to the patient selection criteria proposed for PTNS. The PTNS patient population is primarily OAB patients who are neither suitable nor eligible for Botox therapy or sacral nerve stimulation. Percutaneous tibial nerve stimulation would add to the existing treatment algorithm for OAB, rather than substitute or replace treatment options already available.

The clinical management algorithm presented in this application aligns well with previous MSAC applications for Botox therapy for OAB; however, there are slight differences with the AUA clinical management algorithm. These differences include behavioural treatments and pharmacotherapies indicated as first- and second-line treatments, respectively. Third-line treatments include Boxtox therapy (standard), PTNS (recommended), and sacral nerve stimulation (recommended). PTNS is to be kept on the same line of therapy as Botox therapy and sacral nerve stimulation, in line with the recommendations of the American

Urological Association. PTNS is not offered as a therapeutic option subsequent to Botox therapy or sacral nerve stimulation. PTNS is intended to be presented as an alternate therapeutic option to the currently available second-line OAB treatments. For this reason PTNS is considered a second-line treatment option for OAB.

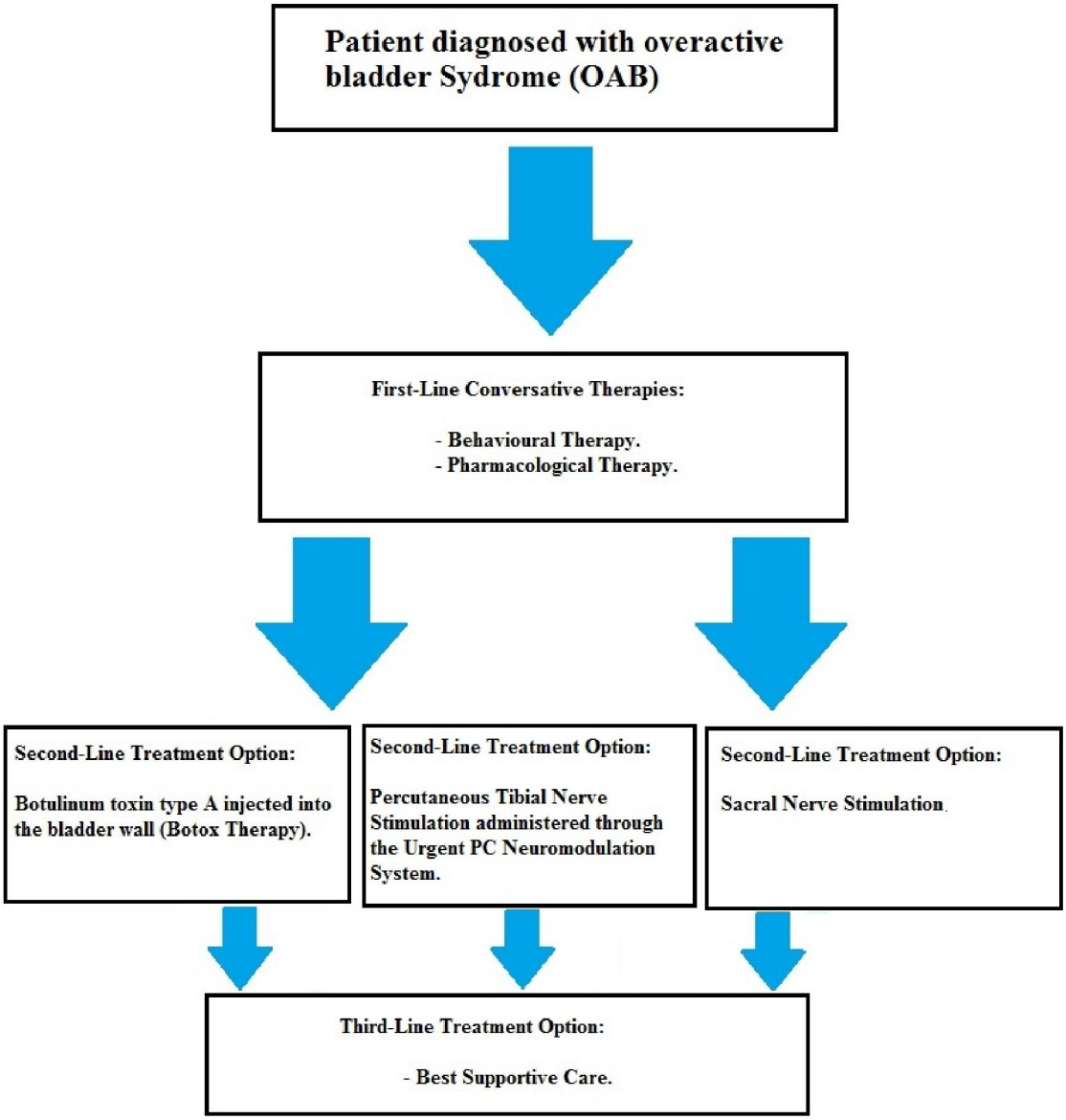

Figure 3: Proposed clinical management algorithm.

10 REGULATORY INFORMATION

The Urgent PC Neuromodulation System, the medical device required for the administration of percutaneous tibial nerve stimulation, is currently registered with the Therapeutic Goods Administration under Australian Register of Therapeutic Goods (ARTG) identifier 152825. The medical device system has been included on the ARTG since the 4 June 2008. The product name is incontinence-control electrical stimulation system, nonimplantable, percutaneous and is categorised as Medical Device Included Class IIa. The sponsor is Endotherapeutics Pty Ltd. The intended purpose for this medical device system as specified on the ARTG is as follows:

> *Intended to treat patients suffering from urinary urgency, urinary frequency, urge incontinence and for treatment of fecal incontinence.*

The Urgent PC Neuromodulation System is currently the only device available for administering PTNS in Australia. The Urgent PC Neuromodulation System is based on the Stoller Afferent Neuromodulation System (SANS) device, which was acquired by Uroplasty, Inc and subsequently developed into the Urgent PC Neuromodulation System. The SANS device is no longer available as it has been replaced/superceded by the Urgent PC Neuromodulation System.

