Medication regimen complexity in patients with uncontrolled hypertension and/or diabetes

Stephen M. Rettig, Yelena Wood, and Jan D. Hirsch

Abstract

Objectives: To compare medication regimen complexity (MRC) for patients with uncontrolled hypertension, uncontrolled diabetes, or both, to examine the contribution of complexity components (dosage form, frequency, additional directions) to total MRC index (MRCI) score, and to explore the relationship of MRC with patient characteristics and medication regimen cost.

Methods: This cross-sectional retrospective study used electronic medical record data for patients' most recent visit to a university internal medicine clinic during 2009. MRCI scores (disease specific and patient level [medications for all conditions]) were calculated for adults with uncontrolled hypertension, diabetes, or both (i.e., not at recommended treatment goals).

Results: 206 patients (85 with hypertension, 60 with diabetes, and 61 with both) were included. The median (range) disease-specific MRCI was significantly greater for diabetes (8.0 [3–21]) than for hypertension (3.0 [2–11], $P < 0.001$), though the median number of disease-specific medications was identical (2). The majority of hypertension MRC was the result of dosage frequency (62.1%), while diabetes MRC was distributed among dosage form (38.3%), frequency (39.1%), and additional directions (27.6%). The median patient-level MRCI scores for each group were 11 to 15 points higher than the disease-specific MRCI scores. Higher MRCI scores were associated with higher regimen cost, comorbidity burden, and female gender.

Conclusion: The magnitude of MRCI scores varied across the three disease groups, increased dramatically when all medications were considered, and revealed greater complexity than a simple count of prescribed medications. The MRCI may be a useful tool for targeting patients for whom medication therapy management services would be most beneficial and cost effective.

Keywords: Medication regimen complexity, medication regimen complexity index, medication therapy management.

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Medication regimen complexity (MRC) has been identified as a factor related to patient nonadherence to prescribed medications.[1–4] Common and simple measures used to quantify MRC include number of prescribed medications and dosage frequency.[5–9] However, MRC also includes other characteristics such as the type of dosage form and additional directions.[10] MRC is multifaceted, and quantifying it objectively could be useful for targeting patients for whom medication therapy management (MTM) services would be most beneficial and cost effective.

The MRC index (MRCI) is a tool to quantify multiple facets of MRC, with higher scores indicating greater complexity.[10] MRCI has been used to quantify MRC in a growing number of studies in outpatient community care settings (PubMed search of English-language studies from 1980 to December 2012).[11–14] The earliest study (n = 94,860 U.S. patients with diabetes) documented MRCI scores for oral antihyperglycemic drugs (mean 3.3 [range 0–14]).[11] Higher MRCI scores were associated with poorer adherence and higher glycosylated hemoglobin (A1C) levels. A smaller study of 161 community pharmacy patients with type 2 diabetes in Brazil reported a mean (±SD) patient-level (all medications) MRCI score of 15.5 ± 7.8 (range 4–40.5).[12] A third outpa-

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Stephen M. Rettig, PharmD, was a student pharmacist, Skaggs School of Pharmacy and Pharmaceutical Sciences, University of California, San Diego, La Jolla, CA, at the time this study was conducted; he is currently a pharmacy practice resident, Community Regional Medical Center, Fresno, CA. **Yelena Wood, MD,** was Associate Clinical Professor of Medicine, Internal Medicine Group, University of California, San Diego, La Jolla, CA, at the time this study was conducted; she is currently practicing with Premier Physician Medical Group, San Clemente, CA. **Jan D. Hirsch, PhD,** is Associate Professor of Clinical Pharmacy, Skaggs School of Pharmacy and Pharmaceutical Sciences, University of California, San Diego, La Jolla, CA, and Clinical Pharmacist Specialist, Department of Veterans Affairs of San Diego Healthcare System, San Diego, CA.

Correspondence: Jan D. Hirsch, PhD, Skaggs School of Pharmacy and Pharmaceutical Sciences, University of California, San Diego, 9500 Gilman Dr., Mail code 0714, La Jolla, CA 92093-0714. Fax: 858-822-6857. E-mail: janhirsch@ucsd.edu

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tient study in South Africa (n = 200 randomly selected outpatient prescriptions) reported that mean MRCI scores were higher for older age groups (e.g., 19.3 ± 8.5 for patients aged 60–69 years).[13] The most recent study to quantify MRC in outpatients using MRCI was conducted in Medicare Part D patients (mean age 71.2 ± 7.5).[14] Those receiving MTM services (n = 60) had a mean MRCI of 21.5 (range 8–43).

