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Validation and application of a module of the MD Anderson Symptom Inventory for measuring perioperative symptom burden in patients with gynecologic cancer (the MDASI-PeriOp-GYN)☆

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HIGHLIGHTS

- Using patient-reported outcomes (PROs) in perioperative care is increasingly common.
- The MD Anderson Symptom Inventory (MDASI) is widely used to assess cancer symptoms.
- The MDASI-PeriOp-GYN was created for use in perioperative care for gynecologic cancer or benign conditions.
- Development included patient input on salient symptoms and expert panel review.
- The MDASI-PeriOp-GYN is psychometrically valid, reliable, and concise.

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ABSTRACT

Objective. Using patient-reported outcomes (PROs) in perioperative care is increasingly common. We report the development, validation, and application of an MD Anderson Symptom Inventory version for use in patients undergoing surgery for gynecologic cancer or benign conditions (MDASI-PeriOp-GYN).

Methods. Our process included: (1) generating PeriOp-GYN–specific candidate items from qualitative interviews with patients, followed by input from an expert panel; (2) dropping items that lacked independent clinical relevance; (3) validating psychometric properties (reliability, validity) of the resulting MDASI-PeriOp-GYN; and (4) conducting cognitive debriefing interviews with patients to confirm ease of comprehension, relevance, and acceptability.

Results. Qualitative interviews with 40 patients generated 9 new PeriOp-GYN symptom items (bloating, abdominal cramping, constipation, hot flashes, dizziness, grogginess/confusion, urinary pain, difficulty urinating, and diarrhea) that, along with the core MDASI items, formed the new MDASI-PeriOp-GYN. A total of 150 patients (minimally invasive surgery (MIS) = 69, open surgery = 81) participated in the validation study; 121 patients also provided retest data. Cronbach alphas were 0.89 for symptoms and 0.86 for interference. Test-retest reliability was 0.88 for all symptom severity items. Known-group validity was supported by the detection of significant differences in symptom and interference levels by performance status ($P < 0.01$) and for all symptoms by surgery type ($P < 0.01$). Cognitive debriefing with 20 of the 150 patients demonstrated that the MDASI-PeriOp-GYN is an easy-to-use and understandable tool.

Conclusions. The MDASI-PeriOp-GYN is a valid, reliable, concise tool for measuring symptom severity and functional interference in patients undergoing gynecologic surgery and can be useful in assessing postoperative symptom burden via PROs.

1. Introduction

Caused by both disease and treatment, cancer-related symptoms greatly influence a patient's functional status and quality of life. Managing such symptoms is an especially important part of care for patients with gynecologic cancers or benign tumors who have undergone

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surgery. Active management of perioperative symptom burden might reduce or even prevent postoperative complications, promote better adherence to National Comprehensive Cancer Network guidance on timely return to adjuvant therapy, and avoid potential decrease in progression-free survival [1,2]. Gynecologic clinicians thus have a critical need for a standardized, validated multisymptom assessment tool that they can use to monitor clinically meaningful events and evaluate the effectiveness of procedures in their specific patient cohorts. However, even though the possibility of symptomatic recovery after surgical care in patients with gynecologic cancer is well known, no patient-reported outcomes (PRO) questionnaire has been established for use in perioperative care for major types of gynecologic cancers and gynecologic surgical procedures.

The MD Anderson Symptom Inventory (MDASI) is well established as a reliable, validated instrument for assessing cancer-related symptoms and their effects on daily functioning [3]. The "core" MDASI measures the most common symptoms reported across most cancer types and treatments: 13 items assess symptom severity at its worst and 6 items assess symptom-related interference, all rated on a 0–10 numeric scale in the last 24 h. Adding further items to the core MDASI tailors the symptom assessment to specific patient populations, and the validation studies of these new versions present opportunities to incrementally substantiate the psychometric properties of the core MDASI.

The primary objective of this study was to develop and psychometrically validate a perioperative gynecologic version of the MDASI for patients undergoing surgery to treat gynecologic cancer or benign conditions (the MDASI-PeriOp-GYN). We previously developed a MDASI version for patients with ovarian cancer treated with chemotherapy (MDASI-OC) [4], but this instrument was not designed or validated in patients undergoing surgery. We constructed the MDASI-PeriOp-GYN in line with US Food and Drug Administration (FDA) guidelines, which recommend that developers of PRO measures include both patient and clinician contributions to item generation, psychometric validation of the developed scale, and cognitive debriefing to examine patient comfort with and understanding of scale items and the relevance of the scale to the patients' symptom experience [5–9]. Having the MDASI-PeriOp-GYN would allow for the measurement of symptom prevalence and symptom burden among patients undergoing open surgery or minimally invasive surgery (MIS) for gynecologic cancer or benign tumor, would be useful for clinical evaluation of these patients, and would document the effects of various treatments on patient symptom burden [8,10,11]. The MDASI's 24-hour recall period should be favorable for daily postoperative assessment.

