Does Better Quality of Care for Falls and Urinary Incontinence Result in Better Participant-Reported Outcomes?

Lillian C. Min, MD, MSHS,[*†‡] *David B. Reuben, MD,*[§] *John Adams, PhD,*[‡] *Paul G. Shekelle, MD, PhD,*[‡§‖] *David A. Ganz, MD, PhD,*[§‖] *Carol P. Roth, RN, MPH,*[‡] *and Neil S. Wenger, MD*[‡§]

OBJECTIVES: To determine whether delivery of better quality of care for urinary incontinence (UI) and falls is associated with better participant-reported outcomes.

DESIGN: Retrospective cohort study.

SETTING: Assessing Care of Vulnerable Elders Study 2 (ACOVE-2).

PARTICIPANTS: Older (≥75) ambulatory care participants in ACOVE-2 who screened positive for UI (n = 133) or falls or fear of falling (n = 328).

MEASUREMENTS: Composite quality scores (percentage of quality indicators (QIs) passed per participant) and change in Incontinence Quality of Life (IQOL, range 0–100) or Falls Efficacy Scale (FES, range 10–40) scores were measured before and after care was delivered (mean 10 months). Because the treatment-related falls QIs were measured only on patients who received a physical examination, an alternative Common Pathway QI (CPQI) score was developed that assigned a failing score for falls treatment to unexamined participants.

RESULTS: Each 10% increment in receipt of recommended care for UI was associated with a 1.4-point improvement in IQOL score ($P = .01$). The original falls composite quality-of-care score was unrelated to FES, but the new CPQI scoring method for falls quality of care was related to FES outcomes (+0.4 points per 10% increment in falls quality, $P = .01$).

CONCLUSION: Better quality of care for falls and UI was associated with measurable improvement in participant-reported outcomes in less than 1 year. The connection between process and outcome required consideration of the interdependence between diagnosis and treatment in the falls QIs. The link between process and outcome demonstrated for UI and falls underscores the importance of improving care in these areas. **J Am Geriatr Soc 59:1435–1443, 2011.**

Key words: quality of care; urinary incontinence; falls

Urinary incontinence (UI) and falls are prevalent geriatric conditions[1–4] and are associated with disability, morbidity, and poor quality of life.[2,5–7] Despite the availability of effective treatments to improve UI and reduce the risk of falling,[7–16] delivery of recommended care for these conditions in primary care settings is poor.[17,18]

The Assessing the Care of Vulnerable Elders Study 2 (ACOVE-2) was a controlled trial of an intervention to increase adherence to evidence- and consensus-based processes of care for three geriatric conditions (UI, falls, and dementia). The primary outcome of ACOVE-2 was the group-level score on 18 process-of-care indicators spanning these three conditions. The ACOVE-2 intervention was associated with moderate improvements in quality of care for falls (44% vs 23% of recommended care delivered for the intervention vs control site) and UI (37% vs 22%).[19] Although ACOVE-2 was not designed to study clinical outcomes, participants were also given condition-specific symptom inventories for UI (the Incontinence Quality of Life (IQOL) survey[20]) and falls (fear of falling measured using the Falls Efficacy Scale (FES)[21]) before and after the quality improvement intervention was implemented. This article presents a secondary analysis that examines the relationship between quality of care delivered during ACOVE-2 and these participant-reported outcomes. It was hypothesized that delivering more recommended care processes to participants with UI and falls would result in less-severe symptoms as measured using the IQOL and FES, respectively.

METHODS

Study Design

ACOVE-2 enrolled 649 participants (aged ≥75) to test a multicomponent intervention to improve quality of care for UI, falls, and dementia.[19] The intervention, which consisted

From the *Division of Geriatrics, University of Michigan Medical School, Ann Arbor, Michigan; †Ann Arbor Veterans Affairs Healthcare System, Geriatrics Research, Education and Clinical Care Center, Ann Arbor, Michigan; ‡RAND Health, Santa Monica, California; §David Geffen School of Medicine, University of California at Los Angeles, Los Angeles, California; and ‖Greater Los Angeles Veterans Affairs Healthcare System, Los Angeles, California.

