*Original Article*

# Assessing Analgesic Regimen Adherence with the Morisky Medication Adherence Measure for Taiwanese Patients with Cancer Pain

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***Abstract***

*The purposes of this study were (1) to examine the psychometric properties of the Taiwanese version of the Morisky Medication Adherence Measure (MMAM), including its validity and reliability, (2) to investigate levels of analgesic regimen adherence, and (3) to explore the predictors of adherence to the analgesic regimen in a sample of Taiwanese cancer patients with pain. One hundred thirty-five patients receiving analgesics for cancer pain participated in this study. Instruments consisted of the Taiwanese version of the MMAM, the Barriers Questionnaire-Taiwan form, the Chinese version of the Brief Pain Inventory, the American Pain Society Outcome Questionnaire, Karnofsky Performance Status, and a demographic questionnaire. Analgesic use ratios were calculated. The Taiwanese version of the MMAM had good psychometric properties for measuring adherence with the analgesic regimens taken by Taiwanese cancer pain patients. Reliability was supported by good internal consistency Cronbach α and test-retest coefficients. Validity was corroborated by good known group validity, construct validity, and criterion-related validity. The majority of the patients (51%) showed low levels of medication adherence. The significant predictors for the medication adherence score were age, the Barriers Questionnaire score, and satisfaction with pain management by clinicians after entering pain severity, pain interference with daily life, age, gender, education, types of analgesics used, functional status, and satisfaction with pain management as independent variables. The model accounted for 63% of the variance in the medication adherence score. The Taiwanese version of the MMAM shows excellent reliability and validity. The use of this reliable, valid, simple, and easily administered tool can improve communication between patients and clinicians about use of analgesics and further improve the analgesic regimen adherence.* J Pain Symptom Manage 2008;36:157–166. © *2008 U.S. Cancer Pain Relief Committee. Published by Elsevier Inc. All rights reserved.*

***Key Words***

*Cancer pain, compliance, medication adherence, analgesics*

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## Introduction

Analgesics are a major treatment modality for the management of cancer pain. Yet hesitance about using analgesics has been a barrier to effective management.[1,2] As with other chronic medical conditions, achieving adequate adherence to analgesic regimens is difficult despite recent advances in analgesic treatment. Even the most advanced therapeutic regimen of appropriate medication will fail without patient adherence.[3] The positive relationship between patient adherence and treatment outcomes has been documented across chronic medical conditions.[4] Although adherence with therapeutic regimens for other chronic medical conditions has been widely investigated, very few studies have explored oncology patients' level of adherence with their analgesic regimens.

One factor that has been demonstrated to contribute to the undertreatment of cancer pain is patients' lack of adherence to the therapeutic regimen.[5] Miaskowski et al.[5] evaluated oncology outpatients' adherence to analgesic regimens over a five-week period and found overall adherence rates for around-the-clock opioid analgesics ranged from 84.5% to 90.8%. Du Pen et al.[6] reported that oncology patients adhered to prescribed opioid therapy between 62% and 72% of the time. Moreover, in a study of breakthrough pain, Ferrell et al.[7] observed adherence rates for opioid analgesics had a mean of 80%. The methods used to calculate adherence scores varied across these studies, making it difficult to compare results, and included pill counts or use of diary data, which may not be easily applied in practice.

Experience gained from measuring adherence to medical regimens for other chronic conditions can provide an important basis for measuring cancer pain patients' adherence to analgesic regimens. The Morisky Medication Adherence Measure (MMAM) is a simple, valid, and reliable four-question survey originally developed to assess adherence to medication regimens in patients with hypertension[8] and has also been used to measure adherence to antiretroviral therapy in patients who are HIV-positive.[9] The Morisky measure has been validated against clinical measures of blood pressure control in a sample of patients with hypertension.[8] Compared with the gold standard of filed prescription claims, the MMAM, used alone, was found to have a sensitivity of 61%.[10] However, it also has been shown that the concordance between the MMAM and measures of missed doses is unsatisfactory.[11] Nevertheless, the Morisky measure may have great potential for assessing oncology patients' adherence to analgesic regimens.