A secondary objective was to examine whether the MDASI-PeriOp-GYN would be useful for describing symptom burden around the perioperative care period. The profiles characterizing worst symptom burden could be disease-specific or postsurgery-specific and could be used as the most relevant PROs to guide postoperative care.

2. Materials and methods

2.1. Patients and data collection

The study (qualitative interview and a cross-sectional survey) was approved by the Institutional Review Board of The University of Texas MD Anderson Cancer Center. Patients were consecutively recruited from the MD Anderson Gynecologic Oncology Center in 2017. Patients eligible for this study were required to be at least 18 years old, speak English, be scheduled for or have undergone a surgical procedure for either gynecologic cancer or benign tumor, understand the study's intent, and agree to be enrolled. All patients approached agreed to participate in the study and gave written informed consent.

A trained study coordinator conducted qualitative interviews, had patients complete self-administered questionnaires, and collected information from patients' medical records. Demographic information, current disease information (including cancer site and staging; presence of recurrent disease), treatment information, laboratory results, and comorbidities were recorded. Patient functional status was evaluated by clinicians using the Eastern Cooperative Oncology Group Performance Status Scale (ECOG PS) [12].

2.2. Development of the MDASI-PeriOp-GYN

To develop the MDASI-PeriOp-GYN in accordance with FDA guidance for creating and validating PRO tools [5], we followed a 4-step process that involved (1) generating a list of candidate items from qualitative interviews with patients, soliciting input on the relevance of these items from gynecologic oncology experts (health care providers, patients, and family members), and then adding the revised list of candidate items to the core MDASI for testing (the provisional MDASI-PeriOp-GYN); (2) dropping candidate items that lacked independent clinical relevance; (3) validating the psychometric properties (validity and reliability) of the resulting MDASI-PeriOp-GYN; and (4) conducting cognitive debriefing interviews with patients.

2.2.1. Generation of candidate PeriOp-GYN symptom items (content validity)

An initial group of patients with gynecological cancer who were either scheduled for surgery (open or MIS), hospitalized postsurgery, or coming for their first postoperative clinic visit were recruited to participate in qualitative interviews about their disease and surgical experience. After patients gave written informed consent to participate, individual interviews were conducted by trained qualitative interviewers. Interviews were digitally audiotaped and professionally transcribed verbatim. Interviewers used an interview guide that asked patients to describe their current experience of gynecological cancer, including symptoms, and their experiences since diagnosis of gynecological cancer, including symptoms. The interviewers asked additional probe questions as needed to elicit clear descriptions of the patient experience. After the interview, patients completed the MDASI-OC and were then offered the opportunity to discuss any symptoms they had forgotten to mention during the interview.

Descriptive exploratory analysis [13] was done by an experienced qualitative researcher. Symptom experiences described by patients were grouped into symptom names. A second qualitative researcher verified the identification of symptom experiences and symptom name assignments. Any symptom mentioned by at least 20% of subjects was identified as a PeriOp-GYN symptom item for the provisional MDASI-PeriOp-GYN.

2.2.2. Psychometric validation

A second group of patients was recruited for the validation portion of this study. These patients completed the provisional MDASI-PeriOp-GYN and a generic clinical outcome instrument, the Functional Assessment of Cancer Therapy-Ovarian Cancer (FACT-O) [14], and a single-item quality-of-life measure at baseline. The MDASI-PeriOp-GYN assessment was repeated 24–48 h later for test-retest purposes.

Determining a sufficient sample size to evaluate and validate the MDASI-PeriOp-GYN was based on the ability of the instrument to distinguish between patients with poor and good performance status, as well as between type of procedure (open surgery versus MIS), as measures of known-group validity [3]. We expected patients who had good ECOG PS or underwent MIS to have lower symptom severity than would patients who had poor ECOG PS or underwent open surgery. An adequate sample size would allow us to detect a half-standard-deviation difference in symptom severity between groups [15,16]. We determined that a sample size of 150

would provide statistical power of 80%, assuming a two-tailed test with $\alpha = 0.05$.

2.3. Statistical analysis

Single items of the MDASI-PeriOp-GYN are presented with means, standard deviations (SDs), and minimum and maximum values. We used a cutpoint of ≥7 on the MDASI-PeriOp-GYN's 0–10 scale to define a severe symptom, on the basis of previous research [17]. Several composite scores are presented: MDASI-core (average score of the 13 MDASI core symptom items), PeriOp-GYN (average score of the PeriOp-GYN-specific symptom items), MDASI-WAW (average score of the interference items work, activity, and walking), and MDASI-REM (average score of the interference items relations with other people, enjoyment of life, and mood).