At this time there is one other device which may be capable of administering PTNS therapy, the NURO Neuromodulation System. The NURO Neuromodulation System is not currently CE Marked or FDA approved. As a result this device is not available in Australia and is not widely available internationally. At this time it is unknown whether, if ever, the NURO Neuromodulation System will be made available for use in Australia.

The Urgent PC Neuromodulation System is currently the only device indicated for PTNS administration available in Australia. Practically, the use of the Urgent PC Neuromodulation System is the only means by which clinicians are able to provide PTNS services within Australia.

11 DECISION ANALYTIC

Table 6 outlines the PICO criteria for the proposed medical service. The patient characteristics for the proposed medical service are consistent with the proposed patient population defined in Section 3.2. The treatment outcomes described in Table 6 are consistent with the expected health outcomes identified in Section 7. The medical service must be reviewed in the context that it is intended to lessen the impact of the medical condition being treated, rather than completely resolve the condition. OAB is a chronic disorder which will typically require persistent therapy in order to treat the condition. Therefore, the relevant outcomes must relate to the improvements in symptom presentation, improvements to a patient's quality of life and increased ability to productively contribute to society. Another relevant outcomes relate to health economics in lessening the impact on healthcare resources, be it through a patient's reliance on healthcare professionals to help in the management of their symptoms and/or through expenditure on continence aids. The safety of providing the proposed medical service must also be assessed in comparison to the available treatments, and the proposed comparator, which form the current clinical management algorithm for the medical condition.

Table 6. Summary of PICO to define research question

PICO	Comments
Patients	• at least 18 years of age; and • has been diagnosed with idiopathic OAB; and • has been refractory to, or contraindicated/not suitable for, conservative treatments including anti-cholinergic agents; and • is contraindicated or otherwise not suitable for Botox therapy; and • is contraindicated or otherwise not suitable for sacral nerve stimulation; and • is willing and able to comply with protocol.
Intervention	Percutaneous tibial nerve stimulation (administered through the Urgent PC Neuromodulation System)
Comparator	Sacral nerve stimulation
Outcomes	Reduction in OAB symptom presentation, improvements in patient quality of life, and safety of the proposed intervention.

