SCREENING FOR URINARY INCONTINENCE

RECOMMENDATION TO THE HEALTH RESOURCES AND SERVICES ADMINISTRATION

DECEMBER 2017

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Screening for Urinary Incontinence: Recommendation to Health Resources and Services Administration was developed by the Multidisciplinary Steering Committee of the Women's Preventive Services Initiative. These recommendations should not be viewed as a rigid body of rules. The recommendations are general and intended to be adapted to many different situations, taking into account the needs and resources particular to the locality, the institution, or the type of practice. Variations and innovations that improve the quality of patient care are encouraged rather than restricted. The purpose of these guidelines will be well served if they provide a firm basis on which local norms may be built.

Evidence Summaries and systematic reviews are used with permission from Oregon Health & Science University.

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Clinical Recommendations

The Women's Preventive Services Initiative recommends screening women for urinary incontinence annually. Screening should ideally assess whether women experience urinary incontinence and whether it impacts their activities and quality of life. The Women's Preventive Services Initiative recommends referring women for further evaluation and treatment if indicated.

Implementation Considerations

The Women's Preventive Services Initiative recommends screening women for urinary incontinence as a preventive service. Factors associated with an increased risk for urinary incontinence include increasing parity, advancing age, and obesity; however, these factors should not be used to limit screening.

Several screening tools demonstrate fair to high accuracy in identifying urinary incontinence in women. Although minimum screening intervals are unknown, given the prevalence of urinary incontinence, the fact that many women do not volunteer symptoms, and the multiple, frequently-changing risk factors associated with incontinence, it is reasonable to conduct annually.

Research Recommendations

1. Study the incidence and prevalence of urinary incontinence to better identify risk factors over the life course.

2. Assess whether there are racial and ethnic differences related to urinary incontinence.

3. Determine the efficacy of screening and treatment for urinary incontinence.

Screening for Urinary Incontinence

Systematic Review for the Women's Preventive Services Initiative

Investigators and Staff:
Heidi D. Nelson, MD, MPH
Amy Cantor, MD, MPH
Miranda Pappas, MA
Liev Miller, BA

Pacific Northwest Evidence-based Practice Center
Oregon Health & Science University

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INTRODUCTION

Urinary incontinence is the involuntary loss of urine.[1] Several types of urinary incontinence have been described by the International Urogynecological Association/International Continence Society.[2] Stress incontinence is characterized by an inability to retain urine during physical exertion or activities that increase intraabdominal pressure, such as coughing or sneezing, and results from impaired sphincter function. Urgency incontinence is the involuntary loss of urine associated with the sensation of a sudden urge to void and usually results from contraction, over activity, or dysfunction of the detrusor muscle, resulting in a rise in bladder pressure. The term "overactive bladder" is defined as urinary urgency with or without incontinence, usually accompanied by frequency and nighttime voiding. Approximately one-third of women with overactive bladder also experience urgency incontinence. Mixed urinary incontinence is used to describe situations when both stress and urge incontinence are present.

Approximately 25% of young women,[3] 44 to 57% of middle-aged and postmenopausal women,[4] and 75% of older women experience some involuntary urine loss.[5] Stress urinary incontinence is more common in younger women in association with pelvic floor trauma and uterine prolapse, often related to vaginal delivery.[6] Urgency and mixed urinary incontinence are more common in older women in association with overactive bladder with or without sphincter dysfunction[1,6] Urinary incontinence can adversely affect women's function and well-being as it may interfere with work and social function, sexual function, quality of life, morbidity and independence.[7]

Risk Factors

Obesity is a strong risk factor for incontinence. Based on national surveys and prevalence data, obese women are nearly three times as likely to experience urinary incontinence compared with non-obese women.[8,9] Weight loss is a first line lifestyle intervention associated with improvement or resolution of urinary incontinence, particularly among women with stress incontinence. Pregnancy and childbirth is associated with risk of pelvic

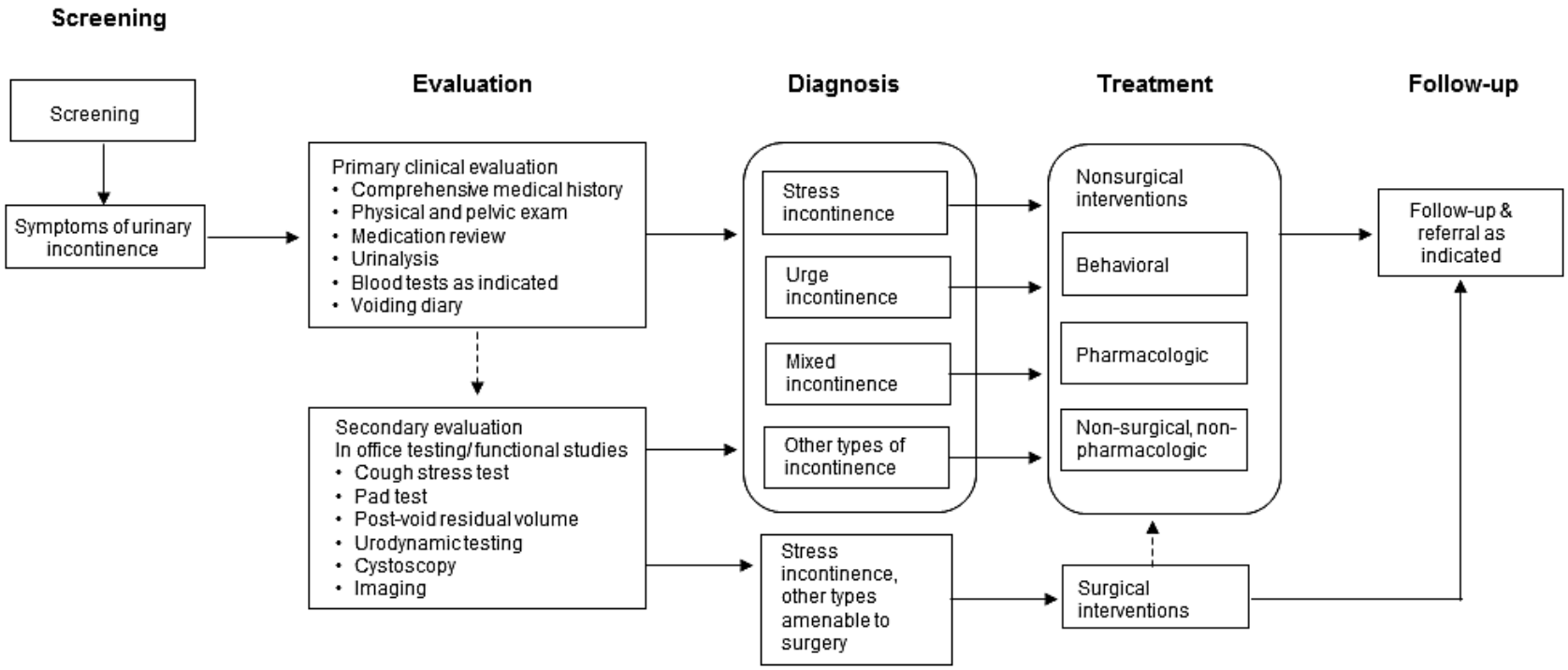
organ prolapse. Women who have had a vaginal delivery are at higher risk of stress incontinence compared with women who have undergone cesarean section.[10] This relationship is less clear among women with urgency incontinence or overactive bladder. Advancing age is also a risk factor, however, age alone may not be an independent risk factor when taking into account other comorbid conditions.[11] Other potentially modifiable risk factors associated with an increased risk of incontinence include smoking, caffeine intake, diabetes, depression, vaginal atrophy, constipation, and functional status. Additional risk factors include menopausal status, hysterectomy, cognitive impairment, functional impairment, and other chronic medical conditions.

Clinical Practice

Urinary incontinence is a common and sometimes debilitating condition, yet it is often not addressed during routine health care.[12] Women may be reluctant to discuss their incontinence and urinary symptoms due to embarrassment, social stigma, acceptance as normal, lack of knowledge about treatment options, or fear of surgery. In addition, most clinicians do not routinely inquire about urinary incontinence and the condition may only reach their attention if the woman seeks help. However, of women who ultimately seek medical attention, 30% are not evaluated for their symptoms and 80% are not treated.[12]

Consequently, urinary incontinence is currently under recognized and undertreated in women of all ages in the United States. Early identification and intervention could reduce progression of symptoms and the need for more complex and costly treatments later. Treatment could improve social and physical function and reduce complications of incontinence such as urinary tract infections, skin ulceration, falls and fractures.[13] No guidelines currently recommend standardized screening for urinary incontinence, despite its potential to identify affected women. Once identified, women can undergo clinical evaluations to diagnose the predominant type of incontinence and determine the severity of symptoms, leading to appropriate treatment and management as outlined in the clinical pathway below (**Figure 1**). Current clinical methods for the evaluation and treatment of urinary incontinence in women, including use of exercises, lifestyle modifications, medications, and surgery were recently summarized in a narrative review.[14]

Figure 1. Clinical Pathway



Current clinical recommendations address components of the diagnostic evaluation (**Table 1**).

Table 1. Guidelines for Evaluating Urinary Incontinence

Organization	Recommendation
American Urological Association (AUA)[15]	• The evaluation should include: focused history, focused physical examination, objective demonstration of stress urinary incontinence, assessment of post void residual urine volume, urinalysis, and culture if indicated. • Additional diagnostic studies can be performed to assess the integrity and function of the lower urinary tract, including: pad testing and/or voiding diary, urodynamics, cystoscopy, imaging. • Indications for further testing include: an inability to make a definitive diagnosis based on symptoms and the initial evaluation, concomitant overactive bladder symptoms, prior lower urinary tract surgery, including failed anti–incontinence procedures, known or suspected neurogenic bladder, negative stress test, abnormal urinalysis such as unexplained hematuria or pyuria, excessive residual urine volume, grade III or greater pelvic organ prolapse, any evidence for dysfunctional voiding.
American Congress of Obstetricians and Gynecologists (ACOG) and American Urogynecologic Society (AUGS)[16]	Recommendation addresses evaluation prior to surgery: the basic office evaluation, including normal post void residual urine volume, negative urinalysis result, and positive cough stress test result, is not inferior to urodynamic testing in women with stress-predominant urinary incontinence undergoing anti-incontinence surgery.
European Association of Urology (EAU)[17]	Components include: • Validated and appropriate questionnaire when standardized assessment is required. • Voiding diary to evaluate co-existing storage and voiding dysfunction. • Urinalysis, treat a symptomatic urinary tract infection appropriately; do not treat asymptomatic bacteriuria in elderly patients to improve urinary incontinence. • Ultrasound to measure post-voiding residual. • Measure post-voiding residual in patients with voiding dysfunction and with complicated urinary incontinence.
Canadian Urological Association (CUA)[18]	The evaluation should be systematic and include: history, medical history, review of systems, social history, physical examination, investigations and treatment expectations.