The MDASI-PeriOp-GYN items were examined for reliability, validity, and clinical interpretability. Cronbach coefficient α values for the symptom severity and symptom interference items were used to establish internal consistency. We established test-retest reliability using intra-class correlation (ICC) of data from two timepoints 1–3 days apart. We tested known-group validity by differentiating among patients according to their ECOG PS and type of surgery. These calculations used a global symptom composite score (mean of the 13 core MDASI symptom items and the 9 PeriOp-GYN candidate items) and an interference component score (mean of all 6 interference items). Means of differences, 95% confidence limits, statistical significance, and Cohen's *d* effect sizes are reported. Independent two-sample *t*-tests and analysis of variance were applied to compare means between groups. Nonparametric testing (e.g., Kolmogorov-Smirnov and Kruskal–Wallis tests) was used when normality assumptions were not met.

We tested convergent validity by calculating Spearman rank correlation coefficients between MDASI-core vs. FACT-O-core (minus the additional ovarian cancer items), PeriOp-GYN vs. the FACT-O-AD additional ovarian item subscale, MDASI-WAW vs. the FACT-O-GP physical wellbeing subscale, and MDASI-REM vs. the FACT-O-EM emotional wellbeing subscale. We also examined Spearman rank correlation coefficient between each MDASI-PeriOp-GYN composite score and the single-item quality-of-life measure, which uses a 0–10 scale [18]. We specified these combinations a priori to limit the number of comparisons with these pairs, to control type I error rates.

All statistical procedures were performed using SAS statistical software, version 9.4. All *P* values reported are 2-tailed. Statistical significance was set at $P < 0.05$.

Table 1
Demographic and disease characteristics ($N = 150$).

Patient characteristics, mean (SD)	Entire sample ($N = 150$)	MIS ($n = 69$)	Open ($n = 81$)	*P* (MIS vs. open)
Age, years	57.49 (12.78)	57.14 (12.87)	57.79 (12.78)	0.8980
Length of stay, days ($n = 149$)[a]	3.03 (1.83)	1.61 (0.65)	4.25 (1.63)	<0.0001
Patient characteristics, no. (%)				
Ethnicity				0.2002
Hispanic or Latino	26 (17.33)	9 (13.04)	17 (20.99)	
Not Hispanic or Latino	124 (82.67)	60 (86.96)	64 (79.01)	
Race				0.9062
White	115 (76.67)	54 (78.26)	61 (75.31)	
Black or African American	19 (12.67)	9 (13.04)	10 (12.35)	
Asian	9 (6.00)	3 (4.35)	6 (7.41)	
Other	7 (4.67)	3 (4.35)	4 (4.94)	
Education ($n = 149$)[a]				0.0534
Below high school	9 (6.04)	7 (10.14)	2 (2.50)	
High school	66 (44.30)	25 (36.23)	41 (51.25)	
College and above	74 (49.66)	37 (53.62)	37 (46.25)	
Employment ($n = 149$)[a]				0.1246
Employed outside the home, full-time	67 (44.97)	37 (54.41)	30 (37.04)	
Employed outside the home, part-time	9 (6.04)	4 (5.88)	5 (6.17)	
Retired	46 (30.87)	15 (22.06)	31 (38.27)	
Others	27 (18.21)	12 (17.65)	15 (18.52)	
Marital status				
Married/partnered	92 (61.33)	39 (56.52)	53 (65.43)	0.2641
Single/others	58 (38.67)	30 (43.48)	28 (34.57)	
ERAS patient				0.2099
Yes	148 (98.67)	67 (97.10)	81 (100.00)	
No	2 (1.33)	2 (2.90)	0 (0.00)	
Recurrence disease ($n = 140$)[a]				0.0010
Yes	11 (7.86)	0 (0.00)	11 (14.47)	
No	129 (92.14)	64 (100.00)	65 (85.53)	
Prior treatment				<0.0001
Yes	36 (24.00)	6 (8.70)	30 (37.04)	
No	114 (76.00)	63 (91.30)	51 (62.96)	
Cancer site				<0.0001
Ovarian/fallopian/primary peritoneal	46 (30.67)	4 (5.80)	42 (51.85)	
Endometrial	48 (32.00)	37 (53.62)	11 (13.58)	
Benign	37 (24.67)	18 (26.09)	19 (23.46)	
Others	19 (12.67)	10 (14.49)	9 (11.11)	
ECOG PS ($n = 125$)[a]				<0.0001
Good (0–1)	90 (72.00)	49 (100.00)	41 (53.95)	
Poor (2–3)	35 (28.00)	0 (0.00)	35 (46.05)	
Charlson Comorbidity Index				0.2931
0	109 (72.67)	53 (76.81)	56 (69.14)	
1+	41 (27.33)	16 (23.19)	25 (30.86)	

Abbreviations: ECOG PS, Eastern Cooperative Oncology Group performance status; ERAS, enhanced recovery after surgery; MDASI-PeriOp-GYN, MD Anderson Symptom Inventory Gynecologic Cancer Perioperative Module; MIS, minimally invasive surgery.

[a] Less than the total sample size of 150 due to missing data.

2.3.1. Cognitive debriefing

At the end of the development process, a subset of patients from the validation study were asked to participate in cognitive debriefing of the MDASI-PeriOp-GYN to test the ease of item comprehension and patient comfort in responding to the new instrument [5,19].