12 HEALTHCARE RESOURCES

Table 7. List of resources to be considered in the economic analysis

	Provider of resource	Setting in which resource is provided	Proportion of patients receiving resource	Number of units of resource per relevant time horizon per patient receiving resource	Disaggregated unit cost					
					MBS	Safety nets*	Other government budget	Private health insurer	Patient	Total cost
Resources provided to identify eligible population										
MBS Item 104 Initial Consultation	Specialist (urologist or urogynaecologist)	Consulting rooms	TBA		$85.55					TBA
Resources provided to deliver proposed intervention										
Administration of percutaneous tibial nerve stimulation	Specialist (urologist or urogynaecologist)	Consulting rooms, day surgery or outpatient clinic	TBA							TBA
Urgent PC Neuromodulation System – Stimulator	Specialist (urologist or urogynaecologist)	Consulting rooms, day surgery or outpatient clinic	TBA				TBA			$1,950.00 One off cost for treatment centre.
Urgent PC Neuromodulation System – Needle Electrode Lead-Sets.	Specialist (urologist or urogynaecologist)	Consulting rooms, day surgery or outpatient clinic	TBA				TBA			$120.00 per treatment.
Resources provided in association with proposed intervention										
MBS Item 23 Consultation to treat occurrence of PTNS therapy side-effect		Consulting rooms	TBA		$37.05					TBA
Resources provided to deliver comparator 1: Sacral nerve stimulation										
Peripheral nerve evaluation										
MBS Item 104 Specialist consultation	Specialist (urologist or urogynaecologist)	Consulting rooms or hospital	TBA		$85.55					TBA
MBS Item 36666 Pleacement of sacral nerve pulse generator	Specialist (urologist or urogynaecologist)	Surgical	TBA		$334.00					TBA
MBS Item ~~32213~~ 36663 Placement of sacral nerve leads.	Specialist (urologist or urogynaecologist)	Surgical	TBA		$660.95					TBA
MBS Item 60503 Fluoroscopy	Specialist (urologist or urogynaecologist)	Surgical	TBA		$29.75					TBA

	Provider of resource	Setting in which resource is provided	Proportion of patients receiving resource	Number of units of resource per relevant time horizon per patient receiving resource	Disaggregated unit cost					
					MBS	Safety nets*	Other government budget	Private health insurer	Patient	Total cost
MBS item 20690 or 21110 Initiation of anaesthesia	Anaesthetist	Surgical	TBA		TBA					TBA
MBS item XXXX ***(e.g. 23010 to 24136)*** Anaesthesia time units (relative value guide)	Anaesthetist	Surgical			TBA					TBA
MBS Item 18274 Local anaesthesia	Specialist (urologist or urogynaecologist)	Surgical	TBA		$88.65					TBA
InterStim Neurostimulator		Surgical	TBA							$9,550.00
Sacral nerve stimulation lead		Surgical	TBA							$4,420.00
Resources provided in association with comparator : Sacral nerve stimulation										
MBS Item 36665 Adjustments to sacral generator and leads	Specialist (urologist or urogynaecologist)		TBA		$125.40					TBA
Interstim lead introducer kit		Surgical	TBA				TBA			$541.00
Interstim extension lead		Surgical	TBA				TBA			$1,510.00
Sacral nerve test lead		Surgical	TBA				TBA			$393.00
Stimulation cables for intraoperative testing		Surgical	TBA				TBA			$200.00
MBS Items 17610 or 17625 (depends on time spent with patient) Pre-surgery consult	Anaesthetist		TBA		$43.00 Or $150.90					TBA
MBS Item 105 Follow up	Specialist (urologist or urogynaecologist)		TBA		$43.00					TBA
Resources provided to deliver comparator 2: Botox therapy										
MBS Item 104 Initial consult	Specialist (urologist or urogynaecologist)	Consulting rooms or hospital			$85.55					
MBS Item 20910 Initiation of anaesthesia	Anaesthetist	Surgical			$79.20					
MBS Item 18379 Botox therapy	Specialist (urologist or urogynaecologist)	Surgical			$229.85					
PBS Code 6103F Botulinum Toxin Type A		Surgical					$415.50			
Resources provided in association with comparator 2: Botox therapy										
MBS Item 11919 Urodynamic study	Specialist (urologist or urogynaecologist)	Consulting rooms			$428.35					