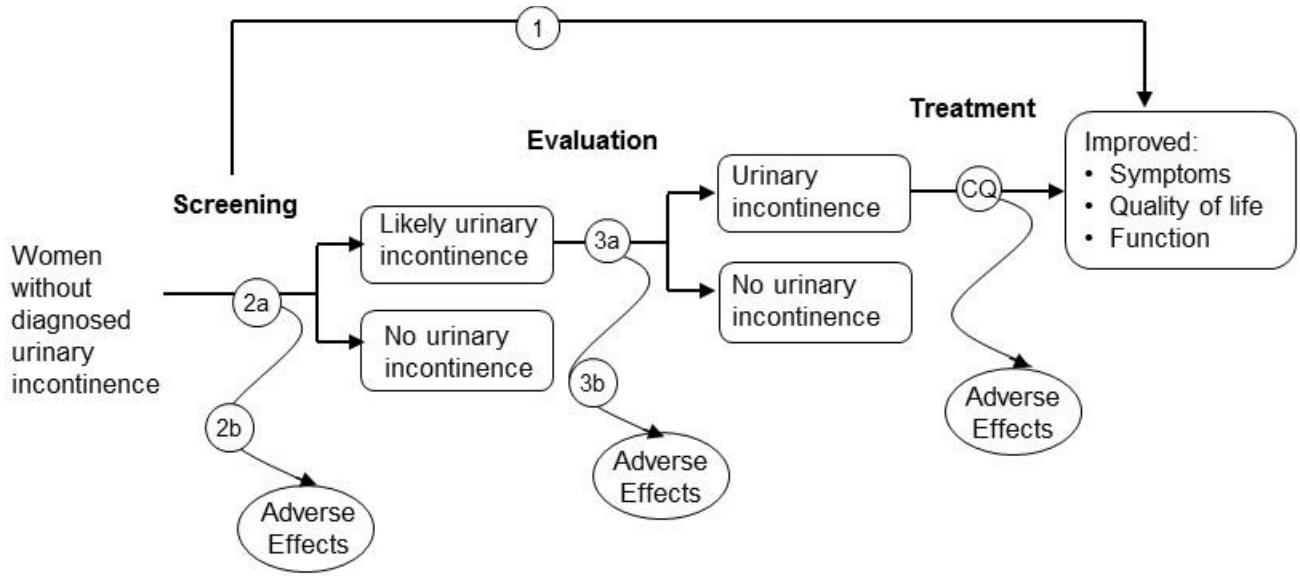
Treatment includes behavioral, pharmacologic,[19,20] nonpharmacologic,[20] and surgical interventions specific to the type and severity of incontinence. Treatment choice depends on the type of incontinence, patient preferences, and degree of incontinence. Conservative interventions are recommended as the first line of treatment because they are the least

invasive and typically have fewer risks or side effects compared with most pharmacologic or surgical interventions. Non-invasive treatments include lifestyle interventions, such as weight loss, fluid intake modification, and avoidance of bladder irritants; physical therapy, such as pelvic floor muscle training; behavioral approaches such as biofeedback and timed voiding; and anti-incontinence devices. Pharmacological interventions exhibit varying levels of effectiveness, but are associated with higher discontinuation rates from unwanted side effects.[20] Surgical treatments are often reserved for women with insufficient improvement following conservative therapy. However, depending on severity of symptoms, surgery may be an appropriate initial approach for some women.

METHODS

The WPSI Advisory Group determined the scope and key questions for this review. Investigators created an analytic framework outlining the key questions and patient populations, interventions, and outcomes (**Figure 2**). The target population includes women who are not currently pregnant and have not been previously diagnosed with urinary incontinence.

Figure 2. Analytic Framework



Key Questions

1. In women without previously diagnosed urinary incontinence, does screening for urinary incontinence improve symptoms, quality of life, and function?

2a. What is the accuracy of methods to screen for urinary incontinence? How does accuracy vary between age, social-demographic, and cultural groups; and among women with comorbid conditions or who use additional medications?

2b. What are the potential adverse effects of screening for urinary incontinence?

3a. Among women with likely urinary incontinence by screening, what is the accuracy of methods to diagnose urinary incontinence?

3b. What are the potential adverse effects of methods to diagnose urinary incontinence?

Contextual Questions

Two contextual questions were also included to provide additional background information. Contextual questions are not reviewed using systematic review methodology but are addressed using the strongest, most relevant evidence. These include the following:

1. What is the effectiveness of treatments for urinary incontinence in improving symptoms, quality of life, and function?
2. What are the potential adverse effects of treatments for urinary incontinence?

Literature Searches

A research librarian conducted electronic database searches in Ovid MEDLINE, the Cochrane Central Register of Controlled Trials, and the Cochrane Database of Systematic Reviews from 1996 to October 13, 2017. Search strategies are provided in **Appendix 1**. Investigators also manually reviewed reference lists of relevant systematic reviews and articles.

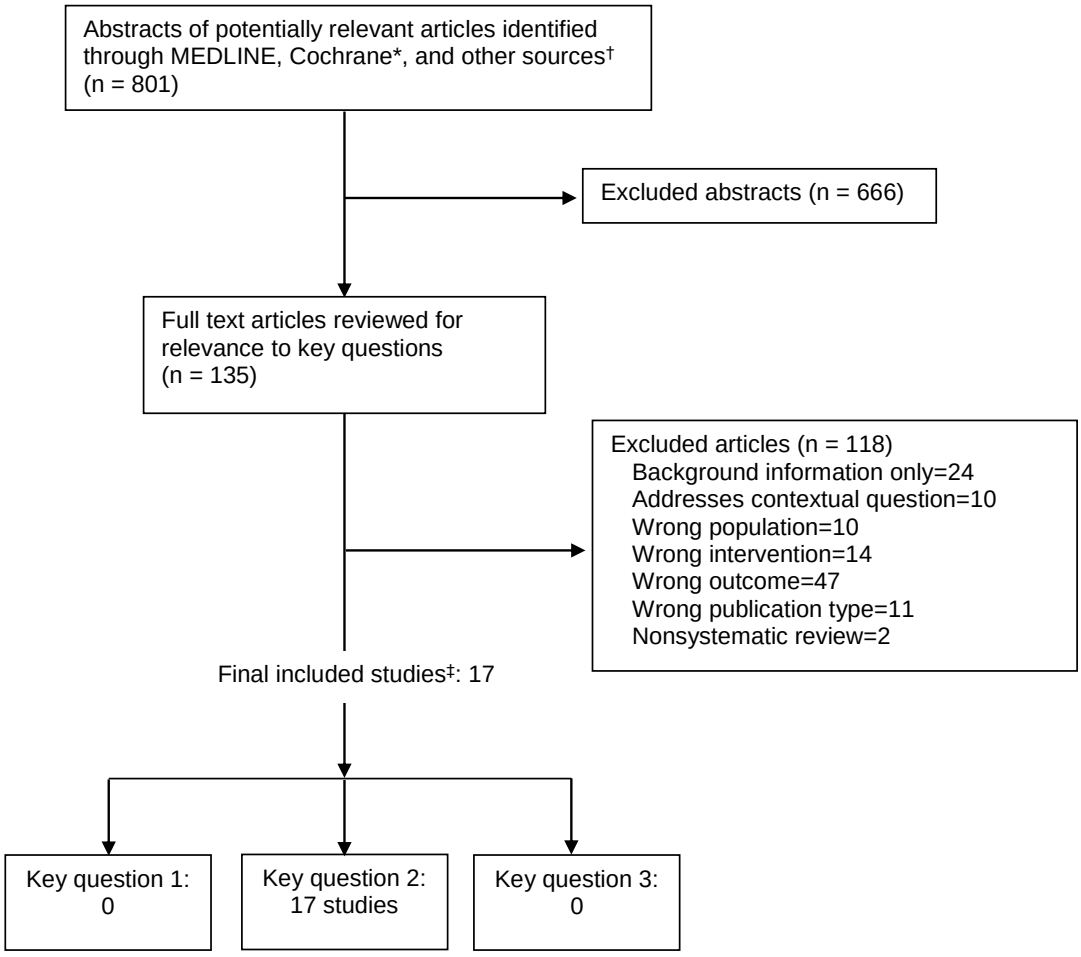
Study Selection

All titles and abstracts identified through searches were independently reviewed for eligibility against pre-specified inclusion/exclusion criteria organized by PICOTS (population, intervention, comparator, outcome, timing, study design) by a trained member of the research team (**Appendix 2**). Studies marked for possible inclusion by a reviewer underwent a full-text review. All results were tracked in an EndNote® database (Thomson Reuters, New York, NY).

Each full-text article was independently reviewed by two trained members of the research team for inclusion or exclusion based on pre-specified eligibility criteria. A best evidence approach was applied when reviewing abstracts and selecting studies to include for this review that involves using the most relevant studies with the strongest methodologies.[21-23] Disagreements were resolved by discussion and consensus. Results of the full text review were tracked in the EndNote® database, including the reason for exclusion. Results of searches and study selection are described in **Figure 3**.

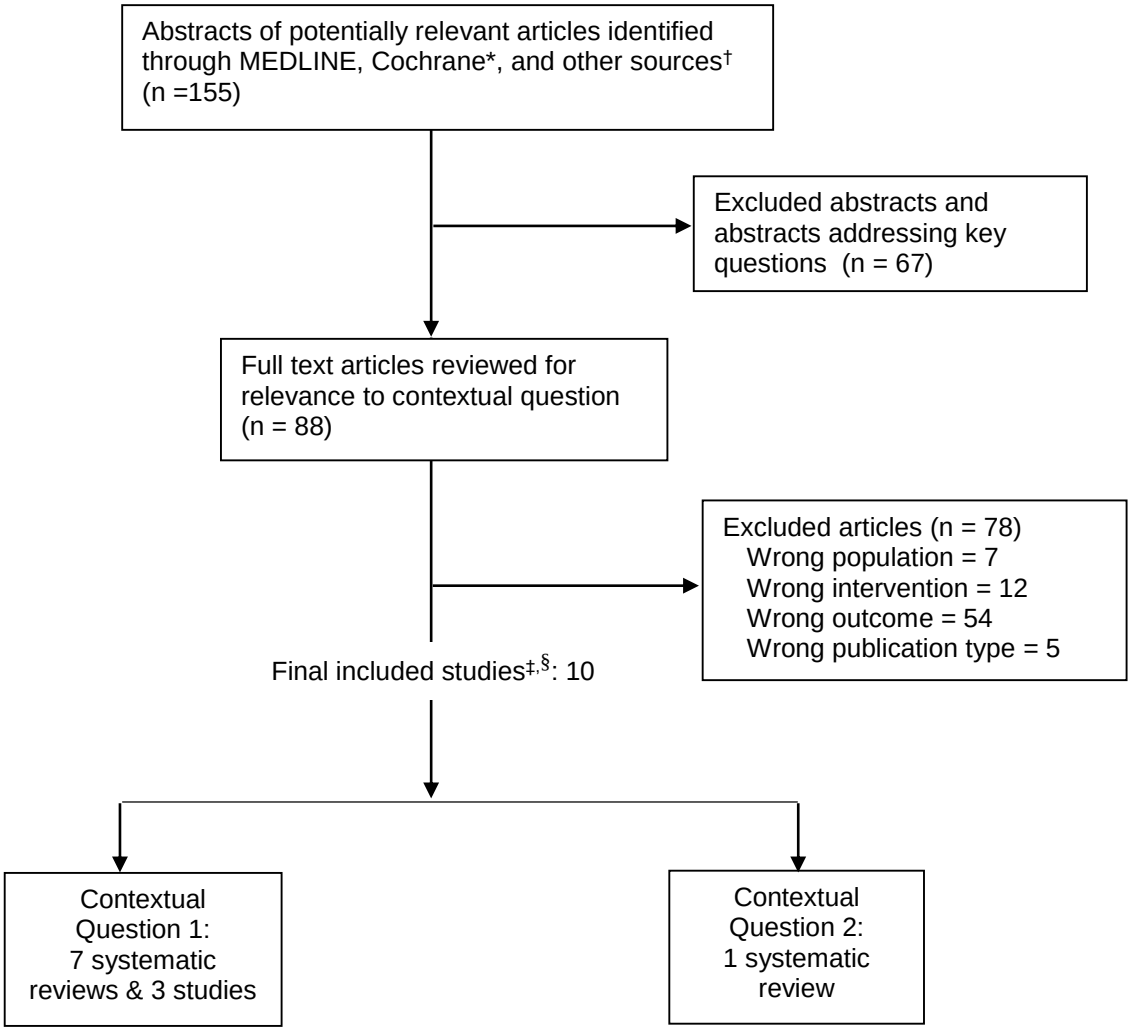
Figure 3. Literature Flow Diagrams

A. Key Questions



*Cochrane databases include the Cochrane Central Register of Controlled Trials and the Cochrane Database of Systematic Reviews.
†Identified from reference lists, hand searching, and other sources.
‡Studies that provided data and contributed to the body of evidence were included.

B. Contextual Questions



*Cochrane databases include the Cochrane Central Register of Controlled Trials and the Cochrane Database of Systematic Reviews.
†Identified from reference lists, hand searching, and other sources.
‡Studies that provided data and contributed to the body of evidence were included.
§ 1 systematic review was included in both contextual questions

Studies were included that enrolled non pregnant women and women without diagnosed urinary incontinence. Studies of screening tests for urinary incontinence included methods currently used in practice settings in the United States. Comparisons included screening methods and approaches compared with usual care; or one method compared with another method. Outcomes of studies included clinical outcomes related to screening and subsequent treatment (KQ 1); measures of test performance (area under the receiver-

operator characteristics curve [AUC] values; sensitivity, specificity; likelihood ratios) (KQ 2a; 3a); false positive/negative results, anxiety, distress, and other adverse events impacting quality of life (KQ 2b, 3b). Studies conducted in settings applicable to the United States were particularly relevant. Findings related to population subgroups were specifically included when available.