2.3.2. Application assessment

The application of the MDASI-PeriOp-GYN was examined via patient compliance with use of the tool and comparison of symptom severity profiles from presurgery, within 5 days of surgery, or >5 days after surgery.

3. Results

Overall, 190 patients either scheduled for surgery, hospitalized postsurgery, or at their first postoperative clinic visit were recruited. Of these, 40 patients were recruited to participate in qualitative interviews about their disease and surgical experience, and 150 were recruited to participate in the MDASI-PeriOp-GYN psychometric validation study.

Table 1 presents demographic and disease-related characteristics for the validation sample. A total of 148 patients received care under an Enhanced Recovery After Surgery (ERAS) pathway. Thirty-seven patients (25%) were diagnosed with a benign condition, primarily fibroids or benign ovarian masses. Approximately 73% of the patients (109) had no major comorbidities at baseline.

3.1. Content validity of the MDASI-PeriOp-GYN

3.1.1. Qualitative interviews

Of the 40 patients recruited for qualitative interviews, 5 had not yet had surgery, 13 were hospitalized postsurgery, and 22 had come for

Date: _____ **Institution:** _____

Participant Initials: _____ **Hospital Chart #:** _____

Participant Number: _____

MD Anderson Symptom Inventory – Gynecologic Cancer (MDASI-PeriOp-GYN)

Part I. How **severe** are your symptoms?

People with cancer frequently have symptoms that are caused by their disease or by their treatment. We ask you to rate how severe the following symptoms have been ***in the last 24 hours.*** Please select a number from 0 (symptom has not been present) to 10 (the symptom was as bad as you can imagine it could be) for each item.

	Not Present 0	1	2	3	4	5	6	7	8	9	As Bad As You Can Imagine 10
1. Your **pain** at its WORST?	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯
2. Your **fatigue (tiredness)** at its WORST?	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯
3. Your **nausea** at its WORST?	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯
4. Your **disturbed sleep** at its WORST?	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯
5. Your feelings of being **distressed (upset)** at its WORST?	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯
6. Your **shortness of breath** at its WORST?	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯
7. Your problem with **remembering things** at its WORST?	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯
8. Your problem with **lack of appetite** at its WORST?	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯
9. Your feeling **drowsy (sleepy)** at its WORST?	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯
10. Your having a **dry mouth** at its WORST?	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯
11. Your feeling **sad** at its WORST?	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯
12. Your **vomiting** at its WORST?	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯
13. Your **numbness or tingling** at its WORST?	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯
14. Your **bloating/abdominal tightness** at its WORST?	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯

Fig. 1. The MD Anderson Symptom Inventory Gynecologic Cancer Perioperative Module (MDASI-PeriOp-GYN).

	Not Present 0	1	2	3	4	5	6	7	8	9	As Bad As You Can Imagine 10
15. Your **abdominal cramping** at its WORST?	○	○	○	○	○	○	○	○	○	○	○
16. Your **constipation** at its WORST?	○	○	○	○	○	○	○	○	○	○	○
17. Your **diarrhea** at its WORST?	○	○	○	○	○	○	○	○	○	○	○
18. Your **dizziness** at its WORST?	○	○	○	○	○	○	○	○	○	○	○
19. Your **grogginess or confusion** at its WORST?	○	○	○	○	○	○	○	○	○	○	○
20. Your **urinary urgency** at its WORST?	○	○	○	○	○	○	○	○	○	○	○
21. Your **inability to urinate/ difficulty urinating** at its WORST?	○	○	○	○	○	○	○	○	○	○	○
22. Your **hot flashes** at their WORST?	○	○	○	○	○	○	○	○	○	○	○

Part II. How have your symptoms **interfered** with your life?

Symptoms frequently interfere with how we feel and function. How much have your symptoms interfered with the following items ***in the last 24 hours***? Please select a number from 0 (symptoms have not interfered) to 10 (symptoms interfered completely) for each item.

	Did Not Interfere 0	1	2	3	4	5	6	7	8	9	Interfered Completely 10
23. **General activity**?	○	○	○	○	○	○	○	○	○	○	○
24. **Mood**?	○	○	○	○	○	○	○	○	○	○	○
25. **Work (including work around the house)?**	○	○	○	○	○	○	○	○	○	○	○
26. **Relations with other people?**	○	○	○	○	○	○	○	○	○	○	○
27. **Walking**?	○	○	○	○	○	○	○	○	○	○	○
28. **Enjoyment of life?**	○	○	○	○	○	○	○	○	○	○	○

Fig. 1 (*continued*).

their first postoperative clinic visit. One patient at the postoperative clinic visit did not complete the interview, leaving 39 interviews for analysis. The interviews generated 54 candidate PeriOp-GYN symptom items (which overlapped with 12 of the 13 MDASI core symptom items).

3.1.2. Expert panel review

After preliminary professional review by clinicians and the research team, similar items (e.g., bloating and increased abdominal size) were combined into a single symptom to remove items that were objective signs rather than subjective symptoms while ensuring that a symptom representing that concept was retained, resulting in an interim list of 45 symptoms, including the 13 core MDASI symptom items.