	Provider of resource	Setting in which resource is provided	Proportion of patients receiving resource	Number of units of resource per relevant time horizon per patient receiving resource	Disaggregated unit cost					
					MBS	Safety nets*	Other government budget	Private health insurer	Patient	Total cost
MBS Items 17610 or 17625 (depends on time spent with patient) Pre-surgery consult	Anaesthetist	Consulting rooms or hospital			$43.00 Or $150.90					
MBS Item 105 Follow up	Specialist (urologist or urogynaecologist)	Consulting rooms or hospital			$43.00					
MBS Item 11900 Urine flow study	Specialist (urologist or urogynaecologist)	Consulting rooms			$27.55					
Resources used to manage patients successfully treated with the proposed intervention										
Ongoing PTNS therapy	Specialist (urologist or urogynaecologist)	Consulting rooms, day surgery or outpatient clinic	TBA							TBA
Urgent PC Neuromodulation System – Needle Electrode Lead-Sets.	Specialist (urologist or urogynaecologist)	Consulting rooms, day surgery or outpatient clinic	TBA							$120.00 per treatment.
Resources used to manage patients who are unsuccessfully treated with the proposed intervention										
Best supportive care			TBA							TBA
Resources used to manage patients successfully treated with comparator 1										
MBS Item 36665 Adjustments to sacral generator and leads	Specialist (urologist or urogynaecologist)	Surgical	TBA		$125.40					TBA
MBS Item 36660 Removal and replacement of sacral nerve stimulator	Specialist (urologist or urogynaecologist)	Surgical	TBA		$255.45					TBA
MBS Item 36662 Removal and replacement of sacral leads	Specialist (urologist or urogynaecologist)	Surgical	TBA		$610.30					TBA
MBS Item 36664 Repositioning of sacral leads	Specialist (urologist or urogynaecologist)	Surgical	TBA		$593.55					TBA
Replacement InterStim generator		Surgical	TBA							$9,550.00
Replacement Sacral leads		Surgical	TBA							$4,420.00
Resources used to manage patients who are unsuccessfully treated with comparator 1										
MBS Item 36658 Removal of sacral nerve stimulator	Specialist (urologist or	Surgical	TBA		$526.40					TBA

	Provider of resource	Setting in which resource is provided	Proportion of patients receiving resource	Number of units of resource per relevant time horizon per patient receiving resource	Disaggregated unit cost					
					MBS	Safety nets*	Other government budget	Private health insurer	Patient	Total cost
	urogynaecologist)									
MBS Item 36667 Removal of sacral leads	Specialist (urologist or urogynaecologist)	Surgical	TBA		$156.30					TBA
Best supportive care			TBA							TBA

13 QUESTIONS FOR PUBLIC FUNDING

- Which health / medical professionals provide the service?
- Are there training and qualification requirements?
- What is the appropriate setting for the service?
- Is the proposed PTNS treatment session duration of between 45 to 60 minutes appropriate for the administration of the medical service?
- What is the key patient exclusion and inclusion criteria for the medical service?
- Is there a subset of the OAB patient population which currently has no access to a satisfactory publicly funded treatment option?
- What is the cost-saving of utilising the proposed medical service?
- What are the economic benefits of improving the way in which OAB is treated?

Bibliography

1 Clinical articles

Barnett, G.& Ockrim, J. 'Re: Cost of neuromodulation therapies for overactive bladder: percutaneous tibial nerve stimulation versus sacral nerve stimulation: M. Martinson, S. MacDiarmid and E. Black J Urol 2013; 189: 210-216' (2013). *Journal of Urology*, 190 (4), 1444-5.

Biemans, J. M.& van Balken, M. R. 'Efficacy and effectiveness of percutaneous tibial nerve stimulation in the treatment of pelvic organ disorders: a systematic review' (2013). Neuromodulation, 16 (1), 25-33.