Taiwanese cancer patients' hesitancy to use analgesics is a barrier to optimal cancer pain management.[1,2,12,13] However, these patients' adherence to analgesic regimens has received little attention in Taiwan. The specific aims of this study were, therefore: (1) to examine the psychometric properties of the Taiwanese version of the MMAM, including validity and reliability, (2) to investigate levels of adherence to the analgesic regimen, and (3) to explore the predictors of adherence to the analgesic regimen in a sample of Taiwanese cancer patients with pain.

## Methods

### *Participants and Setting*

This study was part of a larger study of the effectiveness of a patient and family pain education program for reducing cancer patients and caregiver resistance to pain management and for decreasing pain intensity and interference with daily life.[2] Only participants in the control group were used in the analysis. This study was conducted in the oncology outpatient clinics of two Taipei area hospitals. To be included in the study, patients had to (1) have been diagnosed with cancer, (2) be experiencing cancer pain and currently taking oral analgesics for pain treatment, (3) be over the age of 18 years, and (4) be able to communicate in Mandarin or Taiwanese. A total of 135 patients were used for the analysis.

### *Instruments*

Instruments consisted of the Taiwanese Version of the MMAM, the Barriers Questionnaire-Taiwan form (BQT), the Chinese version of the Brief Pain Inventory (BPI-C), the American Pain Society (APS) Outcome Questionnaire, Karnofsky Performance Status (KPS), and a demographic questionnaire.

*The Taiwanese Version of the MMAM.* The original version of the MMAM is a structured four-

item measure developed by Morisky, Green, and Levin[8] to measure compliance to prescribed use of analgesics for pain. Items in the scale address possible barriers preventing patients from taking medications. The theory underlying this measure is that drug errors of omission can occur for any or all of the following reasons: forgetfulness, carelessness, cessation of the drug when feeling better, and initiation of the drug when feeling worse. The sum of the "yes" answers provides a composite measure of nonadherence. Scoring of the item was reversed to be consistent with the scale properties, thus the total score ranges from 0 to 4, with higher scores indicating higher adherence. The high-adherence group was defined by a total score of 4, the moderate-adherence group by a score of 2−3, and the low-adherence group by a score of 0−1. Reliability, and concurrent and predictive validities of this measure have been supported.[8] The Taiwanese version of the MMAM was developed using a translation and back-translation process. The self-reporting measure of medication adherence was first translated from English into Taiwanese by a bilingual person. Then a second bilingual person who had not seen the original English version back-translated from Taiwanese into English. The process was repeated until the back-translated items and the originals agreed.

*Barriers Questionnaire-Taiwan Form (BQT).* The BQT, developed from the Barriers Questionnaire,[14] was translated for use by Taiwanese patients and was subsequently modified.[1] It now consists of nine subscales (a total of 34 items), including the following: (1) fatalism (i.e., pain medicine cannot really control pain), (2) addiction (i.e., people get addicted to pain medicine easily), (3) desire to be good (i.e., doctors might find it annoying to be told about pain), (4) fear of distracting physicians (i.e., it is more important for the doctor to focus on curing illness than to put time into controlling pain), (5) disease progression (i.e., increased pain is a sign that the illness has gotten worse), (6) tolerance (i.e., pain medicine should be "saved" in case the pain gets worse), (7) side effects (i.e., pain medicine will cause harm to the liver), (8) religious fatalism (i.e., pain is caused by Karma or given by God and patients have to tolerate the pain in order to avoid carrying it into their next life), and (9) prn or "as needed," (i.e., pain medicine is better given as needed instead of on a scheduled basis). The BQT asks patients to rate the extent to which they agree with each item on a scale from 0 (do not agree at all) to 5 (agree very much). Both subscale scores (the mean of the items in a given subscale) and the total score (the mean of all items) were used in the analyses. The reliability and validity of the BQT has been proven.[1,12] Moreover, at the end of the BQT, patients were asked "During the last week, have you ever hesitated to take analgesics?" Response options for each item were either yes or no.