Members of an expert panel reviewed the list of 45 symptoms for relevance to patients undergoing surgery for gynecological cancer or benign conditions. The expert panel included 6 gynecologic oncology surgeons and 6 midlevel providers working in the Gynecologic Oncology Center, 12 patients (6 who had undergone open surgery and 6 who had undergone MIS), and 6 family caregivers of gynecological oncology surgery patients.

The expert panel identified 11 of the PeriOp-GYN items for inclusion in the provisional MDASI-PeriOp-GYN, on the basis of their clinical meaningfulness for patient care. The proposed candidate items included bloating, abdominal heaviness, abdominal cramping, constipation, diarrhea, dizziness, grogginess/confusion, urinary pain, inability to urinate/difficultly urinating, incision pressure, and hot flashes.

3.2. Psychometric validity of the MDASI-PeriOp-GYN

The 11 candidate PeriOp-GYN symptom items plus the 19 items of the core MDASI were administered to 150 patients for purposes of

psychometric evaluation; 121 of the 150 patients also completed this assessment at the second timepoint 24–72 h later. Of these, 10 patients completed the second assessment before surgery and 111 patients completed it after surgery.

In the initial item correlation from baseline data, we found that abdominal heaviness was highly related to multiple symptoms (bloating ($r = 0.67$), abdominal cramping ($r = 0.66$), and pain ($r = 0.59$)), which indicated that this item lacked specificity. Given this observation and results from patient cognitive debriefing, another round of clinician input supported removal of the abdominal heaviness item. In this consultation, clinicians also suggested removing the incision pressure item, due to its limited clinical implication and significance in the postoperative period. Accordingly, 9 candidate PeriOp-GYN symptom items were retained in the MDASI-PeriOp-GYN for validation analysis (Fig. 1).

3.2.1. Reliability

3.2.1.1. Internal consistency reliability. A high degree of internal consistency within the symptom severity items and the interference items was observed (Table 2). The Cronbach α was 0.89 for the symptom severity scale (13 core +9 PeriOp-GYN symptom items) and 0.86 for the interference scale (6 items). When we deleted each single symptom item and recalculated the α coefficient, it consistently remained similar to the overall coefficient for that factor, indicating that each symptom contributed to the factor and should remain in the group.

3.2.1.2. Test-retest reliability. Test-retest reliability also was excellent. The intra-class correlation (ICC) was 0.88 for the 22 symptom severity items; ICCs were comparable for the 9 PeriOp-GYN items (ICC = 0.892), the 13 core symptoms (ICC = 0.847), and the 6 interference items (ICC = 0.885). Test-retest reliability remained strong for the 9 PeriOp-GYN items when analyzed by timepoint (ICC = 0.826 during hospitalization; ICC = 0.938 > 5 days after surgery).

3.2.2. Construct validity

3.2.2.1. Known-group validity. The MDASI-PeriOp-GYN was able to detect different levels of symptom severity based on timing of perioperative care. During hospitalization (≤5 days after surgery), patients who underwent open surgery reported significantly more severe symptoms (core plus PeriOp-GYN symptoms, $P = 0.0042$) compared with patients who underwent MIS. Patients with poorer performance status (ECOG PS 2–3 vs. 0–1) reported significantly higher severity for all MDASI core and PeriOp-GYN symptoms (all $P < 0.01$; Table 3), Cohen's d = for good vs. poor ECOG PS was 0.47 for core plus PeriOp-GYN symptom items ($P = 0.001$), and 0.68 for total interference ($P = 0.0004$).

3.2.2.2. Convergent validity. The validity of the MDASI-PeriOp-GYN was evaluated against the FACT-O. Significant correlations were found for the MDASI-core vs. FACT-O-core, PeriOp-GYN vs. FACT-O-AD, MDASI-WAW vs. FACT-O-GP, and MDASI-REM vs. FACT-O-EM (all $P < 0.0001$). Each MDASI-PeriOp-GYN composite score was significantly related to the single-item quality-of-life measure ($P < 0.0001$).

3.3. Cognitive debriefing results

Twenty of the validation patients participated in the cognitive debriefing part of the study. All 20 patients (100%) confirmed that the MDASI-PeriOp-GYN was easy to complete. None of the patients reported that the scale had too many questions or was burdensome. Almost all of the patients (95%) were very comfortable completing the instrument. Most were able to complete the MDASI-PeriOp-GYN in 2–3 min.

Table 2
Reliability of the MDASI-PeriOp-GYN: Cronbach coefficient α values with items deleted.