Randomized controlled trials (RCTs), large (>100) prospective cohort studies, diagnostic accuracy studies, and systematic reviews were included if they met inclusion criteria. Other study designs, such as case-control and modeling studies, were included when evidence from other study designs was lacking.

For the contextual questions on treatment (CQ 1, 2), studies comparing treatment against a placebo group were selected for consistency across treatment types, and studies comparing two or more different interventions were excluded because of the heterogeneity of these data. Systematic reviews were primarily selected to provide contextual summaries of relevant research, and RCTs and observational studies were cited when systematic reviews were unavailable. Treatment effectiveness outcomes include continence (voluntary bladder control), number of events attributable to active treatment, relative risk, number needed to treat (NNT), and quality of life measures.

Data Management and Analysis

For studies meeting inclusion criteria, data were abstracted into tables to summarize relevant information including characteristics of study populations, interventions, comparators, outcomes, study designs, settings, and methods. All data abstractions were reviewed for completeness and accuracy by another member of the team.

Predefined criteria were used to assess the quality of individual controlled trials, systematic reviews, and observational studies,[24] rating them as "good," "fair," or "poor," depending on methodological limitations.[24] Each study was independently rated for quality by two team members and disagreements were resolved by consensus.

No statistical meta-analyses were conducted because studies were lacking to provide estimates. Studies were qualitatively synthesized according to interventions, populations, and outcomes measured. Studies and their findings are described in a narrative, descriptive format to provide an overview of relevant evidence for each key question.

Assessing Applicability

Applicability is defined as the extent to which the effects observed in published studies are likely to reflect the expected results when a specific intervention is applied to the population of interest under "real-world" conditions.[23] It is an indicator of the extent to which research included in a review might be useful for informing clinical decisions. Factors important for understanding the applicability of studies were considered including differences in the interventions, comparators, populations, and settings.

Establishing the Strength of Recommendations

Investigators created evidence maps to provide a descriptive summary of supporting evidence for each question. Results of systematic reviews and research studies, epidemiologic data, U. S. Preventive Services Task Force recommendations, clinical best practices, and other relevant sources are included in the evidence maps.

RESULTS

Key Question 1. Effectiveness of Screening for Urinary Incontinence

No studies evaluating the effectiveness of screening for urinary incontinence in women met inclusion criteria.

Key Question 2a. Accuracy of Screening Methods

Seventeen diagnostic accuracy studies of 18 different methods for screening for urinary incontinence met inclusion criteria (**Appendix 3**).[25-41] Studies ranged in size from 69 to 1,911 participants and enrolled women from the community or primary care, gynecology, or urogynecology clinics in the United States,[26,28-31,35,38-41] United Kingdom,[25,34] Denmark,[27] Austria,[33] Norway,[36] Finland,[37] and Australia.[32] Although participants' ages varied, age-specific results were not provided. Race, body mass index (BMI), parity, and menopausal status were not uniformly reported. Most studies enrolled participants based on the presence of incontinence symptoms, although some studies did not, particularly studies of women recruited from the community or primary care clinics.

Methods included various clinician or self-administered questionnaires addressing symptoms of urinary incontinence (**Table 2**). Responses were typically scored using a Likert scale or other point system. Diagnostic cut-points were determined by comparing scores against reference standards that differed across studies including clinical diagnosis based on physical examinations and tests,[25,27-30,36,40] urodynamic testing,[26,31,33-35,37-39,41] and the pad test.[32] Several studies reported results specifically for stress and urge (or overactive bladder) incontinence, as well as general or mixed incontinence. Results were expressed as AUC c-statistics, sensitivity and specificity values, or positive and negative likelihood ratios.

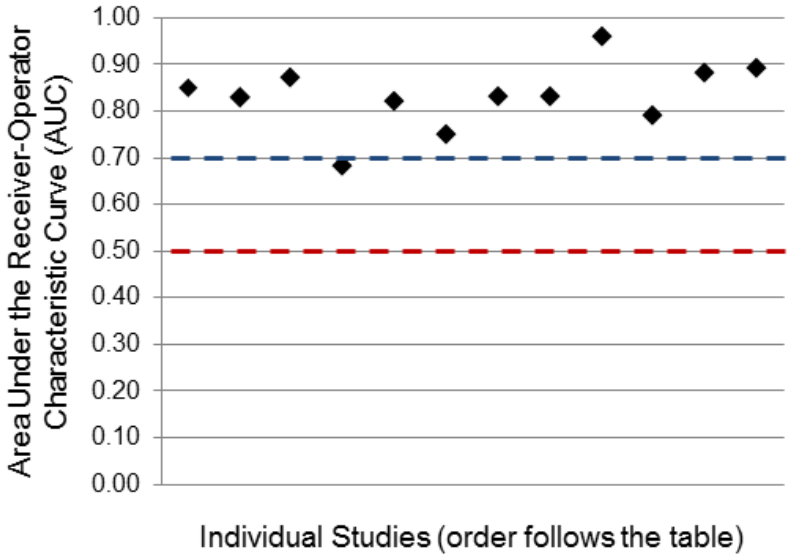
Table 2. Patient Instruments to Asses Urinary Incontinence

Instrument	Abbreviation	Description	Studies of instrument
3 Incontinence Questions[29]	3IQ	3 questions about urine leakage to identify stress urinary incontinence, urge incontinence, other causes, or mixed incontinence.	Brown, 2006[29]
Actionable Bladder Symptom Screening Tool[30]	ABSST	8 items using a 4-point Likert scale and a 7-day recall period. Questions focus on frequency, leakage, urgency, and nighttime voiding and the impact on social relations, work interference, and embarrassment. Score of ≥3 (range of 0 to 8) indicates need for further evaluation and/or treatment.	Cardozo, 2014[30]
Bladder Control Self-Assessment Questionnaire[42]	B-SAQ	Self-completed questionnaire with a scale ranging from 0 (not at all) to 3 (a great deal) for 4 symptom questions and 4 corresponding bother questions. Scores are totaled for each set of questions from 0 to 12, with higher scores indicating symptoms of urinary incontinence and higher degree of bother.	Basra, 2012[25]
Bristol Female Lower Urinary Tract Symptoms Questionnaire[43]	BFLUTS	19-item questionnaire with 3 main domains: incontinence (5 items related to urge, frequency, stress, unpredictable, and nocturnal incontinence); voiding (3 items relating to hesitancy, straining to start, and intermittency); and filling (4 items relating to nocturia, urgency, bladder pain, and frequency); with additional subscales for sexual function (2 items related to sex life being spoiled and leakage during intercourse) and quality of life (5 items related to changing outer clothes, cutting down fluid, daily tasks, avoidance of situations, and overall quality of life).	Khan, 2004[34]
Detrusor Instability Score[44]	DIS	10 questions regarding the patient's urogynecological dysfunction. Each question is scored 0, 1, or 2. Zero indicates stress urinary incontinence, and 1 or 2 indicates slight or marked detrusor instability. Scores range from 0 to 20, with a score from 0 to 7 indicating slight detrusor instability, and a score ≥8 marked detrusor instability.	Klovning, 1996[36]
Gaudenz-Incontinence-Questionnaire[33]		26 questions related to stress urinary incontinence and detrusor instability.	Haeusler, 1995[33]

Instrument	Abbreviation	Description	Studies of instrument
Incontinence Screening Questionnaire[32]	ISQ	Self-administered, 6-item questionnaire designed to distinguish between stress urinary incontinence, and urge urinary incontinence.	Gunthrope, 2000[32]
Michigan Incontinence Symptom Index[40]	M-ISI	10 items using a 4-point Likert scale; subdomains include stress urinary incontinence, urge urinary incontinence, and pad use, along with a bother domain. Total scores range from 0 to 32; bother domain scores 0 to 8; stress incontinence and urge incontinence scores 0 to 12; and the pad use 0 to 8. Higher scores indicate greater symptoms/bother.	Suskind, 2015[40]
Overactive Bladder Awareness Tool[45]	OAB-V8	8 items describing symptoms; each scored on a 6-point Likert scale ranging from 0 (not at all) to 5 (a very great deal). Scores are summed and patients with ≥8 are instructed to speak to their physicians about their urinary symptoms.	Basra, 2012[25]
Questionnaire for Urinary Incontinence Diagnosis[28]	QUID	Stress and urge incontinence subscales with 3 items each. For each item, scores range from 0 (none of the time) to 5 (all of the time), with total scores for each subscale ranging from 0 to 15. Stress incontinence is diagnosed with a stress score ≥4 and urge incontinence with an urge score ≥6.	Bradley, 2005[28]
Urogenital Distress Inventory, 6 items[46,47]	UDI-6	Short-form with 6 questions of urogenital distress rated on a scale of 0 (does not experience symptom) to 4 (bothered by symptom quite a bit). Higher scores indicate higher disability.	Lemack and Zimmern, 1999[38]

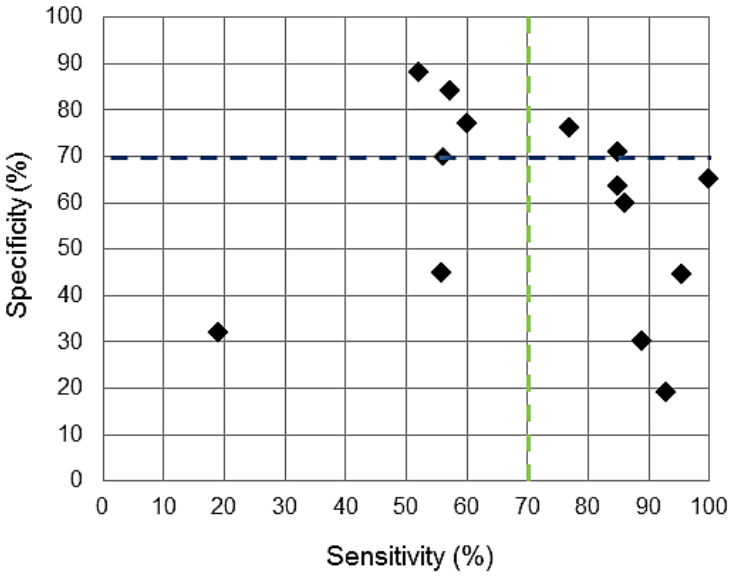
Four studies of five methods reported AUC values for stress, urge, and general or mixed incontinence (**Figure 4**).[25,28,30,40] Fourteen studies reported sensitivity and specificity for stress incontinence (**Figure 5**), 12 for urge incontinence (**Figure 6**), and six for general or mixed incontinence (**Figure 7**). Performance measures varied across the 17 studies, with only five studies of six methods (B-SAQ, OAB-V8, QUID, 3IQ, ABSST, and MISI) reporting results indicating fair to good clinical utility—the relevance and usefulness of an intervention to patient care (AUC >0.70; sensitivity and specificity >70%).[25,28-30,40] These studies are described in **Table 3** and their quality ratings in **Appendix 4**.