Address correspondence to Lillian Min, 300 North Ingalls Bldg, Wing E Room 966, Ann Arbor, MI 48109. E-mail: lmin@med.umich.edu

DOI: 10.1111/j.1532-5415.2011.03517.x

0002-8614/11/$15.00

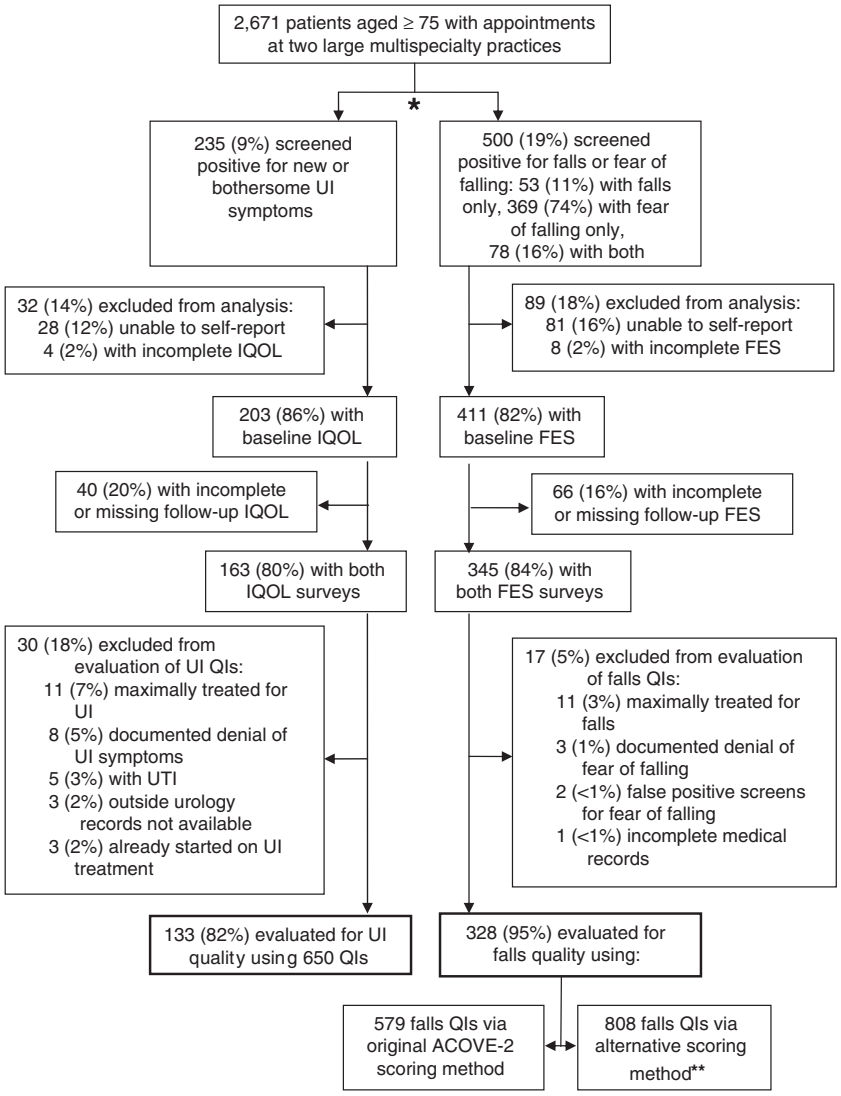

Figure 1. Enrollment and quality-of-care measurement for falls and urinary incontinence in participants in the Assessing the Care of Vulnerable Elders Study (ACOVE-2). *Participants with positive screens for urinary incontinence (UI) and falls were considered in both samples. There were 115 (4.3% of screened sample of 2,671) with positive UI and falls or fear of falling screens. After exclusions, the final analytical sample included 55 participants who screened positive for both conditions (17% of the falls sample and 41% of the UI sample). **The original scoring method did not evaluate whether appropriate treatment was delivered to 241 participants who were not examined for falls or fear of falling. The Common Pathway Quality Indicator (CPQI) scoring method assumes that participants with no examination documentation had an abnormal examination and evaluates treatment for these participants. FES = Falls Efficacy Scale; IQOL = Incontinence Quality of Life Survey; QI = Quality indicator; UTI = Urinary tract infection.

of physician education, structured visit notes that guided physicians to provide recommended care, and community resource and education handouts for participants,[22] was implemented at two large medical practices in southern California (each with intervention and control sites). Institutional review boards at RAND, the University of California at Los Angeles, and the Greater Los Angeles Veterans Affairs Healthcare System approved the research protocol.