Deleted symptom item	Baseline overall α = 0.890		Retest overall α = 0.890	
	n	α	*n*	α
Pain	145	0.879	120	0.882
Fatigue	145	0.879	120	0.880
Nausea	145	0.882	120	0.885
Sleeping disturbance	145	0.879	120	0.881
Distress	145	0.881	120	0.884
Shortness of breath	145	0.886	120	0.888
Remember	145	0.879	120	0.886
Poor appetite	145	0.878	120	0.882
Drowsiness	145	0.878	120	0.880
Dry mouth	145	0.883	120	0.889
Sadness	145	0.884	120	0.886
Vomiting	145	0.894	120	0.891
Numbness/tingling	145	0.890	120	0.894
Bloating	145	0.884	120	0.884
Abdominal cramping	145	0.882	120	0.879
Constipation	145	0.883	120	0.887
Diarrhea	145	0.895	120	0.896
Dizziness	145	0.882	120	0.882
Grogginess/confusion	145	0.879	120	0.883
Urinary pain	145	0.886	120	0.887
Inability to urinate/difficulty urinating	145	0.891	120	0.889
Hot flashes	145	0.887	120	0.886
Deleted interference item	**Baseline overall α = 0.860**		**Retest overall α = 0.852**	
	n	α	*n*	α
Activity	148	0.823	120	0.819
Mood	148	0.848	120	0.832
Work	148	0.831	120	0.812
Relations	148	0.852	120	0.858
Walking	148	0.832	120	0.810
Enjoyment of life	148	0.834	120	0.830

Abbreviations: MDASI-PeriOp-GYN, MD Anderson Symptom Inventory Gynecologic Cancer Perioperative Module.

Almost all of the patients (95%) reported that the questions were understandable (comprehensibility) and felt comfortable in answering the questions (acceptability). All of the patients (100%) reported that the 0–10 scale was easy to use, and none suggested any other items as being needed to characterize the disease and treatment experience.

3.4. Application of the MDASI-PeriOp-GYN

3.4.1. Patient compliance

We observed extremely high compliance with this newly developed tool, as 95% of patients had no missing data at all. Overall, 28 MDASI-PeriOp-GYN items were presented; 95% of patients had no missing data, 4% missed 1 item, and 1% missed 5 items. In comparison, with 40 items on the FACT-O, the missing-data rates were 18% with no missing data, 51% missing 1 item, 19% missing 2 items, and 11% missing 3–12 items.

3.4.2. Symptom prevalence and severity

Table 4 presents symptom severity as well as floor and ceiling effects by timepoint for the entire sample at baseline ($N = 150$). Fatigue, pain, disturbed sleep, drowsiness, dry mouth, and lack of appetite were rated as the 6 most severe core symptom items, and bloating and abdominal cramps were the most severe PeriOp-GYN items. Using a cutpoint of ≥7 on the 0–10 scale to define a severe symptom, we found that 40% of the sample rated one or more symptoms as severe during hospitalization: 8% rated 1 symptom ≥7, 3% rated 2 symptoms, 7% rated 3 symptoms, 17% rated 4–6 symptoms, and 5% rated 7–11 symptoms ≥7. No significant difference in symptom severity for the PeriOp-GYN items was observed between patients who underwent open surgery vs. those who underwent MIS. After discharge from the hospital, 16% rated one or more severe symptoms.

3.4.3. Symptom impact on total interference

Among the MDASI core items, pain and sadness (both $P < 0.0001$) and lack of appetite and drowsiness (both $P < 0.05$) were associated with total interference. Fatigue, pain, lack of appetite, and vomiting were significantly associated with interference with general activity (all $P < 0.05$). Five of the 9 PeriOp-GYN items (dizziness and constipation (both $P < 0.0001$) and diarrhea, bloating, and abdominal cramping (all $P < 0.05$)) were significantly correlated with total interference.

4. Discussion

The MDASI-PeriOp-GYN was developed with qualitative interviews to obtain patient input and expert panel review to obtain clinician input, which produced 11 gynecologic cancer-specific candidate items. After examination of item sensitivity, 9 items (bloating, abdominal cramping, constipation, diarrhea, dizziness, grogginess/confusion, urinary pain, inability to urinate/difficulty urinating, and hot flashes) were retained for the final instrument (Fig. 1) and were psychometrically validated. As evidenced by satisfactory content validity, item sensitivity, known-group validity, convergent validity, internal consistency reliability, and test-retest reliability, the MDASI-PeriOp-GYN is a concise, internally stable, and sensitive instrument for measuring the severity of multiple symptoms and symptom interference with functioning during perioperative care in patients with gynecologic cancer or with a benign condition (25% of our sample). The negligible incidence of missing data, the brevity of administration time, and ease of use reported by patients supports the MDASI-PeriOp-GYN's minimal burden upon patients in the target population.

The MDASI-PeriOp-GYN can be used in both clinical practice and clinical trials to evaluate patient symptom burden during perioperative care, even with frequent assessments [7,20]. Despite the instrument's brevity, its 22 symptom items form a relatively comprehensive list of symptoms commonly experienced by patients with gynecologic cancer or benign tumor, regardless of disease site or stage. The 0–10 numeric scale is simple, familiar, and easily used in conjunction with modern technology, such as computer administration in the clinic or computer-aided telephone systems or web-based patient portals from home. This feature gives both professionals and patients the flexibility to communicate efficiently and effectively in describing symptom severity and symptom interference in real time.