Burton, C., Sajja, A., and Latthe, P. M. 'Effectiveness of percutaneous posterior tibial nerve stimulation for overactive bladder: A systematic review and meta-analysis' (2012). *Neurourology and Urodynamics*, 31(8), 1206-1216.

Congregado Ruiz, B., Pena Outeirino, X. M. et al. 'Peripheral afferent nerve stimulation for treatment of lower urinary tract irritative symptoms' (2004). *Eur Urol*, 45 (1), 65-9.

Finazzi-Agro, E., Petta, F., Sciobica, F., Pasqualetti, P., Musco, S., and Bove, P. 'Percutaneous tibial nerve stimulation effects on detrusor overactivity incontinence are not due to a placebo effect: A randomized, double-blind, placebo controlled trial' (2010). *The Journal of Urology*, 184, 2001-2006.

Gaziev, G., Topazio, L. et al. 'Percutaneous Tibial Nerve Stimulation (PTNS) efficacy in the treatment of lower urinary tract dysfunctions: a systematic review' (2013). *BMC Urology*, 13, 61.

Govier, F. E., Litwiller, S., Nitti, V., Kreder, K. J., and Rosenblatt, P. L. 'Percutaneous afferent neuromodulation for the refractory overactive bladder: Results of a multicentre study' (2001). *The Journal of Urology*, 165, 1193-1198.

Klingler, H. C., Pycha, A. et al. 'Use of peripheral neuromodulation of the S3 region for treatment of detrusor overactivity: A urodynamic-based study' (2000). *Urology*, 56 (5), 766-71.

Leong, F. C., McLennan, M. T., Barr, S. A., and Steele, A. C. 'Posterior tibial nerve stimulation in patients who have failed anticholinergic therapy: efficacy and time to response' (2011). *Female Pelvic Medicine & Reconstructive Surgery*, 17(2), 74-75.

Levin, P. J., Wu, J. M. et al. 'The efficacy of posterior tibial nerve stimulation for the treatment of overactive bladder in women: a systematic review' (2012). *International Urogynecology Journal*, 23 (11), 1591-7.

Martinson, M., MacDiarmid, S., and Black, E. 'Cost of neuromodulation therapies for overactive bladder: Percutaneous tibial nerve stimulation versus sacral nerve stimulation' (2013). *The Journal of Urology*, 189, 210-216.

MacDiarmid, S. A., Peters, K. M., Abbas Shobeiri, S., Wooldridge, L. S., Rovner, E. S., Leong, F. C., Siegel, S. W., Tate, S. B., and Feagins, B. A. 'Long-term durability of percutaneous tibial nerve stimulation for the treatment of overactive bladder' (2010). *The Journal of Urology*, 183, 234-240.

Medical Services Advisory Committee (MSAC) (2012). Consultation Decision Analytical Protocol (DAP) to guide the assessment of Transurethral injection of BOTOX® (botulinum toxin) for the treatment of urinary incontinence due to neurogenic detrusor overactivity (NDO). MSAC application 1221. Canberra, Australia.

Moossdorff-Steinhauser, H. F.& Berghmans, B. 'Effects of percutaneous tibial nerve stimulation on adult patients with overactive bladder syndrome: a systematic review' (2013). *Neurourology & Urodynamics*, 32 (3), 206-14.

Nuhoglu, B., Fidan, V. et al. 'Stoller afferent nerve stimulation in woman with therapy resistant over active bladder; a 1-year follow up' (2006). *Int Urogynecol J Pelvic Floor Dysfunct*, 17 (3), 204-7.

Peters, K. M., Carrico, D. J., MacDiarmid, S. A., Wooldridge, L. S., Khan, A. U., McCoy, C. E., Franco, N., and Bennett, J. B. 'Sustained therapeutic effects of percutaneous tibial nerve stimulation: 24-month results of the STEP study' (2013a). *Neurourology and Urodynamics*, 32(1), 24-29.

Peters, K. M., Carrico, D. J., Perez-Marrero, R. A., Khan, A. U., Wooldridge, L. S., Davis, G. L., and MacDiarmid, S. A. 'Randomized trial of percutaneous tibial nerve stimulation versus sham efficacy in the treatment of overactive bladder syndrome: Results from the SUmiT trial' (2010). *The Journal of Urology*, 183, 1438-1443.