Figure 4. Area Under the Receiver-Operator Characteristic Curves (AUC) of Clinical Screening Methods for Urinary Incontinence



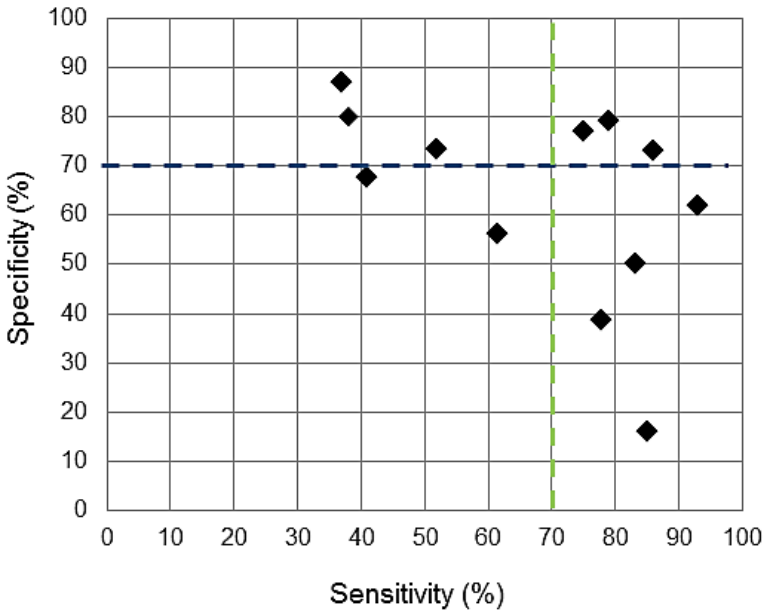
Study	AUC
Basra, 2012	
B-SAQ stress	0.85
B-SAQ urge	0.83
B-SAQ mixed	0.87
OAB-V8 stress	0.68
OAB-V8 urge	0.82
OAB-V8 mixed	0.75
Bradley, 2005	
QUID stress	0.83
QUID urge	0.83
Cardozo, 2014	
ABSST	0.958
Suskind, 2015	
MISI stress	0.79
MISI urge	0.88
MISI total	0.89

Figure 5. Sensitivity and Specificity of Clinical Screening Methods for Urinary Stress Incontinence



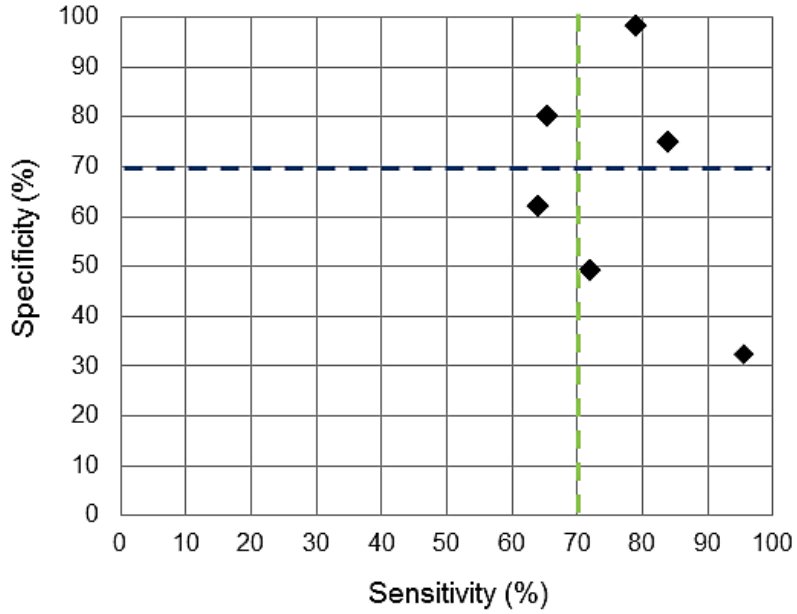
Study	Sensitivity %	Specificity %
Bergman, 1990		
Questionnaire	56	70
Borup, 2008		
Self-report	95.5	44.6
Bradley, 2005		
QUID	85	71
Brown, 2006		
3IQ	86	60
Diokno, 1990		
Self-report	57.2	84.1
Haeusler, 1995		
GIQ	55.9	44.7
Khan, 2004		
Bristol	89	30
Klingele, 2002		
Self-report	52	88
Klovning, 1996		
DIS	60	77
Kujansuu, 1982		
Urgency score	19	32
Lemack, 1999		
UDI-6	84.8	63.4
Sand, 1988		
Symptoms	100	65.2
Suskind, 2015		
MISI	77	76
Walters, 1988		
One question	93	19

Figure 6. Sensitivity and Specificity of Clinical Screening Methods for Urinary Urge Incontinence



Study	% Sensitivity	% Specificity
Bergman, 1990		
Questionnaire	38	80
Borup, 2008		
Self-report	40.9	67.6
Bradley, 2005		
QUID	79	79
Brown, 2006		
3IQ	75	77
Diokno, 1990		
Self-report	52	73.2
Haeusler, 1995		
GIQ	61.5	56.1
Khan, 2004		
Bristol	85	16
Klingele, 2002		
Self-report	37	87
Kujansuu, 1982		
Urgency score	93	62
Lemack, 1999		
UDI-6	83.3	50.0
Sand, 1988		
Symptoms	77.9	38.7
Suskind, 2015		
MISI	86	73

Figure 7. Sensitivity and Specificity of Clinical Screening Methods for Mixed or All Types of Urinary Incontinence



Study	% Sensitivity	% Specificity
Borup, 2008		
Self-report	95.5	32.4
Cardozo, 2014		
ABSST	79.1	98.2
Gunthorpe, 2000		
ISQ	65.5	80.0
Klingele, 2002		
Self-report	72	49
Kujansuu, 1982		
Urgency score	64	62
Suskind, 2015		
MISI	84	75

Table 3. Studies of Clinical Screening Methods Reporting High Accuracy

Author; quality	Population & setting	Baseline Symptoms	Screening tests	Definition of positive test	Reference standard	Accuracy measures (95% CI)
Basra, 2012[25] Fair	223 women from general gynecology, urogynecology, and primary care clinics in London. Mean age 49 years; 75% White; 17% Black; 8% Asian. BMI, parity, menopausal status not reported.	Not recruited on the basis of symptoms; reasons for visit: 46% with lower track symptoms; 51% with unrelated problems, 60% of these with bothersome symptoms.	B-SAQ OAB-V8	B-SAQ: aggregate symptom score ≥3 or bother score ≥1 OAB-V8: total score ≥8	Clinical diagnosis	AUC (B-SAQ; OAB-V8) Stress: 0.85; 0.68 Overactive bladder: 0.83; 0.82 Mixed: 0.87; 0.75
Bradley, 2005[28] Fair	117 women with symptoms of urinary incontinence seen at the urogynecology clinic at the University of Pennsylvania. Median age 56 years (22-87); 73% White; 21% Black; 2% Asian; 3% Hispanic. Median BMI 26.6 kg/m^2 (17.4-47.1); median	Duration of symptoms: <1 year: 15%; 1-5 years: 50%; >5 years: 30%	QUID	Urge: score ≥6 Stress: ≥4	Clinical diagnosis	Stress; urge; mixed Sensitivity: 85% (75 to 91); 79% (69 to 86); 70% (57 to 80) Specificity: 71% (51 to 87); 79% (54 to 94); 86% (71 to 95) PPV: 90% (81 to 96); 95% (87 to 99) NPV: 61% (42 to 77); 43% (26 to 60) AUC: 0.83 (0.74 to 0.92); 0.83 (0.75 to 0.92)

Author; quality	Population & setting	Baseline Symptoms	Screening tests	Definition of positive test	Reference standard	Accuracy measures (95% CI)
	parity 2 (0-8); 52% postmenopausal.					
Brown, 2006[29] Good	301 community-dwelling women age ≥40 years from 5 U.S. clinical sites with baseline urinary incontinence. Mean age 56 years; 69% White; 13% Black; 12% Latina; 2% Asian/Pacific Islander; 4% Native American/other. Mean BMI not reported; parity 0 (6%); 1-2 (52%); 3-4 (32%); >4 (9.0%); 33% postmenopausal; 34% hysterectomy.	≥3 episodes per week for ≥3 months; 7 years mean duration of incontinence; 30 mean total episodes per week.	3IQ	Response to third question	Extended clinical evaluation for all participants	Stress; urge Sensitivity: 86% (79 to 90); 75% (68 to 81) Specificity: 60% (51 to 68); 77% (69 to 84) PLR: 2.13 (1.71 to 2.66); 3.29 (2.39 to 4.51) NLR: 0.24 (0.16 to 0.35); 0.32 (0.24 to 0.43)

Author; quality	Population & setting	Baseline Symptoms	Screening tests	Definition of positive test	Reference standard	Accuracy measures (95% CI)
Cardozo, 2014[30] Poor	100 women recruited from 6 U.S. gynecology clinics. Mean age 47.9 years; 71% White; 19% Black. Mean BMI 28.9 kg/m$^{2;}$ parity and menopausal status not reported.	53% with symptoms of urgency or overactive bladder	ABSST	Total score ≥3	Clinical diagnosis	Sensitivity: 79.1% Specificity: 98.2% PPV: 97.1% NPV: 86.2% AUC: 0.958
Suskind, 2015[40] Good	214 community dwelling women age 35-64 years in Michigan. Mean age 50.5 years; 32% White; 68% Black. Mean BMI 33.1 kg/m^2; mean parity 2.2; 57% no menstrual period in the last year.	54% self-reported incontinence; 53% using pads	MISI total; stress subdomain; urge subdomain	Total: score ≥7 Stress: ≥3 Urge: ≥5	Extended clinical evaluation for all participants	Stress; urge; total Sensitivity: 77%; 86%; 84% Specificity: 73%; 76%; 75% PPV: 43%; 73%; 75% NPV: 92%; 86%; 84% AUC: 0.79; 0.88; 0.89

Abbreviations: 3IQ: three incontinence questions; ABSST: actionable bladder symptom screening tool; AUC: area under the receiver operating characteristic curve; BMI: body mass index; B-SAQ: bladder control self-assessment questionnaire; CI: confidence interval; MISI: Michigan incontinence symptom index; NLR: negative likelihood ratio; NPV: negative predictive value; OAB-V8: overactive bladder awareness tool (eight-item); PLR: positive likelihood ratio; PPV: positive predictive value; QUID: questionnaire for urinary incontinence diagnosis.

Two studies that did not recruit participants on the basis of symptoms of incontinence are most applicable to population screening.[25,40] A good-quality study of 214 community-dwelling women age 35 to 64 years in Michigan evaluated responses on the Michigan Incontinence Symptom Index (MISI) against a physician's clinical diagnosis based on an extended clinical evaluation.[40] Fifty-three percent of participants reported symptoms of incontinence at baseline and 57% were postmenopausal. The MISI is a 10-item questionnaire that uses a 4-point Likert scale to score up to 32 points with domains specific to stress and urge incontinence. The clinical evaluation was provided to all participants and included the POP-Q pelvic exam, vaginal exam, Q-tip angle test, measurement of bladder post-void residual volume, urodynamics with urethral pressure profile, leak point pressure and uroflow, and a paper towel test. Results indicated AUC values of 0.79 for stress, 0.88 for urge, and 0.89 for mixed incontinence.

A fair-quality study of 223 women from general gynecology, urogynecology and primary care clinics in London compared results of the Bladder control Self-Assessment Questionnaire (B-SAQ) and Overactive Bladder Awareness Tool (OAB-V8) against a clinical diagnosis.[25] In this study, 46% of women had symptoms of incontinence at baseline and others reported bothersome symptoms. The B-SAQ is an 8-item questionnaire that evaluates urinary symptoms, incontinence, and bother on a 4-point Likert scale. The OAB-V8 is an 8-item questionnaire that evaluates symptoms of overactive bladder including urinary frequency, nocturia, urgency and urgency incontinence on a 6-point Likert scale. Both instruments provide results for stress incontinence, overactive bladder, and mixed incontinence. Although the clinical diagnosis was considered the reference standard for the study, details of the clinical evaluation were not described. Results indicated AUC values for the B-SAQ of 0.85 for stress incontinence, 0.83 for overactive bladder, and 0.87 for mixed incontinence. For the OAB-V8, values were 0.68, 0.82, and 0.75, respectively.

Two additional studies enrolled women with baseline symptoms of urinary incontinence.[28,29] In a good-quality study of community-dwelling women with 3 or more episodes of incontinence per week, the 3 Incontinence Questions (3IQ) instrument was evaluated against a physician's diagnosis based on an extended clinical evaluation that was provided for all participants.[29] The 3IQ is a brief screening questionnaire that determines whether a woman has symptoms consistent with stress or urge incontinence. The extended clinical evaluation included a comprehensive history, physical and neurological exam, pelvic exam, cough stress test, post void residual volume, and 3-day voiding diary. Results indicated 86% sensitivity and 60% specificity for stress incontinence, and 75% sensitivity and 77% specificity for urge incontinence.

A fair-quality study of 117 women with symptoms of urinary incontinence seen at a urogynecology clinic, the Questionnaire for Urinary Incontinence Diagnosis (QUID) was evaluated against a physician's diagnosis that varied by patient. The QUID is a 20-item questionnaire using a 6-point Likert scale. In this study, the 3-item stress score and separate 3-item urge score were specifically evaluated. Results indicated 85% sensitivity and 71% specificity for stress incontinence, 79% sensitivity and 79% specificity for urge incontinence, and 70% sensitivity and 86% specificity for mixed incontinence.

Key Question 2b. Adverse Effects of Screening

No studies evaluating the adverse effects of screening for urinary incontinence in women met inclusion criteria.