Before appointments at intervention and control sites, all individuals aged 75 and older (n = 2,671, Figure 1) were screened for UI and falls during a 13-month observation window in 2002/03. The screening questions, administered by office personnel, asked: Do you have a problem with UI (or your bladder) that is bothersome enough that you would like to know more about how it could be treated?" and "In the past 12 months, have you fallen 2 or more times? . . . fallen and hurt yourself or needed to see a doctor because of a fall? . . . or been afraid that you would fall because of balance or walking problems?" Participants who screened positive for UI answered the IQOL survey, a measure of incontinence-related quality of life associated with clinical incontinence severity.[20,23] Those who screened positive for falls or fear of falling (answering yes to any of the three questions) were administered the FES,[21] a measure of concern about falling during daily activities that is associated with future falls, gait and balance impairment, and disability.[8,21,24–26]

At study completion, participants were readministered the IQOL and FES survey. The analysis included participants who completed pre- and postsurveys. Participant

Table 1. Sample Characteristics

Characteristic	Falls Sample (n = 328)	UI Sample (n = 133)
Age, mean	80.6	80.1
Male, %	32.6	18.0
FES (10–40) or IQOL score (0–100), mean ± SD	19.3 ± 7.5	75.1 ± 20.3
Number of falls or UI quality indicators triggered, mean ± SD	1.8 ± 1.0	4.9 ± 0.6
Time between FES or IQOL measurements, months, mean (range)	10.4 (4.2–17.0)	9.8 (4.2–14.6)
Number of all ACOVE-2 quality indicators triggered across all medical and geriatric conditions (a proxy for comorbidity), mean ± SD (range)*	12.0 ± 4.3 (5–27)	14.8 ± 4.0 (9–27)
Received care from an intervention site, %	54.6	54.9
Overall pass rate for falls or UI, mean ± SD	31.3 ± 39.7	32.6 ± 29.9

* Assessing the Care of Vulnerable Elders Study 2 (ACOVE-2) participants qualified for 98 indicators based on their comorbid conditions. In addition to falls and urinary incontinence (UI), it included care pertaining to continuity of care, dementia, depression, diabetes mellitus, end of life, hearing loss, heart failure, hypertension, ischemic heart disease, malnutrition, medication use, osteoarthritis, osteoporosis, pain management, pneumonia, pressure ulcers, preventive care, stroke, and vision.

IQOL = Incontinence Quality of Life; FES = Falls Efficacy Scale; SD = standard deviation.

characteristics are summarized in Table 1. Participants who participated in the study for both conditions were included in both analyses.

Outcome Variables

The outcome variable for the UI analysis was change in severity of UI symptoms as measured according to the IQOL survey.[23,27] The overall IQOL score ranges from 0 to 100 points, with higher scores representing better quality of life (milder symptoms). The overall IQOL is calculated as the sum of 22 questions scored on a 5-point scale, each item ranging from extremely symptomatic (1 point) to not at all (5 points), followed by rescaling to the 100-point range. Subscores representing three subdomains of incontinence-related quality of life are also calculated using subsets of the items (also followed by rescaling to 0–100): avoidance and limiting behavior (e.g., "I worry where the toilets are in new places"), social embarrassment (e.g., "I worry about wetting myself"), and psychosocial consequences (e.g., "I feel depressed because of UI problems").[20] The analytical sample included subjects with three or fewer missing items. Multiple imputation (ordered logit models, 5 imputations with recombination of 5 data sets for all analyses) were used to obtain complete IQOL scores for 13 baseline interviews and four follow-up interviews with three or fewer missing items.[28] Change scores were computed by subtracting the baseline IQOL score from the follow-up IQOL score. Because higher IQOL scores represent less-severe disease, a positive change in score represents improvement in the UI condition over time. In this study, a 2-point improvement in IQOL score was considered to be the minimally important effect size. In a prior study of the effect of duloxetine on UI, participants who perceived their overall change in symptoms as a little better, much better, or very much better had mean IQOL change scores of 2, 6, and 13 points, respectively. Those who reported a substantial improvement in incontinent episodes per day (≥25% fewer) had mean IQOL change scores that were 5 points better than those who reported no improvement in incontinence episodes.[20,27]

The outcome variable for the falls analysis was change in FES, a measure of participant concern for falls during 10 daily activities (e.g., bathing, walking around the neighborhood).[21] Responses ranged from least (1 point) to most concerned (4 points), yielding a final score with a range from 10 to 40.[29] A higher FES score indicates greater fear of falling, and the FES is associated with future falls and disability.[8,21,24–26] To facilitate interpretation of results, the change scores for the falls analysis were calculated as baseline FES score minus follow-up FES score, so a positive change score indicated improvement in the falls condition (i.e., less concern about falls over time). The analytical sample for falls included participants with two or fewer missing FES items. Multiple imputation was used to obtain complete FES scores for 16 baseline and 18 follow-up interviews with two or fewer missing items. Minimally important effect sizes for this version of the FES were not available, so to put the FES score into clinical perspective, the findings from an intensive controlled multidisciplinary home visit intervention that reduced risk of falls by 23% were examined. The pre–post difference in FES scores between the intervention and control groups was 1.4 FES points (+0.2 points vs −1.2 points, $P = .02$).[9]