*Brief Pain Inventory-Chinese Version (BPI-C).* The BPI-Chinese version[15] was used for this study to measure pain intensity and resulting interference with life activities. The first part of the BPI consists of the following four single-item measures of pain intensity, with each item rated on a scale of 0 (no pain) to 10 (the worst pain I can imagine): (1) worst pain (please rate your pain by circling the number that best describes your pain at its worst in the last 24 hours), (2) least pain (please rate your pain by circling the number that best describes your pain at its least in the last 24 hours), (3) average pain (please rate your pain by circling the number that best describes your pain on average), and (4) pain now (please rate your pain by circling the number that tells how much pain you have right now). The second part of the BPI consists of the following seven items that assess the extent to which pain interferes with general activities, mood, walking, working, relations with others, sleeping, and enjoyment of life, with each item rated on a scale of 0 (does not interfere) to 10 (completely interferes). An interference score (the average of the seven items) was computed. Its reliability and validity have been established.[1,15,16]

*Karnofsky Performance Status (KPS).* The KPS is used to assess patients' performance status and is rated on a scale of 1∼100, in steps of 10. The KPS has been documented to have good predictive validity.[17]

*American Pain Society (APS) Outcome Questionnaire.* This questionnaire was translated into Chinese using a translation and back-translation method to ensure accuracy.[18] The questionnaire was based on the APS Standards.[19] This questionnaire included (1) patients'

assessment of pain severity and satisfaction with how pain was managed by physicians and nurses, (2) patients' perceptions of the time between a complaint about pain and receipt of medication, and (3) patients' perceptions of the time between a complaint of inadequate medication and receipt of different or stronger medication. Patients were asked if their doctors or nurses discussed the importance of pain management with them.

*Demographic and Disease Information.* A demographic information sheet covered basic information on patients, including age, gender, education, marital status, religious beliefs, and occupation. A disease information sheet recorded a patient's diagnosis, medications, and treatment status, as well as whether metastasis has or has not occurred.

*Analgesic Use Ratio.* An analgesic use ratio was calculated using the amount of analgesics taken by patients divided by the amount of analgesics prescribed. All medications were standardized using an equianalgesic conversion table to calculate oral morphine equivalents.

### *Procedures*

Approval for this study was obtained from the Human Subject Committee of the hospitals, and patients who met the selection criteria were recruited. A research assistant approached patients individually to describe the study and to obtain informed consent from patients. Patients completed the MMAM, the BQT, the BPI-C, the APS Outcome Questionnaire, and the KPS. Two weeks after the first interview, the analgesics use ratio was computed for each patient.

### *Statistical Analysis*

Descriptive statistics were used to describe demographic and disease characteristics and the BQT, BPI-C, and Medication Adherence Measure scores. The reliability and validity of the Taiwanese version of the MMAM were assessed as follows. Internal consistency was established by calculating the Cronbach $\alpha$ coefficient, which ranges from 0 to 1, with higher values indicating less measurement error. Test-retest reliability was evaluated by calculating the Pearson product moment correlation coefficient with a three-day interval between pretest and posttest for a sample of 21 patients. Construct validity was established by principal-axis factor analysis with direct oblimin rotation. The number of factors was identified using a scree test, a plot showing the number of factors against the eigenvalues. Convergent validity was examined by calculating the Pearson product moment correlation coefficient between the MMAM scores and the patients' and family members' BQT scores. Known-group validity was examined by comparing the MMAM scores of patients with hesitancy to take analgesics vs. no hesitancy in the past week. Regression analyses were used to explore predictors of medication adherence and levels of pain.