Peters, K., Carrico, D. J., Wooldridge, L. S., Miller, C. J., and MacDiarmid, S. A. 'Percutaneous tibial nerve stimulation for the long-term treatment of overactive bladder: 3-Year results of the STEP study' (2013b). *The Journal of Urology*, 189, 2194-2201.

Peters, K. M., MacDiarmid, S. A., Wooldridge, L. S., Leong, F. C., Shobeiri, S. A., Rovner, E. S., Siegel, S. W., Tate, S. B., Jarnagin, B. K., Rosenblatt, P. L., and Feagins, B. A. 'Randomized trial of percutaneous tibial nerve stimulation versus extended-release tolterodine: Results from the overactive bladder innovative therapy trial' (2009). *The Journal of Urology*, 182, 1055-1061.

Sancaktar, M., Ceyhan, S. T. et al. 'The outcome of adding peripheral neuromodulation (Stoller afferent neuro-stimulation) to anti-muscarinic therapy in women with severe overactive bladder' (2010). *Gynecological Endocrinology*, 26 (10), 729-32.

Staskin, D. R., Peters, K. M., MacDiarmid, S. A., Shore, N., and de Groat, W. C. 'Percutaneous tibial nerve stimulation: A clinically and cost effective addition to the overactive bladder algorithm of care' (2012). *Current Urology Reports*, 13(5), 327-334.

van Balken, M. R., Vandoninck, V. et al . 'Posterior tibial nerve stimulation as neuromodulative treatment of lower urinary tract dysfunction' (2001). *The Journal of Urology*, 166 (3), 914-8.

van Balken, M. R., Vergunst, H. & Bemelmans, B. L.. 'Prognostic factors for successful percutaneous tibial nerve stimulation' (2006). *European Urology*, 49 (2), 360-5.

van der Pal, F., van Balken, M. R. et al. 'Correlation between quality of life and voiding variables in patients treated with percutaneous tibial nerve stimulation' (2006). *Bju International*, 97 (1), 113-6.

Vandoninck, V., van Balken, M. R. et al. 'Percutaneous tibial nerve stimulation in the treatment of overactive bladder: urodynamic data' (2003). *Neurourology & Urodynamics*, 22 (3), 227-32.

Vecchioli-Scaldazza, C., Morosetti, C., Berouz, A., Giannubilo, W., and Ferrara, V. 'Solifenacin succinate versus percutaneous tibial nerve stimulation in women with overactive bladder syndrome: Results of a randomized controlled crossover study' (2013). *Gynecologic and Obstetric Investigation*, 75(4), 230-234.

2 Reports and guidelines

Australian Institute of Health and Welfare (AIHW) (2006). *Australian incontinence data analysis and development*. AIHW cat. No. DIS 44, Canberra, Australia.

Australian Institute of Health and Welfare (AIHW) (2015). *Procedure data cubes*. [Internet]. Australian Government. Available from: http://www.aihw.gov.au/hospitals-data/procedures-data-cubes/ [Accessed 9 June 2015].

Australia Government Department of Human Services (2014). *Annual Report 2013-14. ISSN: 1838-2452 (Online)*. Available from: http://www.humanservices.gov.au/spw/corporate/publications-and-resources/annual-report/resources/1314/resources/annual-report-2013-14.pdf [Accessed 9 June 2015].

Australian Government Department of Human Services (2015a). *Medicare Australia Statistics - Item 18379*. [Internet]. Available from: http://medicarestatistics.humanservices.gov.au/statistics/do.jsp?_PROGRAM=%2Fstatistics%2Fmbs_item_standard_report&DRILL=ag&group=18379&VAR=services&S

TAT=count&RPT_FMT=by+state&PTYPE=month&START_DT=201411&END_DT=201507 [Accessed 28 September 2015].

Australian Government Department of Human Services (2015b). *Medicare Australia Statistics - Item 36663*. [Internet]. Available from: http://medicarestatistics.humanservices.gov.au/statistics/do.jsp?_PROGRAM=%2Fstatistics%2Fmbs_item_standard_report&DRILL=ag&group=36663&VAR=services&STAT=count&RPT_FMT=by+state&PTYPE=calyear&START_DT=201401&END_DT=201412 [Accessed 28 September 2015].