Key Questions 3a and 3b. Accuracy and Adverse Effects of Diagnostic Methods

No studies evaluating the accuracy and adverse effects of diagnostic methods to evaluate women after screening for urinary incontinence met inclusion criteria.

Contextual Question 1. Effectiveness of Treatments for Urinary Incontinence

For this contextual question, a summary of the best available evidence for four categories of treatment is provided. The effectiveness of treatments for urinary incontinence has been evaluated through systematic reviews of surgical[48-51] and nonsurgical interventions.[20] In addition, a narrative review recently summarized some of the most commonly employed treatments, and highlighted an approach to initiate conservative and medical therapy while incorporating patient preference into evaluation and treatment.[14]

Behavioral interventions

Behavioral interventions are often considered first line treatments because they can be offered in a primary care setting, are non-invasive, have fewer reported side effects, and are less likely to cause harm. Although recommendations for lifestyle modification are largely based on the plausibility that such interventions may effectively reduce intraabdominal pressure (in the case of weight loss), remove potential bladder stimulants (caffeine or alcohol), or limit pelvic floor pressure, research to support these interventions is limited.

A systematic review of lifestyle interventions for management of urinary incontinence in adults included 11 trials (n=5974).[52] Three studies investigated caffeine use and three evaluated the effect of reducing fluid volume intake (N=166), but there were no differences in incontinence symptoms. Side effects of reduced fluid intake included constipation, thirst, and headaches. No trials of alcohol use, carbonated beverages, smoking, physical forces, clinical constipation, and straining were included in this review.[52]

Four trials focused on weight loss interventions in obese or overweight women that ranged from 3 to 12 months compared to no treatment. Findings suggested that weight loss may reduce incontinence among overweight women, although two of the trials included diabetics. Consequently, symptom improvement could have been due to improved glycemic control rather than weight loss alone. A randomized trial of overweight and obese women (n=338) reported a decrease in weekly incontinence episodes in patients enrolled in an intensive 6-month weight loss program.[53] In addition, limited observational data indicate that weight loss is associated with improved symptoms of urinary incontinence in obese women, with greater benefits for stress incontinence versus urge incontinence.[53,54]

A Cochrane review on bladder training suggests that bladder training may be helpful for treating mixed, stress, or urge incontinence.[55] Data from eight trials (n=858) enrolling mostly female participants with urinary incontinence at baseline were included in the review. Three trials comparing bladder training with no bladder training (n=172) reported

favorable point estimates; however, confidence intervals were wide and differences were not statistically significant.

A systematic review evaluated the effectiveness of pelvic floor muscle training compared with no treatment, or inactive control treatments, for urinary incontinence in women.[56] Pelvic floor muscle training was defined as a program of repeated voluntary pelvic floor muscle contractions taught and supervised by a healthcare professional. Outcomes included symptoms as determined by patient observations, quantification of symptoms based on measured urine loss, clinical observations (anatomical, functional), and quality of life. Eighteen trials (n=1,051) were included in the analysis. Study quality was limited by the absence of details on participant selection and a lack of clear description of the programs. Women treated with pelvic floor muscle training were more likely to report cure or improvement, better quality of life, fewer leakage episodes per day, and less urine leakage on short office-based pad tests than controls. Women also reported more satisfaction and improved sexual outcomes with the active treatment versus placebo or no treatment.

Pharmacologic interventions

A recent systematic review evaluated the effectiveness of pharmacologic and nonsurgical treatments for urinary incontinence in adult women.[20] The study population included adult women in ambulatory care settings receiving nonsurgical, nonpharmacological or pharmacologic agents available in the United States. Reported outcomes included rates of continence, improvements in urinary incontinence, and harms of treatments. A number of different validated tools were used to measure urinary incontinence treatment success, and thresholds differed by outcome. Pooled and absolute risk differences were calculated, when possible, to estimate the NNT to achieve continence.

Stress incontinence. Four RCTs (n=640) of postmenopausal women compared topical estrogen formulations with placebo.[20] Two trials found that vaginal estrogen tablets increased continence rates compared to placebo (RR 20.68, 95 % CI, 1.23 to 346.46). This effect was not seen with transdermal estrogen.

Studies of duloxetine, a serotonin and noradrenaline reuptake inhibitor (SNRI), demonstrated significant improvement, although not resolution, of symptoms of stress urinary incontinence compared to placebo. However, two studies (n= 736) demonstrated greater continence with placebo than with duloxetine (pooled RR 0.92, 95 percent CI, 0.86 to 0.99). While the use of duloxetine resulted in improved urinary incontinence for 75 to 140 women per 1000 overall, discontinuation due to adverse effects occurred in 129 women per 1,000 women treated. In another review of 8 RCTs, discontinuation rates for duloxetine were 17%.[57]

Urge incontinence. Antimuscarinic medications are the mainstay of treatment for urgency incontinence and include 6 agents available in varying doses and formulations. Medications in this category include
darifenacin, fesoterodine, oxybutynin, solifenacin, tolterodine, and trospium. Overall efficacy of these agents is comparable, but discontinuation rates and dose responses vary.

In a systematic review of RCTs,[20] oxybutynin improved urinary incontinence (NNT 114 per 1,000, 95% CI 40 to 129) and increased continence more often than placebo, but also

resulted in higher treatment discontinuation due to adverse effects (NNT 63 per 1,000, 95% CI 12 to 127). Dry mouth was the most commonly reported adverse effect and was more frequently reported in immediate release formulations than controlled release or transdermal.

Tolterodine increased continence rates and significantly improved urinary incontinence compared to placebo (85 per 1,000, 95% CI 40 to 129), while discontinuation rates due to adverse effects did not differ between treatment and placebo groups. Twenty-four RCTs examined clinical outcomes with tolterodine versus placebo.

Darifenacin significantly improved urgency urinary incontinence and quality of life compared with placebo (NNT 117 per 1,000, 95% CI 57 to 177) and treatment discontinuation rates due to adverse effects did not differ between groups. However, adverse effects were more commonly reported in treatment groups.

Solifenacin increased continence rates and demonstrated a dose response among those treated with higher doses (NNT 107 per 1,000, 95% CI 58 to 156). Increased continence rates with greater benefits were reported in those treated with higher doses. Discontinuation rates were more common in treatment groups due to adverse effects (NNT 13 per 1,000, 95% CI 1 to 26), but were not dose responsive.

Fesoterodine also increased continence rates with significant improvement in urinary incontinence compared to placebo. A dose-response effect of treatment was also reported, with a significantly better treatment response with a higher dose of the drug. Resolution of urinary incontinence occurred in 120 women per 1,000 (95% CI 58 to 202), but treatment discontinuation rates were higher among those treated due to adverse effects (31 per 1,000, 95% CI 10 to 56).

Botulinum toxin may be used in women with urge or urgency predominant mixed urinary incontinence who do not tolerate or who do not respond to pharmacotherapy. Botulinum toxin is injected into the detrusor muscle. Four RCTs (n=185) suggested a reduction in urinary incontinence episodes after intravesicular injection. Improved continence rates or resolution of urgency urinary incontinence was demonstrated in two trials, and one trial reported a dose-response relationship.[58] Published RCTs reported treatment related adverse effects in 40 percent of those treated. Adverse effects include an increased risk of post void residual and/or urinary retention.

Non-surgical, non-pharmacologic interventions

Two systematic reviews of studies evaluating the effectiveness of mechanical devices designed to control urinary leakage by insertion within the vagina; within the urethra; or applied to the external surface of the urethra were inconclusive.[20,59] Studies enrolled few participants, had short follow-up periods, and were methodologically limited.

Surgical interventions

Surgical interventions are generally reserved for women without sufficient improvement with more conservative therapies, but may be the first choice of treatment depending on the severity and etiology of a woman's symptoms.[48] Surgery provided by specialists results in

high cure rates for stress incontinence, even in older women. Synthetic midurethral mesh slings are the most common primary surgical treatment for stress incontinence.[16] Other surgical options include urethral bulking agents, retropubic suspension, and fascial slings.[60-62]

Contextual Question 2. Adverse Effects of Treatments

No harms have been identified in studies of behavioral interventions, such as pelvic floor muscle training or weight loss interventions. In a large systematic review of nonsurgical treatments for urinary incontinence,[20] discontinuation rates and adverse effects were more common among patients treated with drugs, while adverse effects with nonpharmacological treatments were uncommon. For drugs, harms commonly include dry mouth, constipation, heartburn, and urinary retention. Information on long-term drug safety is generally unavailable. Surgical complications include direct injury to the lower urinary tract and general surgical complications such as hemorrhage, infection, bowel injury, or wound complications.

SUMMARY

Results of the systematic review are summarized in the Evidence Map below. No studies were identified that addressed the effectiveness and adverse effects of screening for urinary incontinence in women, or the accuracy and adverse effects of methods to diagnose urinary incontinence among women identified by screening. Research is needed to address these evidence gaps.

Seventeen studies evaluated the diagnostic accuracy of 18 screening methods against a clinical diagnosis of incontinence or results of diagnostic tests. Screening methods included brief clinician or self-administered questionnaires describing symptoms. While performance measures varied across studies, five studies of six methods (B-SAQ, OAB-V8, QUID, 3IQ, ABSST, MISI) reported results indicating fair to good clinical utility (AUC >0.70; sensitivity and specificity >70%). Of these, two studies did not recruit participants on the basis of symptoms of incontinence and more closely reflected the population of women expected to be screened in routine clinical practice. Screening instruments evaluated in these studies (MISI, AB-SAQ, OAB-V8) include 8 to 10 items, are easily scored and interpreted, and demonstrated high levels of accuracy, with most AUC values above 0.80. Additional research of the feasibility, accuracy, and effectiveness of these instruments in larger, more diverse screening populations is needed to establish a standardized screening method that could be widely implemented in routine practice.

Published systematic reviews described the effectiveness and adverse effects of behavioral, pharmacologic, non-surgical non-pharmacologic, and surgical interventions for urinary incontinence. Randomized trials and observational studies indicate that weight loss improves symptoms of urinary incontinence in obese women, particularly for stress compared to urge incontinence. Women treated with pelvic floor muscle training were more likely to report cure or improvement and had better satisfaction and quality of life than controls. In randomized trials, drugs were more effective than placebo in improving continence, but the magnitude of the effect was low (absolute risk difference <20% for all drugs). Two drugs (solifenacin and festerodine) demonstrated dose-response effects among treatment groups for improving symptoms. Studies do not support the effectiveness of intravaginal or intraurethral devices for treating incontinence. Surgical interventions (e.g., synthetic midurethral mesh slings, urethral bulking agents, retropubic suspension, fascial slings) are effective for selected cases of stress incontinence, although trials are limited. Additional research, including head-to-head trials, comparing effectiveness and adverse effects of various treatments, as well as combinations and sequences of treatments, is need to provide a stronger evidence base for patient and clinician decision making.

FUTURE RESEARCH NEEDS

Evidence supporting the effectiveness of screening and treatment for urinary incontinence is lacking. More research is needed to evaluate the adverse effects of screening and the accuracy and adverse effects of diagnostic methods and treatment. Given the burden of this condition, additional research that focuses on effective screening tools could greatly improve the quality of life, overall function, sexuality, morbidity and independence for many women. Additional research is needed to understand changes in the incidence and prevalence of urinary incontinence over time and the influence of specific risk factors, including racial and ethnic differences. Research is needed to help guide standards for

screening for UI in the primary care setting so women do not need to wait until symptoms are severe to seek support and treatment.

CONCLUSIONS

Urinary incontinence adversely affects health, quality of life, and function for the majority of women at some point of their lives, yet it is currently underdiagnosed and under treated in the United States. Standardized screening in routine clinical practice, particularly as part of the well-woman visit, has the potential to identify affected women and initiate diagnostic evaluations and treatment. No clinical recommendations addressing routine screening for urinary incontinence have been issued from guideline groups, although recommendations for diagnostic evaluations and treatment are available and have been generally accepted as standards of care. The implementation of universal screening through the use of a brief questionnaire could identify symptoms of urinary incontinence before they negatively impact the lives of women.