## *Results*

### *Participant Characteristics*

Demographic and disease-related characteristics of patients are presented in Table 1. Fifty-nine percent of the participants were women and the mean (SD) age was 58.37 (15.63) years. The majority was married (82%) and the mean (SD) years of education was 7.84 (4.19). Forty-nine percent were retired. The participants were diagnosed with various types of cancer. Cancer sites included breast (27%), lung (16%), nasopharyngeal (14%), oral (13%), colorectal (6%), prostate (6%), and various others (18%). Fourteen percent of participants were receiving chemotherapy and 39% were receiving radiotherapy. Seventy-one percent of participants' cancer had metastasized. Forty-two percent of them were outpatients and 58% were inpatients. The mean (SD) KPS score was 82.81 (13.14). The mean (SD) analgesic ratio was 0.67 (0.24).

### *Internal Consistency*

The internal consistency was established by calculating the Cronbach $\alpha$ coefficient. Cronbach $\alpha$ coefficient was 0.73 for four items, which indicates the fair internal consistency of the Taiwanese version of the MMAM. The item-to-item correlation coefficients ranged from 0.22 to 0.59 for these four items (Table 2).

### *Test-Retest Reliability*

The test-retest reliability was evaluated by calculating the Pearson product moment correlation coefficient between pretest and posttest over a two-week interval in a sample of 21 cancer outpatients. The test-retest

*Table 1*
**Demographic and Disease-Related Characteristics of the Patients ($n = 135$)**

| Characteristics | Mean | SD |
|---|---|---|
| Age (years) | 58.37 | 15.63 |
| Education (years) | 7.84 | 4.19 |
| KPS | 82.81 | 13.14 |
| | *n* | % |
| Gender | | |
| Male | 55 | 41 |
| Female | 80 | 59 |
| Marital status | | |
| Married | 111 | 82 |
| Other | 24 | 18 |
| Disease stage | | |
| Localized | 39 | 29 |
| Metastasized | 96 | 71 |
| Treatment | | |
| Chemotherapy (CT) | 19 | 14 |
| Radiotherapy (RT) | 52 | 39 |
| CT + RT | 9 | 7 |
| None | 55 | 40 |
| Cancer sites | | |
| Breast | 36 | 27 |
| Lung | 21 | 16 |
| Nasopharyngeal | 19 | 14 |
| Oral | 18 | 13 |
| Colorectal | 9 | 6 |
| Prostate | 8 | 6 |
| Others | 24 | 18 |

reliability for the adherence score was 0.60 ($P = 0.004$). Furthermore, paired *t*-tests indicated no difference on the adherence measure between pretest and post-test over a two-week interval (means [SD] for pretest and post-test were 1.19 [1.17] and 1.33 [1.20], respectively; $t = -0.61$).

### *Construct Validity*

Factor analysis was used to determine the underlying constructs measured by the items in the medication adherence measure. The result revealed a single underlying construct among the four medication adherence measure items. The factor loadings were high and ranged from 0.37 to 0.85, which indicates the association of the four measure items with a single factor (Table 3).

*Table 2*
**Item-to-Item Correlation Coefficients for the Taiwanese Version of the MMAM ($n = 135$)**

| | Item 1 | Item 2 | Item 3 | Item 4 |
|---|---|---|---|---|
| Item 1 | 1 | — | — | — |
| Item 2 | 0.41[a] | 1 | — | — |
| Item 3 | 0.48[a] | 0.59[a] | 1 | — |
| Item 4 | 0.23[a] | 0.22[a] | 0.33[a] | 1 |

[a]*P*-values of all correlations are <0.01 (two tailed).

### *Convergent Validity*

Convergent validity was evaluated by correlating the MMAM with the BQT scores of patients and their family members. The MMAM score was significantly correlated with the patients' and family members' BQT scores ($r = -0.50$ and $-0.45$, respectively, $P < 0.001$). Results supported the hypothesis that the MMAM score correlates with the concerns about using analgesics measured by the BQT.