Objectives

The objectives of this study were to (1) compare MRC (disease specific and patient level) for patients with uncontrolled hypertension, uncontrolled diabetes, or both, (2) examine the contribution of complexity components (dosage form, frequency, additional directions) to total MRCI score, and (3) explore the relationship of MRC with patient characteristics and medication regimen cost. The hypothesis was that the group with diabetes would have higher MRCI scores than the group with hypertension because diabetes therapy can involve injectable dosage forms and more complicated dosing directions.

Methods

This was a cross-sectional retrospective study at a university general internal medicine clinic. The Institutional Review Board of University of California, San Diego, approved the study.

Each group of patients (hypertension, diabetes, or both) was randomly selected from the roster of active clinic patients in June 2010. Inclusion criteria were (1) 18 years or older at the beginning of the index period (January 1, 2009, to December 31, 2009), (2) hypertension diagnosis with most recent blood pressure value of 140/90 mm Hg or more or blood pressure of 130/80 mm Hg or more if having a concurrent diabetes diagnosis and/or a diagnosis of diabetes with last available A1C of greater than 8% (i.e., uncontrolled), and (3) currently using at least one antihypertensive or antihyperglycemic medication. Data were collected for patients' most recent visit in 2009. A sample size of 87 participants per group was estimated to test differences in MRCI among groups, assuming a two-sided significance test, difference of 5 points, alpha of 0.05, and 90% power.

MRC was assessed using the MRC Index (MRCI) and data from the electronic medical record (EMR).[10] Total scores were based on preassigned weights and the sum of the scores received for the dosage forms, dosage frequencies, and additional directions in the medication regimen. Higher scores indicated greater complexity, and no upper limit existed. Each patient had two MRCI scores: (1) disease-specific medications only (e.g., hypertension medications for hypertension group) and (2) patient-level medications (including all prescription and over-the-counter [OTC] medications). OTC medications, though not part of the original MRCI, were included because OTC use is common and many medications for common chronic conditions have been switched to OTC status. Data for age, gender, Charlson comorbidity index (predictive of 10-year mortality given patient comorbidities), and disease severity were extracted from the EMR.[15–18] Medication regimen cost was estimated using Drugstore.com (accessed during June to August 2012).

Descriptive statistics were calculated for all variables. Percent contribution of MRCI components to total MRCI score was calculated for each patient, then averaged for the group. Between-group analyses were conducted using analysis of variance (means) and Kruskal-Wallis test (medians), and Tukey and Mann-Whitney *U* tests were used for post hoc pairwise comparisons, respectively (significance level 0.05). Multiple linear regression analysis was conducted to explore factors associated with MRCI. Stata version 11.0 (StataCorp, College Station, TX) was used for statistical analyses.

Results

The majority of patients (n = 206 total) were women (55.8%). Patients with hypertension (n = 85) were significantly older (mean = 67.8) than those with diabetes (n = 60, mean = 54.1) and those with both hypertension and diabetes (n = 61, mean = 60.9; $P < 0.001$). No significant difference in median (range) Charlson comorbidity index was observed among groups (hypertension 3 [1–14], diabetes 3 [1–10], hypertension and diabetes 4 [1–12]; $P = 0.092$). Median total medication cost was greatest for patients with hypertension and diabetes ($1,044 [101–5,226]) compared with those with diabetes ($901 [32–5,677]) and those with hypertension ($728 [15–4,961]; $P = 0.01$). The median disease-specific MRCI score for the diabetes group was significantly greater (8.0 [3–21]) than that for the hypertension group (3.0 [2–11], $P < 0.001$). However, the median number of disease-specific medications (2.0 [1–5]) was identical for the two groups. The median disease-specific MRCI score for the group with hypertension and diabetes (13.0 [3.5–27]) was significantly greater than that for the groups with either hypertension or diabetes ($P < 0.0001$); however, no statistical difference in the median number of medications was observed.

Significant differences were observed for median (range) patient-level MRCI scores (18.0 [2–50], 20.5 [4–72.5], and 27.0 [6–89]; $P < 0.001$) and number of medications (9.0 [1–22], 8.0 [1–24], and 12.0 [3–32]; $P = 0.016$) among the groups with hypertension, diabetes, or both, respectively. Comparing patient-level and disease-specific MRCI scores within each patient group revealed a much wider range of complexity than comparing the number of medications (Figure 1). For example, for the group with hypertension and diabetes, the maximum patient-level MRCI was 89 and the disease-specific MRCI was 27 (62 point difference). However, among