EVIDENCE MAP

KQ 1: Effectiveness of screening for urinary incontinence in improving symptoms, quality of life and function.		
Systematic Reviews	**Additional Studies**	**Recommendations**
No systematic reviews	No studies	No recommendations
KQ 2a: Accuracy of screening methods.		
Systematic Reviews	**Additional Studies**	**Recommendations**

No systematic reviews	• Seventeen diagnostic accuracy studies evaluated 18 screening methods against a clinical diagnosis of incontinence or diagnostic tests.
	• Methods included clinician or self-administered questionnaires of symptoms.
	• Performance measures varied; 5 studies of 6 methods (B-SAQ, OAB-V8, QUID, 3IQ, ABSST, MISI) reported results indicating fair to good clinical utility (AUC >0.70; sensitivity and specificity >70%).
	• Two studies that did not recruit participants on the basis of symptoms of incontinence are most applicable to population screening.
	  ○ MISI: AUC 0.79 for stress, 0.88 for urge, and 0.89 for mixed incontinence.
	  ○ AB-SAQ: AUC 0.85 for stress, 0.83 for overactive bladder, and 0.87 for mixed incontinence.
	  ○ OAB-V8: AUC 0.68 for stress, 0.82 for overactive bladder, and 0.75 for mixed incontinence.
		No recommendations

KQ 2b: Adverse effects of screening.		
Systematic Reviews	**Additional Studies**	**Recommendations**
No systematic reviews	No studies	Not applicable

KQ 3a, b: Accuracy and adverse effects of diagnostic methods.		
Systematic Reviews	**Additional Studies**	**Recommendations**
No systematic reviews	No studies	• AUA: Evaluation should include history, physical examination, objective demonstration of stress urinary incontinence, post void residual urine volume, urinalysis, and culture if indicated. Additional diagnostic studies can be performed if needed including pad testing and/or voiding diary, urodynamics, cystoscopy, imaging. • ACOG/AUGS: Basic office evaluation (normal post void residual urine volume, negative urinalysis result, and positive cough stress test result) is not inferior to urodynamic testing for women with stress-predominant urinary incontinence undergoing anti-incontinence surgery.

CQ 1: Effectiveness of treatments.		
Systematic Reviews	**Additional Studies**	**Recommendations**

• Weight loss improves symptoms of urinary incontinence in obese women, with greater benefits for stress versus urge incontinence.
• Women treated with pelvic floor muscle training were more likely to report cure or improvement and had better satisfaction and quality of life than controls.
• In RCTs, drugs were more effective than placebo in improving continence, but the magnitude of the effect was low (absolute risk difference <20% for all drugs).
• Two drugs (solifenacin and festerodine) demonstrated dose-response effects among treatment groups for improving symptoms.
• Studies do not support the effectiveness of intravaginal or intraurethral devices for treating incontinence.
• Surgical interventions (synthetic midurethral mesh slings, urethral bulking agents, retropubic suspension, fascial slings) are effective for selected cases of stress incontinence.
	Not reviewed for contextual question	• ACOG: Counseling about treatment should begin with conservative options.
		• AUGS: Because treatment options vary by incontinence type and effectiveness, it is important to first determine the etiology and severity of the patient's symptoms. After determining the type of incontinence, physicians should assess each woman's goals and expectations for treatment to help her select the best treatment option.
		• NICE: Offer a trial of supervised pelvic floor muscle training of at least 3 months duration as first-line treatment to women with stress or mixed incontinence.
		  ○ Offer bladder training lasting for a minimum of 6 weeks as first-line treatment to women with urgency or mixed incontinence.
		  ○ Offer one of the following choices first to women with mixed incontinence: oxybutynin (immediate release), **or** tolterodine (immediate release), **or** darifenacin (once daily preparation).
		  ○ If conservative management for stress incontinence has failed, offer: synthetic mid-urethral tape or open colposuspension, or autologous rectus fascial sling.

CQ 2: Adverse effects of treatments.		
Systematic Reviews	**Additional Studies**	**Recommendations**
• In RCTs, no harms were identified for behavioral interventions such as pelvic floor muscle training or weight loss interventions. • In a systematic review of treatments, discontinuation rates and adverse effects were more common among patients treated with drugs, while adverse effects with nonpharmacological treatments were uncommon. • Adverse effects of drug treatment include dry mouth, constipation, heartburn, and urinary retention, resulting in high rates of discontinuation. Information on long term drug safety is unavailable. • Treatment discontinuation is most common with oxybutynin and least common with solifenacin. • Surgical complications include direct injury to the lower urinary tract and general surgical complications such as hemorrhage, infection, bowel injury, or wound complications.	Not reviewed for contextual question	Not applicable

Abbreviations**:** 3IQ: three incontinence questions; ABSST: actionable bladder symptom screening tool; ACOG: American Congress of Obstetricians and Gynecologists; AUA: American Urological Association; AUC: area under the receiver operating characteristic curve; AUGS: American Urogynecologic Society; B-SAQ: bladder control self-assessment questionnaire; CI: confidence interval; MISI: Michigan incontinence symptom index; NICE: National Institute for Health and Care Excellence; OAB-V8: overactive bladder awareness tool (eight-item); QUID: questionnaire for urinary incontinence diagnosis.

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APPENDIX 1

Search Strategies

Database: Ovid MEDLINE(R) without Revisions
Search Strategy:

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1 exp Urinary Incontinence/ (18961)
2 exp Urinary Bladder, Overactive/ (3285)
3 1 or 2 (21389)
4 exp Mass Screening/ (79980)
5 exp Women's Health/ (22896)
6 Female/ (4632475)
7 exp Women's Health Services/ (4429)
8 5 or 6 or 7 (4634117)
9 3 and 4 and 8 (59)
10 ((urin* or stress* or urge*) adj5 (incontin* or leak* or ((unabl* or inabilit*) adj3 (hold* or control* or contain* or retain*)))).mp. [mp=title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms] (25594)
11 4 and 8 and 10 (69)
12 9 or 11 (75)
13 ((screen* or undiagnos* or undetect* or hide or hiding or hidden or occult or asymptomatic* or unrecogniz* or unacknowledg*) adj10 ((urin* or stress* or urge*) adj5 (incontin* or leak* or ((unabl* or inabilit* or incapab* or cannot or ("not" adj able) or struggl*) adj3 (hold* or control* or contain* or retain*))))).mp. (259)
14 (((well adj wom#n) or ((routin* or annual* or yearly or regular) adj5 (visit* or appointment* or consult* or physical or physicals or exam or exams or examination* or checkup or check-up))) adj10 ((urin* or stress* or urge*) adj5 (incontin* or leak* or ((unabl* or inabilit* or incapab* or cannot or ("not" adj able) or struggl*) adj3 (hold* or control* or contain* or retain*))))).mp. [mp=title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms] (8)
15 8 and 13 (232)
16 8 and 14 (7)
17 15 or 16 (239)
18 12 or 17 (302)
19 ((screen* or undiagnos* or undetect* or hide or hiding or hidden or occult or asymptomatic* or unrecogniz* or unacknowledg*) adj10 (overactiv* adj5 bladder*)).mp. [mp=title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms] (36)
20 (((well adj wom#n) or ((routin* or annual* or yearly or regular) adj5 (visit* or appointment* or consult* or physical or physicals or exam or exams or examination* or checkup or check-up))) adj10 (overactiv* adj5 bladder*)).mp. [mp=title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms] (0)
21 8 and 19 (31)
22 8 and 20 (0)

23 21 or 22 (31)
24 18 or 23 (323)

Database: EBM Reviews - Cochrane Central Register of Controlled Trials
Search Strategy:
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1 ((screen* or undiagnos* or undetect* or hide or hiding or hidden or occult or asymptomatic* or unrecogniz* or unacknowledg*) adj10 ((urin* or stress* or urge*) adj5 (incontin* or leak* or ((unabl* or inabilit* or incapab* or cannot or ("not" adj able) or struggl*) adj3 (hold* or control* or contain* or retain*))))).mp. (75)
2 (((well adj wom#n) or ((routin* or annual* or yearly or regular) adj5 (visit* or appointment* or consult* or physical or physicals or exam or exams or examination* or checkup or check-up))) adj10 ((urin* or stress* or urge*) adj5 (incontin* or leak* or ((unabl* or inabilit* or incapab* or cannot or ("not" adj able) or struggl*) adj3 (hold* or control* or contain* or retain*))))).mp. [mp=title, original title, abstract, mesh headings, heading words, keyword] (3)
3 ((screen* or undiagnos* or undetect* or hide or hiding or hidden or occult or asymptomatic* or unrecogniz* or unacknowledg*) adj10 (overactiv* adj5 bladder*)).mp. [mp=title, original title, abstract, mesh headings, heading words, keyword] (5)
4 (((well adj wom#n) or ((routin* or annual* or yearly or regular) adj5 (visit* or appointment* or consult* or physical or physicals or exam or exams or examination* or checkup or check-up))) adj10 (overactiv* adj5 bladder*)).mp. [mp=title, original title, abstract, mesh headings, heading words, keyword] (1)
5 ((urin* or stress* or urge*) adj5 (incontin* or leak* or ((unabl* or inabilit*) adj3 (hold* or control* or contain* or retain*)))).mp. [mp=title, original title, abstract, mesh headings, heading words, keyword] (4660)
6 (overactiv* adj5 bladder*).mp. [mp=title, original title, abstract, mesh headings, heading words, keyword] (1564)
7 5 or 6 (5520)
8 screen*.mp. (26747)
9 7 and 8 (116)
10 ((routin* or annual* or yearly or regular) adj5 (visit* or appointment* or consult* or physical or physicals or exam or exams or examination* or checkup or check-up)).mp. [mp=title, original title, abstract, mesh headings, heading words, keyword] (3340)
11 7 and 10 (17)
12 1 or 2 or 3 or 4 or 9 or 11 (176)
13 (woman* or women* or female*).mp. [mp=title, original title, abstract, mesh headings, heading words, keyword] (503769)
14 12 and 13 (140)
15 limit 14 to english language (121)
16 limit 14 to abstracts (131)
17 15 or 16 (132)

Database: EBM Reviews - Cochrane Database of Systematic Reviews
Search Strategy:
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1 ((screen* or undiagnos* or undetect* or hide or hiding or hidden or occult or asymptomatic* or unrecogniz* or unacknowledg*) adj25 ((urin* or stress* or urge*) adj5 (incontin* or leak* or ((unabl* or inabilit* or incapab* or cannot or ("not" adj able) or struggl*) adj3 (hold* or control* or contain* or retain*))))).mp. (11)
2 (((well adj wom#n) or ((routin* or annual* or yearly or regular) adj5 (visit* or appointment* or consult* or physical or physicals or exam or exams or examination* or checkup or check-up))) adj25 ((urin* or stress* or urge*) adj5 (incontin* or leak* or ((unabl* or inabilit* or incapab* or cannot or ("not" adj able) or struggl*) adj3 (hold* or control* or contain* or retain*))))).mp. [mp=title, abstract, full text, keywords, caption text] (0)
3 ((screen* or undiagnos* or undetect* or hide or hiding or hidden or occult or asymptomatic* or unrecogniz* or unacknowledg*) adj25 (overactiv* adj5 bladder*)).mp. [mp=title, abstract, full text, keywords, caption text] (1)
4 (((well adj wom#n) or ((routin* or annual* or yearly or regular) adj5 (visit* or appointment* or consult* or physical or physicals or exam or exams or examination* or checkup or check-up))) adj25 (overactiv* adj5 bladder*)).mp. [mp=title, abstract, full text, keywords, caption text] (0)
5 1 or 2 or 3 or 4 (12)
6 ((urin* or stress* or urge*) adj5 (incontin* or leak* or ((unabl* or inabilit*) adj3 (hold* or control* or contain* or retain*)))).mp. [mp=title, abstract, full text, keywords, caption text] (274)
7 (overactiv* adj5 bladder*).mp. [mp=title, abstract, full text, keywords, caption text] (53)
8 6 or 7 (282)
9 screen*.mp. (6017)
10 8 and 9 (182)
11 ((routin* or annual* or yearly or regular) adj5 (visit* or appointment* or consult* or physical or physicals or exam or exams or examination* or checkup or check-up)).mp. [mp=title, abstract, full text, keywords, caption text] (497)
12 8 and 11 (20)
13 (woman* or women* or female*).mp. [mp=title, abstract, full text, keywords, caption text] (4972)
14 5 or 10 or 12 (187)
15 13 and 14 (145)

APPENDIX 2

Inclusion/Exclusion Criteria

Category	Inclusion	Exclusion
Populations	Women without previously diagnosed urinary incontinence.	Women with known urinary incontinence.
Interventions	Screening using multiple methods feasible in U.S. clinical practice settings.	Methods not available or not feasible in U.S. clinical practice settings.
Comparisons	Methods of screening and evaluation versus usual care or versus alternative methods of screening and evaluation.	Other comparisons.
Outcomes	KQ 1: Improvement in symptoms of urinary incontinence; quality of life, and function (days of disability, limitations in activity, absences, other). KQ 2a: Measures of screening test performance (sensitivity, specificity; likelihood ratios; c-stats). KQ 2b: Potential adverse effects of screening (false positive/negative evaluations; anxiety; etc.) KQ 3a: Outcomes of evaluations (diagnostic yield). KQ 3b: Potential adverse effects of evaluations.	Other outcomes not listed.
Setting	Primary care settings and those resulting from referral from primary care; settings comparable to U.S. practice.	Practice settings dissimilar than those in the U.S.
Study Design	KQ 2a, 2b: Discriminatory accuracy studies KQ 1, 2b, 3a, 3b: RCTs, observational studies with or without comparison groups.	Other study designs
Study Quality	Good- and fair-quality studies for meta-analyses	Poor-quality studies

Abbreviations: KQ: key question; RCT: randomized controlled trial.