### *Criterion-Related Validity*

Criterion-related validity was assessed by correlating the MMAM with the patient's actual analgesics use ratio. The MMAM score was significantly correlated with the analgesics ratio actually used by the patient ($r = 0.49$, $P < 0.001$), indicating that patients reporting higher scores on the MMAM actually used more analgesics prescribed by the physician.

### *Known-Group Validity*

As we hypothesized, patients who reported hesitancy about taking analgesics in the past week also reported lower levels of adherence with analgesic regimens (means [SD] for patients reporting hesitancy vs. no hesitancy were 0.87 [1.13] and 2.19 [1.25], respectively; with $t = -6.45$, $P < 0.001$). Similarly, patients reported lower levels of adherence with analgesic regimens (means [SD] for patients reporting hesitancy vs. no hesitancy were 1.18 [1.31] and 1.82 [1.35], respectively; with $t = -2.75$, $P = 0.007$) when their family members reported hesitancy about administering analgesics to the patient in the past week.

*Table 3*
**Factor Loadings of the Taiwanese Version of the MMAM ($n = 135$)**

| | Factor 1 |
|---|---|
| Item 1 | 0.58 |
| Item 2 | 0.68 |
| Item 3 | 0.85 |
| Item 4 | 0.37 |

*The MMAM Distribution of Scores*

The distribution of scores of the MMAM is shown in Table 4. The majority of the patients showed low levels of medication adherence, indicating they were not adequately following their analgesic regimens. Only 8.9% of patients completely complied with the analgesic regimens.

*Predictors of Adherence to Analgesic Regimen*

Regression analysis was applied to determine predictors of patients' adherence to analgesic regimens. Based on previous studies, the medication adherence score was entered as the dependent variable, and the independent variables in the regression model included a pain severity composite score, pain interference with daily life, age, gender, levels of education, types of analgesics used, levels of functional status, and satisfaction with pain management by clinicians. Because there is a high correlation between satisfaction with pain management by nurses and by physicians in the American Pain Society Outcome Questionnaire, the scores of these two items were averaged to represent satisfaction with pain management by clinicians. This model revealed that the selected independent variables accounted for 63% of the variance in the medication adherence score. The significant predictors for the medication adherence score were age, the BQT scores, and satisfaction with pain management by clinicians (Table 5).

*Table 4*
**The MMAM (Taiwanese) Distribution of Scores ($n = 135$)**

| Total Adherence Score | *n* | % |
|---|---|---|
| 0 | 42 | 31.1 |
| 1 | 27 | 20.0 |
| 2 | 24 | 17.8 |
| 3 | 30 | 22.2 |
| 4 | 12 | 8.9 |

*Table 5*
**Predictors of Adherence with Analgesic Regimens ($n = 135$)**

| | Beta Coefficient | % of Variance Accounted for | *P*-value |
|---|---|---|---|
| Education | 1.66 | <5% | 0.10 |
| Pain severity | 1.57 | <5% | 0.14 |
| BQT Scores | −0.39 | 17% | <0.001[a] |
| Satisfaction with clinicians | 0.37 | 14% | <0.001[a] |
| Age | 0.23 | 5% | 0.02[a] |
| Karnofsky Performance Status | 0.11 | <5% | 0.17 |
| Gender | −0.08 | <5% | 0.30 |
| Types of analgesics used | 0.06 | <5% | 0.40 |
| Pain interference | 0.04 | <5% | 0.74 |

[a] $P < 0.05$.

## Discussion

This study is the first to validate the MMAM for assessing adherence to analgesic regimens in patients with cancer pain. We have demonstrated that this measure has good psychometric properties for measuring compliance with analgesics regimens in Taiwanese cancer pain patients. Its reliability was supported by good internal consistency Cronbach α and fair test–retest coefficients. The measure's validity was supported by good known-group validity, construct validity, and criterion-related validity. Patients with hesitancy to take analgesics in the past week reported lower levels of adherence with analgesic regimens. The medication adherence scores correlated well with the analgesics ratio for medication actually used by the patient, indicating criterion-related validity. Medication adherence scores correlated well with the BQT scores for patients and family members, indicating convergent validity. The psychometric properties of the Taiwanese version of the MMAM are consistent with the original version used in populations in Western countries; it is the first instrument measuring adherence to analgesics regimens that was developed for Taiwanese cancer patients and shows excellent reliability and validity.