This study provides useful and precise information about relevant symptom burden and interference caused by these standard procedures for treating gynecologic cancer. We found that, after discharge from the hospital, 16% percent of patients were reporting one or more symptoms at a severe level (rated ≥7 on the MDASI-PeriOp-GYN's 0–10 scale)—severe enough to require clinical management and indicating a need for effective PRO monitoring. The worst symptom burden during hospitalization and after discharge (see Table 4) could be targeted for intensive monitoring in routine patient care.

Consistent with previous symptom research [3,7], fatigue was the most severe symptom across the perioperative period, which is always challenging in terms of symptom management in oncology care. The high prevalence of other core symptom items suggests that the core MDASI [3] captures much of the symptom distress experienced across perioperative care. Among the PeriOp-GYN items, hot flashes reflect the body's response to postoperative hormone changes and could be corrected when severe. Dizziness and grogginess/confusion were especially important complications, especially during the short period of postoperative hospitalization. Bloating and abdominal cramping are often monitored during recovery, along with other aspects of gastrointestinal

Table 3
Known-group validity: MDASI-PeriOp-GYN severity, by performance status and surgery type.

Comparison by ECOG PS score ($n = 125$)								
Variable	ECOG PS	*N*	Mean	SD	LCL	UCL	*P*	Cohen's *d*
MDASI-core symptoms	Good (0–1)	90	1.42	1.43	1.12	1.72	0.0016	0.52
	Poor (2–3)	35	2.17	1.45	1.67	2.67		
PeriOp-GYN symptoms	Good (0–1)	90	1.06	1.30	0.78	1.33	0.0045	0.32
	Poor (2–3)	35	1.42	1.05	1.06	1.78		
MDASI interference	Good (0–1)	90	2.31	2.33	1.82	2.80	0.0004	0.68
	Poor (2–3)	35	3.79	2.04	3.09	4.49		
MDASI-WAW	Good (0–1)	90	3.04	2.99	2.41	3.66	0.0001	0.82
	Poor (2–3)	35	5.46	2.93	4.45	6.46		
MDASI-REM	Good (0–1)	90	1.58	2.27	1.10	2.05	0.0147	0.27
	Poor (2–3)	35	2.13	1.77	1.52	2.74		
Comparison by surgery type (MIS vs. OPEN) ≤ 5 days after surgery ($n = 87$)								
Variable	Surgery type	*N*	Mean	SD	LCL	UCL	*P*	Cohen's *d*
MDASI-core symptoms	OPEN	37	2.28	1.57	1.76	2.80	0.0019	0.71
	MIS	50	1.33	1.05	1.04	1.63		
PeriOp-GYN symptoms	OPEN	37	1.50	1.07	1.14	1.86	0.0530	0.26
	MIS	50	1.20	1.18	0.87	1.54		
MDASI interference	OPEN	37	3.51	2.15	2.79	4.23	0.0560	0.32
	MIS	50	2.80	2.25	2.16	3.44		
MDASI-WAW	OPEN	37	5.14	3.30	4.03	6.24	0.0476	0.38
	MIS	50	3.97	2.89	3.15	4.79		
MDASI-REM	OPEN	37	1.90	1.63	1.36	2.44	0.1837	0.15
	MIS	50	1.63	2.11	1.03	2.23		

Abbreviations: ECOG PS, Eastern Cooperative Oncology Group performance status; LCL, lower 95% confidence limit; MDASI, MD Anderson Symptom Inventory; MIS, minimally invasive surgery; REM, composite score of relations with other people, enjoyment of life, and mood, representing the MDASI's mental health or social functioning domains; SD, standard deviation; UCL, upper 95% confidence limit; WAW, composite score of work, activity, and walking, representing the MDASI's physical-functioning domain.

Table 4
Descriptive statistics for MDASI-PeriOp-GYN core and module items, by perioperative timing (baseline data only).