APPENDIX 3

Evidence Table of Studies of Screening Methods

Author, Year Quality	N	Population/Setting	Baseline Symptoms	Demographics	Screening Test(s)	Definition of a Positive Test	Reference Standard
Basra, 2012[1] Fair	223	Female patients from general gynecology and urogynecology clinics at 2 London teaching hospitals.	Reason for consultation -LUTS: 46% -Problems unrelated to LUTS: 51% - Of those, 60% were considered to have bothersome LUTS according to doctor	Mean age: 49 years Mean BMI: NR White: 75%; Black: 17%; Asian: 8% Mean parity: NR Postmenopausal: NR	A: B-SAQ B: OAB-V8	A: Aggregate symptom score ≥3 or bother score ≥1 B: Total score ≥8	Clinical diagnosis

Author, Year Quality	Sensitivity and Specificity	PPV and NPV	PLR and NLR	Imaging Accuracy	Other analyses
Basra, 2012[1] Fair	NR	NR	NR	NR	**ROC for diagnosis (B-SAQ vs. OAB-V8)** OAB: 0.83 vs. 0.82 Mixed UI: 0.87 vs. 0.75 Stress UI: 0.85 vs. 0.68

Author, Year Quality	N	Population/Setting	Baseline Symptoms	Demographics	Screening Test(s)	Definition of a Positive Test	Reference Standard
Bergman and Bader, 1990[2] Not rated	154	Women with detailed clinical and urodynamic evaluation in the gynecologic urology division of LAC/USC Medical Center.	GSI: 63% DI: 16% Control: 21%	Mean age: 54 years Mean BMI: NR Race: NR Mean parity: 3 Postmenopausal: 47%	A: 64-item questionnaire, with 12-items for GSI and 24-items for DI	NR	UD

Author, Year Quality	Sensitivity and Specificity	PPV and NPV	PLR and NLR	Imaging Accuracy	Other analyses
Bergman and Bader, 1990[2] Not rated	**Predicting GSI (Sensitivity and Specificity)** Urine loss with cough, sneeze: 90% and 24% Urine loss with straining: 95% and 43% Mean of 12-items: 56% and 70% **Predicting DI (mean of 24-items)** Sensitivity: 38% Specificity: 80%	**Predicting GSI (PPV)** Urine loss with cough, sneeze: 79% Urine loss with straining: 83% Mean of 12-items: 77% **Predicting DI (PPV)** Mean of 24-items: 25%	NR	NR	NR

Author, Year Quality	N	Population/Setting	Baseline Symptoms	Demographics	Screening Test(s)	Definition of a Positive Test	Reference Standard
Borup, 2008[3] Not rated	96	Danish women age 20-59 years living in municipalities of Aarhus and Randers.	Any UI: 73.9% SUI: 64.5% Urge UI: 34.4%	NR	A: Self-report of symptoms	Any UI: positive response regarding experiencing ≥1 periods with involuntary loss of urine during the last 6 months SUI: involuntary loss of urine occurred when coughing, sneezing, laughing, lifting, or straining Urge UI: experienced strong desire to void in association with involuntary loss of urine	Clinical SUI test

Author, Year Quality	Sensitivity and Specificity	PPV and NPV	PLR and NLR	Imaging Accuracy	Other analyses
Borup, 2008[3] Not rated	**Any UI vs. SUI vs. Urge UI** Sensitivity: 95.5% vs. 95.5% vs. 40.9% Specificity: 32.4% vs. 44.6% vs. 67.6%	NR	NR	NR	**Predictors of UI** Self-report of experience of UI in more than drops: OR 8.9, p<0.001 UI lasting for >4 weeks: OR 4.6, p<0.05

Author, Year Quality	N	Population/Setting	Baseline Symptoms	Demographics	Screening Test(s)	Definition of a Positive Test	Reference Standard
Bradley, 2005[4] Fair	103	New patients age ≥18 years seen at the urogynecology clinic at the University of Pennsylvania Medical Center.	Duration of symptoms <1 year: 15.4% 1-5 years: 50.4% >5 years: 29.9%	Median age: 56 years (range: 22-87) Median BMI: 26.6 kg/m^2 (range: 17.4-47.1) White: 72.6%; Black: 21.4%; Asian: 1.7%; Hispanic: 2.6% Median parity: 2 (range: 0-8) Postmenopausal: 52.1%	A: QUID	SUI: score ≥4 Urge UI: score ≥6	Clinical diagnosis

Author, Year Quality	Sensitivity and Specificity	PPV and NPV	PLR and NLR	Imaging Accuracy	Other analyses
Bradley, 2005[4] Fair	**SUI vs. Urge UI** Sensitivity: 85% (95% CI 75 to 91) vs. 79% (95% CI 69 to 86) Specificity: 71% (95% CI 51 to 87) vs. 79% (95% CI 54 to 94)	**SUI vs. Urge UI** PPV: 90% (95% CI 81 to 96) vs. 95% (95% CI 87 to 99) NPV: 61% (95% CI 42 to 77) vs. 43% (95% CI 26 to 60)	NR	**SUI vs. Urge UI** Accuracy: 81% (95% CI 73 to 88) vs. 79% (95% CI 70 to 86) ROC: 0.83 (95% CI 0.74 to 0.92) vs. 0.83 (95% CI 0.75 to 0.92)	NR

Author, Year Quality	N	Population/Setting	Baseline Symptoms	Demographics	Screening Test(s)	Definition of a Positive Test	Reference Standard
Brown, 2006[5] Good	301	Community-dwelling women age ≥40 years from 5 U.S. clinical sites with broad experience with diagnosis and treatment of urinary incontinence.	Mean duration of incontinence: 7.0 years Mean total incontinence episodes per week: 30.2	Mean age: 56.4 years Mean BMI: NR White: 68.8%; Black: 12.6%; Latina: 12.0%; Asian/Pacific Islander: 2.3%; Native American/other: 4.3% Parity of 1-2: 52.3% Parity of 3-4: 32.3% Parity of >4: 9.0% Postmenopausal: 32.7% Hysterectomy: 34.2%	A: 3IQ	NR	Physician diagnosis

Author, Year Quality	Sensitivity and Specificity	PPV and NPV	PLR and NLR	Imaging Accuracy	Other analyses
Brown, 2006[5] Good	**SUI vs. Urge UI** Sensitivity: 86% (95% CI 79 to 90) vs. 75% (95% CI 68 to 81) Specificity: 60% (95% CI 51 to 68) vs. 77% (95% CI 69 to 84)	NR	**SUI vs. Urge UI** PLR: 2.13 (95% CI 1.71 to 2.66) vs. 3.29 (95% CI 2.39 to 4.51) NLR: 0.24 (95% CI 0.16 to 0.35) vs. 0.32 (95% CI 0.24 to 0.43)	NR	NR

Author, Year Quality	N	Population/Setting	Baseline Symptoms	Demographics	Screening Test(s)	Definition of a Positive Test	Reference Standard
Cardozo, 2014[6] Poor	100	Female patients recruited from 6 gynecology clinics located across the U.S.	UUI/OAB: 53%	Mean age : 47.9 years Mean BMI: 28.9 kg/m^2 White: 71%; Black: 19% Mean parity: NR Postmenopausal: NR	A: ABSST	A: Total score ≥3	Clinician urogynecological assessment
Diokno, 1990[7] Not rated	167	Women responding to household surveys and participating in urodynamic testing.	NR	Age: ≥60 years (65.9% age 60-69) Mean BMI: NR White: 95% Mean parity: NR Postmenopausal: NR	A: Self-report of incontinence	A: Reporting any incontinence	UD or cystometry
Gunthorpe, 2000[8] Not rated	89	Women attending a general practice surgery age ≥18 years.	NR	Mean age: 42.4 years Mean BMI: 24 kg/m^2 (SD 5)* Race: NR Mean parity: NR Postmenopausal: NR	A: ISQ	A: Score ≥3	48-hour pad test and self-reported incontinence at the time of pad-testing

Author, Year Quality	Sensitivity and Specificity	PPV and NPV	PLR and NLR	Imaging Accuracy	Other analyses
Cardozo, 2014[6] Poor	Sensitivity: 79.1% Specificity: 98.2%	PPV: 97.1% NPV: 86.2%	NR	NR	ROC: 0.9580
Diokno, 1990[7] Not rated	**SUI vs. DI** Sensitivity: 57.2% vs. 52.0% Specificity: 84.1% vs. 73.2%	NR	NR	**SUI vs. DI** Accuracy: 69.0% vs. 72.%	NR
Gunthorpe, 2000[8] Not rated	Sensitivity: 65.52% (95% CI 45.67 to 82.06)* Specificity: 80% (95% CI 67.67 to 89.22)*	PPV: 61.29% (95% CI 47.22 to 73.70)* NPV: 82.76% (95% CI 74.10 to 88.95)*	PLR: 3.28 (95% CI 1.85 to 5.80)* NLR: 0.43 (95% CI 0.26 to 0.72)*	NR	NR

Author, Year Quality	N	Population/Setting	Baseline Symptoms	Demographics	Screening Test(s)	Definition of a Positive Test	Reference Standard
Haeusler, 1995[9] Not rated	1911	Women referred for urodynamic investigation between 1988 and 1993.		Mean age: 52.4 years Mean BMI: NR Race: NR Mean parity: 2.4 Postmenopausal: 66%	A: Gaudenz-Incontinence-Questionnaire	Score classifies patients as SUI, urge UI, GSI, and DI	UD

Author, Year Quality	Sensitivity and Specificity	PPV and NPV	PLR and NLR	Imaging Accuracy	Other analyses
Haeusler, 1995[9] Not rated	**Diagnosis of GSI vs. DI** Sensitivity: 55.9% vs. 61.5% Specificity: 44.7% vs. 56.1%	**Diagnosis of GSI vs. DI** PPV: 88.2% vs. 2.8% NPV: 18.1% vs. 98.5%	NR	NR	NR

Author, Year Quality	N	Population/Setting	Baseline Symptoms	Demographics	Screening Test(s)	Definition of a Positive Test	Reference Standard
Khan, 2004[10] Not rated	69	Women referred to a tertiary urogynecology clinic with LUTS.	NR	NR	A: Bristol Female Lower Urinary Tract Symptoms Questionnaire	NR	UD

Author, Year Quality	Sensitivity and Specificity	PPV and NPV	PLR and NLR	Imaging Accuracy	Other analyses
Khan, 2004[10] Not rated	**Pure vs. any symptoms for SUI (interview first)** Sensitivity: 17% vs. 89% Specificity: 97% vs. 30% **Pure vs. any symptoms for SUI (self-completion first)** Sensitivity: 14% vs. 88% Specificity: 98% vs. 29% **Pure vs. any symptoms for DI (interview first)** Sensitivity: 8% vs. 85% Specificity: 84% vs. 16% **Pure vs. any symptoms for DI (self-completion first)** Sensitivity: 8% vs. 81% Specificity: 84% vs. 12%	NR	NR	NR	NR