As with other medical conditions, oncology patients' adherence to prescribed analgesic regimens has been recognized as an essential factor in the success of pain management.[5] However, one of the major challenges to assessing adherence to medication regimens is how to measure the actual amount of medication taken by the patient. Several approaches have been used to assess adherence, including monitoring drug levels or pharmacologic markers, checking the filling of prescriptions or pill counts, electronic measurement devices, diary data, or interview data.[8,20] Except for diary data and interview data, the other approaches are not feasible in practice and are expensive.

Therefore, the MMAM, a reliable and valid interview measure, has a great potential for assessing oncology patients' adherence to their analgesic regimens, because of its simplicity, speed, and feasibility in practice.

Failure to manage pain is often due to reluctance to take analgesics according to the dose and time interval prescribed by physicians on account of patient concerns about analgesic use.[1,13,14,21,22] If patients do not take analgesics according to the prescribed schedule and dosage, pain management becomes ambiguous because drug efficacy and dosage becomes difficult to evaluate and the amount of drug titration necessary for pain management becomes even more difficult to determine. In the present study, medication adherence scores showed patients' adherence to a prescribed medication schedule was generally inadequate. Only 8.9% of patients were in the high adherence group, completely complying with the analgesic regimens prescribed by the physician. Moreover, the test-retest reliability coefficient seems rather low. It could be due to the fact that patients may self-terminate their pain medication when the pain lessens. Musi[23] has proposed three reasons for nonadherence in cancer pain patients. First, patients may be willing to tolerate pain rather than experience the side effects of analgesics, among other reasons. Second, successful treatment of cancer pain may not reinstate a premorbid level of quality of life. Lastly, patients sometimes may not desire complete analgesia, because mild pain is compatible with normal functioning. Nevertheless, interventions aimed at improving adherence to analgesic regimens remain fundamental.

In this study, we found that oncology patients who were older reported less concern about using analgesics, were more satisfied with pain management by clinicians and had better adherence scores. The phenomenon of older patients showing greater compliance with treatment than younger patients has been observed in other studies,[24–27] although Coker et al.[28] found no association between age and adherence to follow-up recommendations for abnormal Pap tests. Several explanations have been offered to account for the greater compliance of older patients than younger patients. Younger patients may have interests incongruent with the goals of therapy, leading to a lack of motivation.[27] Younger people may have more distractions in their lives, which interfere with treatment compliance.[29] It has been suggested that older patients have greater motivation for treatment, show greater responsibility for restoring good health, put greater priority on treatment, and demonstrate more positive attitudes toward health professionals, all of which could contribute to better compliance among older patients relative to younger patients.[24]

Recent studies have noted patient satisfaction with the treatment process and outcome is an important factor related to compliance with treatment.[30–32] Although patient satisfaction with treatment for other medical conditions has been widely investigated, patient satisfaction with treatment of cancer pain has received much less research attention. Recent studies have demonstrated that there is a distinct relationship between patient satisfaction and patient compliance for certain treatments.[31,32] There has been no previous study examining the role of patient satisfaction in oncology patients' adherence to their analgesic regimens. After controlling for confounding variables, this study found patient satisfaction with pain management by clinicians significantly predicted levels of adherence to analgesic regimens. In a sample of 180 patients receiving treatment for chronic pain, Hirsh et al.[31] found that patients who were more satisfied with the improvement in pain relief were more compliant with treatment recommendations. It has also been shown that nonadherence was more widespread among patients who were dissatisfied with their physicians.[32] Therefore, patients' perceptions of satisfaction with clinicians' pain management influences their decision about adherence to their analgesic regimens. Interventions that improve patient satisfaction with their clinicians' pain management may subsequently benefit the outcome of treatment for cancer pain.