Symptom	Symptom items by time of survey															*P* group 2 vs group 3 comparison	*P* all groups comparison
	Group 1: presurgery					Group 2: ≤5 days postsurgery					Group 3: >5 days postsurgery						
	n	Mean	SD	Min	Max	*n*	Mean	SD	Min	Max	*n*	Mean	SD	Min	Max		
MDASI core items																	
Pain	25	2.00	3.29	0	9	87	4.21	2.58	0	10	38	1.34	1.65	0	6	<0.0001[a]	<0.0001[a]
Fatigue	25	3.08	3.08	0	10	87	3.66	2.64	0	10	38	2.47	2.23	0	8	0.0227[a]	0.0684
Drowsiness	25	2.56	3.24	0	10	87	2.72	2.70	0	10	38	1.05	1.69	0	5	0.0004[a]	0.0022[a]
Disturbed sleep	25	2.72	2.62	0	8	87	2.71	2.94	0	10	38	1.79	2.68	0	10	0.0848	0.1497
Dry mouth	25	2.36	3.28	0	10	87	2.15	2.86	0	10	38	1.03	1.97	0	8	0.0206[a]	0.0490[a]
Lack of appetite	25	1.36	2.51	0	10	87	1.90	2.53	0	10	38	0.89	1.84	0	7	0.0156[a]	0.0421[a]
Feeling distressed (upset)	25	2.88	3.11	0	10	87	1.16	1.88	0	7	38	0.87	1.86	0	7	0.1371	0.0005[a]
Sadness	25	2.60	3.12	0	10	86	0.99	1.77	0	9	38	0.95	2.18	0	10	0.2896	0.0035[a]
Difficulty remembering	25	2.40	2.89	0	8	87	0.86	1.77	0	10	37	0.27	0.69	0	3	0.0318[a]	0.0008[a]
Nausea	24	0.58	1.72	0	7	87	0.79	1.90	0	10	38	0.58	1.24	0	5	0.6024	0.6163
Shortness of breath	25	0.64	1.32	0	4	87	0.70	1.61	0	9	38	0.32	0.70	0	3	0.3600	0.6551
Numbness/tingling	25	2.16	2.98	0	9	87	0.47	1.13	0	6	38	0.74	1.46	0	5	0.3530	0.0052[a]
Vomiting	25	0.00	0.00	0	0	86	0.22	1.02	0	7	38	0.00	0.00	0	0	0.1329	0.1523
PeriOp-GYN items																	
Bloating/abdominal tightness	25	1.36	2.60	0	10	87	3.24	2.80	0	10	38	0.97	1.67	0	6	<0.0001[a]	<0.0001[a]
Abdominal cramping	25	1.20	2.71	0	10	86	2.60	2.95	0	9	38	0.87	1.47	0	6	0.0045[a]	0.0019[a]
Constipation	25	1.48	2.77	0	10	87	2.09	2.93	0	10	38	0.74	1.88	0	10	0.0023[a]	0.0115[a]
Dizziness	25	0.72	1.57	0	6	86	0.99	2.24	0	10	38	0.29	0.80	0	4	0.1130	0.2888
Grogginess/confusion	25	0.96	1.70	0	7	86	0.81	2.18	0	10	38	0.29	0.87	0	4	0.1629	0.1099
Diarrhea	25	0.00	0.00	0	0	87	0.63	1.94	0	10	38	0.42	1.03	0	4	0.9530	0.0984
Urinary urgency	25	1.12	2.03	0	9	87	0.63	1.47	0	6	38	0.68	1.61	0	7	0.6525	0.2257
Inability to urinate/difficulty urinating	25	0.56	1.85	0	9	86	0.51	1.90	0	10	38	0.50	1.41	0	6	0.5452	0.7691
Hot flashes	25	1.88	3.02	0	9	86	0.51	1.43	0	7	38	1.24	2.10	0	9	0.0113[a]	0.0072[a]

Abbreviations: ECOG PS, Eastern Cooperative Oncology Group performance status; LCL, lower 95% confidence limit; MDASI, MD Anderson Symptom Inventory; MIS, minimally invasive surgery; REM, composite score of relations with other people, enjoyment of life, and mood, representing the MDASI's mental health or social functioning domains; SD, standard deviation; UCL, upper 95% confidence limit; WAW, composite score of work, activity, and walking, representing the MDASI's physical-functioning domain.
[a] Significant at $P < 0.05$.

functioning. Constipation, diarrhea, urinary pain, and difficulty urinating are local postsurgical symptoms that are clinically meaningful and should be addressed.

Our study had a limitations. First, because this was a cross-sectional study, we were not able to examine the sensitivity of the tool, which ideally would be reported in a longitudinal study with the same patient cohort. Second, although the use of ≥7 on a 0–10 scale to indicate clinically significant severe symptoms has proven useful for screening and measuring various symptoms in perioperative care, more research is needed to define cutpoints for moderate and severe levels for individual symptoms that are relevant to significant clinical outcomes in this population.

In conclusion, our study demonstrated that the MDASI-PeriOp-GYN is a useful instrument for tracking common symptoms in English-speaking patients undergoing surgical care for gynecologic cancer or benign tumor. Purposive sampling for both the qualitative study and the cognitive debriefing, along with the use of standard FDA-recommended procedures for validation [6,19], help to ensure that the instrument represents the symptom experience of the targeted population. As a measure of multiple symptoms, the MDASI-PeriOp-GYN may have practical application in the clinic and as an outcome measure in clinical trials that can maximize the effectiveness of postoperative care while limiting symptom burden and promoting the timely commencement of scheduled adjuvant therapy.

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Conflicts of interest

The MD Anderson Symptom Inventory and its derivative versions are copyrighted and licensed by The University of Texas MD Anderson Cancer Center and Charles S. Cleeland. Xin Shelley Wang and Charles S. Cleeland have a financial interest in the MDASI and its derivative versions. The authors report no other conflicts of interest.

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