Author, Year Quality	N	Population/Setting	Baseline Symptoms	Demographics	Screening Test(s)	Definition of a Positive Test	Reference Standard
Klingele, 2002[11] Not rated	278	Women referred to a urogynecologist for evaluation of urinary incontinence.	Urge UI: 21% SUI: 26% Mixed: 53%	Mean age: 53.7 years* (SUI: 54.1 vs. DI: 52.3 vs. mixed: 54.7) Mean BMI: NR White: 61%; Black: 32%; Hispanic: 2%; Other race: 5% Mean parity: 3.0* (SUI: 2.9 vs. DI: 3.1 vs. mixed: 3.1) Postmenopausal: NR Previous hysterectomy: 39%	A: Self-report of symptoms	SUI: objectionable and involuntary loss of urine co-incidental with physical activity Urge UI: complaint of involuntary loss of urine that was associated with a strong desire to urinate GSI: leaked during stress maneuvers without concurrent demonstrable detrusor activity during urethrocystometry	UD

Author, Year Quality	Sensitivity and Specificity	PPV and NPV	PLR and NLR	Imaging Accuracy	Other analyses
Klingele, 2002[11] Not rated	**SUI vs. Urge UI vs. mixed** Sensitivity: 52% vs. 37% vs. 72% Specificity: 88% vs. 87% vs. 49%	**SUI and Urge and mixed** PPV: 71% and 59% and 42% NPV: NR	NR	NR	**Risk factors in multiple logistic regression analysis** White race: p≤0.0001 Cystocele: p=0.038 Symptoms of pure SUI alone: p=0.003

Author, Year Quality	N	Population/Setting	Baseline Symptoms	Demographics	Screening Test(s)	Definition of a Positive Test	Reference Standard
Klovning, 1996[12] Not rated	250	Women referred for urogenital dysfunction, including urinary incontinence.	NR	Mean age: 49.2 years Mean BMI: NR Race: NR Mean parity: NR Postmenopausal: NR	A: DIS	A: Score ≥5	Clinical diagnosis
Kujansuu and Kuappila, 1982[13] Not rated	121	Patients referred to the hospital because of urinary incontinence.	SUI: 47% Urge UI: 12% Mixed: 26% No diagnostic finding: 15%	Mean age: 51.6 years Mean BMI: NR Race: NR Mean parity: 3.5 Postmenopausal: 45%	A: Urgency score	A: Score ≥6	Cystometry

Author, Year Quality	Sensitivity and Specificity	PPV and NPV	PLR and NLR	Imaging Accuracy	Other analyses
Klovning, 1996[12] Not rated	**Predicting DI** Sensitivity: 60% Specificity: 77%	**Predicting DI** PPV: 82% NPV: 52%	NR	0.66	NR
Kujansuu and Kuappila, 1982[13] Not rated	**SUI vs. Urge UI vs. Mixed** Sensitivity*: 19% vs. 93% vs. 64% Specificity:* 32% vs. 62% vs. 62%	**SUI vs. Urge UI vs. Mixed** PPV*: 20% vs. 26% vs. 37% NPV*: 31% vs. 98% vs. 84%	**SUI vs. Urge UI vs. Mixed** PLR*: 0.29 vs. 2.47 vs. 1.71 NLR*: 2.46 vs. 0.11 vs. 0.57	NR	NR

Author, Year Quality	N	Population/Setting	Baseline Symptoms	Demographics	Screening Test(s)	Definition of a Positive Test	Reference Standard
Lemack and Zimmern, 1999[14] Not rated	128	Women presenting with complaints of LUTS or incontinence.	Chief complaint -Mixed incontinence: 26.6% -Pure stress incontinence: 20.3% -Frequency/ urgency: 14.1% -Urge incontinence: 13.3% -Symptomatic prolapse: 10.1% -Total incontinence: 2.3% -Urinary retention: 2.3% -Pelvic pain: 2.3% -Other: 6.4%	Mean age: 61 years Mean BMI: NR Race: NR Mean parity: NR Postmenopausal: NR	A: UDI-6	SUI: Question 3 score ≥2 BOO: Question 5 score ≥2 or score ≥all others DO: Question 1 score ≥2 and/or Question 2 score ≥2	UD

Author, Year Quality	Sensitivity and Specificity	PPV and NPV	PLR and NLR	Imaging Accuracy	Other analyses
Lemack and Zimmern, 1999[14] Not rated	**Sensitivity and Specificity** Predicting SUI: 84.8% and 63.4% Predicting BOO (Question 5 score ≥2): 43.9% and 70.1% Predicting BOO (Question 5 score ≥all others): 39.0% and 85.1% Predicting DO (Question 1 score ≥2): 75.0% and 32.6% Predicting DO (Question 2 score ≥2): 83.3% and 50.0% Predicting DO (Question 1 and question 2 score ≥2): 68.6% and 63.8%	NR	NR	NR	NR

Author, Year Quality	N	Population/Setting	Baseline Symptoms	Demographics	Screening Test(s)	Definition of a Positive Test	Reference Standard
Sand, 1988[15] Not rated	218	Women undergoing complete evaluation of their incontinence symptoms.	Complained of symptoms: 82.6% Symptoms of urgency, frequency, and dysuria without urine loss: 13.8%	Mean age: 51.8 years Mean BMI: NR Race: NR Mean parity: 2.5 Postmenopausal: NR	A: Self-report of symptoms of SUI B: Self-report of symptoms of urgency and urge UI	GSI: urinary incontinence occurred in the absence of a detrusor contraction associated with a rise in intra-abdominal pressure	UD

Author, Year Quality	Sensitivity and Specificity	PPV and NPV	PLR and NLR	Imaging Accuracy	Other analyses
Sand, 1988[15] Not rated	**SUI vs. Urge UI** Sensitivity: 100% vs. 77.9% Specificity: 65.2% vs. 38.7%	**SUI vs. Urge UI** PPV: 86.9% vs. 36.6% NPV: 100% vs. 79.5%	NR	NR	NR

Author, Year Quality	N	Population/Setting	Baseline Symptoms	Demographics	Screening Test(s)	Definition of a Positive Test	Reference Standard
Suskind, 2015[16] Good	214	Community dwelling women ages 35-64 residing in 3 southeastern Michigan communities.	Self-reported incontinence: 54% Using pads: 53.2%	Mean age: 50.5 years Mean BMI: 33.1 kg/m^2 White: 31.8%; Black: 68.2% Mean parity: 2.2 Postmenopausal: NR No menstrual period in the last year: 57.0%	A: MISI total B: SUI subdomain C: UUI subdomain	A: Total score ≥7 B: SUI subdomain score ≥3 C: UUI subdomain score ≥5	Physician diagnosis

Author, Year Quality	Sensitivity and Specificity	PPV and NPV	PLR and NLR	Imaging Accuracy	Other analyses
Suskind, 2015[16] Good	**MISI total vs. SUI subdomain vs. UUI subdomain** Sensitivity: 84% vs. 77% vs. 86% Specificity: 75% vs. 76% vs. 73%	**MISI total vs. SUI subdomain vs. UUI subdomain** PPV: 75% vs. 43% vs. 73% NPV: 84% vs. 86% vs. 92%	NR	NR	**MISI total vs. SUI subdomain vs. UUI subdomain** ROC: 0.88 vs. 0.79 vs. 0.88

Author, Year Quality	N	Population/Setting	Baseline Symptoms	Demographics	Screening Test(s)	Definition of a Positive Test	Reference Standard
Walters, 1988[17] Not rated	106	Women complaining of urinary incontinence who were referred to the gynecologic urodynamics clinic and underwent full urodynamic evaluation.	GSI: 55.7%	Mean age: 46.3 years* (GSI: 46.8 vs. other disorders: 45.7) Mean BMI: NR Mean weight: 165.3 lb.* (GSI: 158.4 vs. other disorders: 173.9) Race: NR Mean parity: 4.4* (GSI: 4.5 vs. other disorders: 4.3) Postmenopausal (GSI vs. other disorders): 39% vs. 34% Hysterectomy (GSI vs. other disorders): 19% vs. 32%	A: SUI question "Do you lose urine by spurts during coughing, sneezing, or lifting?"	A: Positive response	UD or cystometry

Author, Year Quality	Sensitivity and Specificity	PPV and NPV	PLR and NLR	Imaging Accuracy	Other analyses
Walters, 1988[17] Not rated	Sensitivity: 93% Specificity: 19%	PPV: 59% NPV: 41%	NR	NR	NR

Abbreviations: 3IQ: three incontinence questions; ABSST: actionable bladder symptom screening tool; AHCPR: Agency for Health Care Policy and Research; BFLUTS: Bristol female lower urinary tract symptoms questionnaire; BMI: body mass index; BOO: bladder outlet obstruction; B-SAQ: bladder control self-assessment questionnaire; CI: confidence interval; cmH2O: centimeter of water; DI: detrusor instability; DIS: detrusor instability score; DO: detrusor over activity; GSI: genuine stress incontinence; ISQ: incontinence screening questionnaire; LAC: Los Angeles county; LUTS: lower urinary tract symptoms; MISI: Michigan incontinence symptom index; NLR: negative likelihood ratio; NPV: negative predictive value; NR: not reported; OAB: overactive bladder; OAB-V8: overactive bladder awareness tool (eight-item); PLR: positive likelihood ratio; PPV: positive predictive value; QUID: questionnaire for urinary incontinence diagnosis; ROC: receiver operating characteristic; SUI: stress urinary incontinence; UD: urodynamic; UDI: urogenital distress inventory; UDI-6: urogenital distress inventory, six items; UI: urinary incontinence; USC: University of Southern California; UUI: urge urinary incontinence.
*Calculated

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APPENDIX 4

Quality Rating of Screening Methods Studies

Author, year	Groups similar at baseline	Spectrum	Random or consecutive sample	Eligibility criteria specified	Adequate sample size (>50)	Adequate attrition /attrition explained (ITT?)
Basra, 2012[1]	Not applicable	1º and 2º care clinics	Consecutive	Yes	Yes	Yes
Bradley, 2005[2]	Not applicable	Symptomatic referral population	Consecutive	Yes	Yes	Yes
Brown, 2006[3]	Not applicable	Recruited from community not based on symptoms	Consecutive	Yes	Yes	Yes
Cardozo, 2014[4]	No; incontinent group older, higher BMI, more comorbidities	Cases and controls from gynecology clinics	Unclear	Yes	Yes	Unclear
Suskind, 2015[5]	Not applicable	Community cohort continent and incontinent	Consecutive	Yes	Yes	Not applicable

Author, year	Reference standard				Test adequately described	Include sens/ Spec; PPV/NPV; AUC	Quality Rating
	Credible	Replicable	Interpret independently	Applied to all subjects or a random subset			
Basra, 2012[1]	Yes	No, varied	Unclear	Unclear, likely varied by patient	Yes	Yes	Fair
Bradley, 2005[2]	Yes	No, varied	Yes	Varied by patient	Yes	Yes	Fair

Author, year	Reference standard				Test adequately described	Include sens/ Spec; PPV/NPV; AUC	Quality Rating
	Credible	Replicable	Interpret independently	Applied to all subjects or a random subset			
Brown, 2006[3]	Yes	Yes	Yes	Yes	Yes	Yes	Good
Cardozo, 2014[4]	Unclear	No, varied	Unclear	Unclear	Yes	Yes	Poor
Suskind, 2015[5]	Yes	Yes	Yes	Yes	Yes	Yes	Good

Diagnostic/Concordance Studies[6]

Criteria:

- Test applied to an appropriate spectrum of patients (with and without disease/condition), avoiding case-control design
- Population tested was consecutive or random
- Clear eligibility criteria described and rigorous assessment of disease/condition
- Attrition reported and minimal loss to follow-up
- Test is adequately described and reproducible
- Test was validated in a second population group
- Test is an available standard case definition
- Diagnostic test is applied to all patients
- Blinding of outcome assessors to the reference standard

Definition of ratings based on above criteria:

Good: Evaluates relevant available screening test; uses a credible reference standard; interprets reference standard independently of screening test; reliability of test assessed; has few or handles indeterminate results in a reasonable manner; includes large number (more than 500) broad-spectrum patients with and without disease; study attempts to enroll a random or consecutive sample of patients who meet inclusion criteria screening cutoffs pre-stated.

Fair: Evaluates relevant available screening test; uses reasonable although not best standard; interprets reference standard independent of screening test; moderate sample size (100 to 500 subjects) and a "medium" spectrum of patients (i.e. applicable to many settings where the diagnostic test would be applied).

Poor: Has important limitation such as: uses inappropriate reference standard; screening test improperly administered; biased ascertainment of reference standard; small sample size (<100) of very narrow selected spectrum of patients (components of study not well described).

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