Patients in this study who reported higher levels of concern about analgesics were less likely to adhere to analgesic regimens. Studies have affirmed that patients with higher scores on the BQ were more likely to hesitate to take analgesics.[1,2,12] One randomized controlled study[2] has shown that a patient and family pain education program effectively

reduced oncology patients' concerns about using analgesics and improved adherence to analgesic regimens, after controlling for preintervention differences and maturation effects, and these results were consistent with outcomes of other studies. Ferrell et al.[33] presented a pain education program to 40 pairs of elderly cancer patients and their families and found a significant increase in medication adherence, an increase in knowledge about analgesics, and an increase in scheduled use of medication, as opposed to an "as needed" approach. Rimer et al.[34] found that patients who received pain education had better adherence to medication schedules than patients who did not receive education. Furthermore, patients who received pain education did not self-terminate medication when the pain lessened. It appears that pain education programs have a beneficial effect on reducing patients' misconceptions about analgesics and, therefore, improve oncology patients' adherence to their analgesic regimens.

Although there are several strengths of the Morisky measure, there are some potential problems with applying this measure across different patients. The researcher needs to consider whether the concept of interest is adequately measured when applying one instrument to another population. The Morisky measure was originally developed to assess adherence to medication in patients with hypertension and has been widely used in different populations with chronic disease, such as patients with HIV,[9] asthma,[35] Parkinson's disease,[36] and cardiovascular disease.[37] Cancer is a chronic disease and shares similar characteristics with other chronic diseases, especially in issues regarding medication adherence. Therefore, it is appropriate to use the Morisky measure in cancer patients. However, patient honesty and recall in reporting are important to the accurate identification of the possible determinants of adherence behavior and assessment of adherence levels. It is common to note that cancer patients have a desire to be good patients[1]; therefore, patients may be less likely to accurately report their unadherent behaviors. Moreover, self-reported cognitive problems are common among cancer patients receiving therapies. Studies have shown that chemotherapy may result in significant cognitive impairments in patients with breast cancer. Eberhardt et al.[38] reported that chemotherapy has negative short-term effects on memory. A recent study found that the majority of cancer patients reported problems with their memory (71% overall at six months, 60% at 18 months).[39] Therefore, these above issues should be considered when the Morisky measure is used in cancer patients.

The results from this study should be interpreted with caution because of certain limitations. First, we only used one objective measure (analgesic ratio) to supplement the subjective ratings in the MMAM. Other objective measures could be investigated in future studies. Second, we did not collect the data on the use of over-the-counter drugs or herbal supplements for breakthrough pain. This could be a confounding variable. Third, we employed a cross-sectional design. A longitudinal design and a longer follow-up period will be needed to understand how adherence levels changes over time. Lastly, cultural factors could be important to adherence behaviors;[40] in the Chinese culture, for example, the perspectives of family caregivers have great impact on patients' medical treatment. Concerns about the negative effects of analgesics and beliefs about enduring pain have great influence on analgesic adherence of cancer patients. Those concerns arise not only from the viewpoints of patients but also from family caregivers' perspectives.[1,12] Therefore, additional cultural variables needed to be investigated in future studies.

In conclusion, the findings from this study provide support that the MMAM is a reliable, valid, and clinically easy-to-use measure of adherence to analgesic regimens for Taiwanese cancer pain patients. Moreover, the MMAM is more feasible for clinicians as a way of assessing analgesic compliance than pill counts. In addition to the English version, the MMAM can be translated into different languages, allowing the study results to be compared across different countries. Adherence to analgesic regimens has become one of the most significant clinical problems in the management of cancer pain. Increasing patients' adherence levels is one approach to improving management.[5] The use of this reliable, valid, simple, and easily administered tool can improve communication between patients and clinicians about use of analgesics, and thus, has a great

potential for improving management of cancer-related pain.

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