Australian Government Department of Human Services (2015c). *Medicare Australia Statistics - Item 36666*. [Internet]. Available from: http://medicarestatistics.humanservices.gov.au/statistics/do.jsp?_PROGRAM=%2Fstatistics%2Fmbs_item_standard_report&DRILL=ag&group=36666&VAR=services&STAT=count&RPT_FMT=by+state&PTYPE=calyear&START_DT=201401&END_DT=201412 [Accessed 28 September 2015].

Australian Government Department of Human Services (2015d). *Medicare Australia Statistics - Item 36663*. [Internet]. Available from: http://medicarestatistics.humanservices.gov.au/statistics/do.jsp?_PROGRAM=%2Fstatistics%2Fmbs_item_standard_report&DRILL=ag&group=36663&VAR=services&STAT=count&RPT_FMT=by+state&PTYPE=month&START_DT=201411&END_DT=201507 [Accessed 28 September 2015].

Australian Government Department of Human Services (2015e). *Medicare Australia Statistics - Item 36666*. [Internet]. Available from: http://medicarestatistics.humanservices.gov.au/statistics/do.jsp?_PROGRAM=%2Fstatistics%2Fmbs_item_standard_report&DRILL=ag&group=36666&VAR=services&STAT=count&RPT_FMT=by+state&PTYPE=month&START_DT=201411&END_DT=201507 [Accessed 2 September 2015].

Australian Government Department of Human Services (2015f). *Medicare Australia Statistics - Item 36667*. [Internet]. Available from: http://medicarestatistics.humanservices.gov.au/statistics/do.jsp?_PROGRAM=%2Fsta

tistics%2Fmbs_item_standard_report&DRILL=ag&group=36667&VAR=services&STAT=count&RPT_FMT=by+state&PTYPE=calyear&START_DT=201401&END_DT=201412 [Accessed 28 September 2015].

Australian Government Department of Human Services (2015g). *Medicare Australia Statistics - Item 36668*. [Internet]. Available from: http://medicarestatistics.humanservices.gov.au/statistics/do.jsp?_PROGRAM=%2Fstatistics%2Fmbs_item_standard_report&DRILL=ag&group=36668&VAR=services&STAT=count&RPT_FMT=by+state&PTYPE=calyear&START_DT=201401&END_DT=201412 [Accessed 28 September 2015].

Australian Government Department of Human Services (2015h). *Medicare Australia Statistics - Item 36667*. [Internet]. Available from: http://medicarestatistics.humanservices.gov.au/statistics/do.jsp?_PROGRAM=%2Fstatistics%2Fmbs_item_standard_report&DRILL=ag&group=36667&VAR=services&STAT=count&RPT_FMT=by+state&PTYPE=month&START_DT=201501&END_DT=201507 [Accessed 28 September 2015].

Australian Government Department of Human Services (2015i). *Medicare Australia Statistics - Item 36668*. [Internet]. Available from: http://medicarestatistics.humanservices.gov.au/statistics/do.jsp?_PROGRAM=%2Fstatistics%2Fmbs_item_standard_report&DRILL=ag&group=36668&VAR=services&STAT=count&RPT_FMT=by+state&PTYPE=month&START_DT=201501&END_DT=201507 [Accessed 28 September 2015].

Coyne, Payne, Bhattacharyya *et al*: The impact of urinary urgency and frequency on health-related quality of life in overactive bladder: results from a national community survey. Value Health 2004; 7: 455.

Gormley, E. A., Lightner, D. J., Burgio, K. L., Chai., T. C., Clemens, J. Q., Culkin, D. J., Das, A. K., Foster, H. E., Scarpero, H. M., Tessier, C. D and Vasavada, S. P. 'Diagnosis and treatment of overactive bladder (Non-neurogenic) in adults: AUA/SUFU guideline' (2014). *American Urological Association Education and Research, Inc.*

Uroplasty Inc (2006). *Urgent PC Neuromodulation System: Stimulator Instructions for Use*. Minnetonka, USA.