Predictor Variables

QI Measurement

The ACOVE-2 process-of-care quality indicators (QIs) have been described previously in full,[19] and the QIs (Tables 2 and 3) and scoring methods are briefly outlined here. Participants with bothersome UI were eligible for three QIs for UI diagnosis (taking a UI-specific history, examination, and urinalysis, Table 2 QIs 1–3) and three QIs concerning treatment (checking postvoid residual, discussing treatment options, and recommending behavior intervention before pharmacological treatment, QIs 4–6). A participant who had fallen (twice in the past year or once with injury requiring medical attention) was considered to need a fall-specific history (Table 3, QI 1) and a gait and balance examination (QI 2). A participant who had not fallen but reported fear of falling was considered to need only a gait and balance examination (QI 3). If physical examination demonstrated abnormal balance, participants were eligible for treatment with physical therapy or assistive device (QI

Table 2. Relationship Between Incontinence Quality of Life (IQOL) Change Score and Whether Individual Urinary Incontinence (UI) Quality Indicators (QIs) Were Passed or Failed

		IQOL Change Score (n, Number of Participants Who Triggered QI)							
		Overall IQOL		Avoidance Subdomain		Psychological Subdomain		Embarrassment Subdomain	
QI	UI Quality Indicator	Passed	Failed	Passed	Failed	Passed	Failed	Passed	Failed
1	If a person aged 75 and older reports new UI symptoms, then a targeted history should be performed.	−0.2 (38)	−4.8 (95)	−2.1 (38)	−3.5 (95)	+0.5* (38)	−6.5* (95)	+3.3* (38)	−3.8* (95)
2	If a person aged 75 and older reports new UI symptoms, then a targeted examination should be performed.	+1.7* (38)	−5.4* (95)	+0.2 (38)	−4.4 (95)	−0.6* (38)	−6.6* (95)	+6.0* (38)	−4.9* (95)
3	If a person aged 75 and older reports new UI symptoms, then a urinalysis should be performed.	−1.3 (49)	−4.6 (84)	−0.2 (49)	−4.8 (84)	−2.6 (49)	−5.6 (84)	−0.7 (49)	−2.4 (84)
4	If a person aged 75 and older is found to have UI at a new evaluation, and pharmacological therapy is recommended, then a postvoid residual should be performed before pharmacological therapy.	−0.5 (8)	−4.2 (14)	+3.9 (8)	−4.0 (14)	−4.9 (8)	−7.5 (14)	+4.5 (8)	+1.4 (14)
5	If a person aged 75 and older is found to have UI at a new evaluation, then treatment options should be discussed.	−0.7 (57)	−5.4 (76)	+0.2** (57)	−5.6** (76)	−2.4 (57)	−6.1 (76)	+0.9 (57)	−3.8 (76)
6	If a person aged 75 and older who is cognitively intact and ambulatory is found to have UI without hematuria or high postvoid residual, then behavioral therapy should be recommended before pharmacological therapy.	−2.7 (25)	−6.0 (71)	−1.6 (25)	−5.2 (71)	−4.5 (25)	−7.4 (71)	−1.0 (25)	−4.6 (71)

The IQOL score and each subscale range is 0–100 (higher = better quality of life or fewer symptoms). A higher IQOL change score indicates improvement (or less worsening) of IQOL.
$P <$ * .05, ** .10 for unadjusted *t*-test of IQOL change score between patients who failed versus those who passed QI.

4); if abnormal gait was found, participants were eligible for physical therapy (QI 5).

Evaluation of individual QIs was performed using all outpatient primary care and specialist medical records for a 13-month observation period for each participant. If the participant received the recommended care process, a score of 1 was awarded; if the process was not performed, a score of 0 was assigned. If the participant refused recommended care, full credit was awarded. Selected QIs (Falls QIs 3–5) were excluded from application to individuals with advanced dementia or life expectancy of 6 months or less.[30] In addition, if the participant was documented in the medical record as having received an examination and completed recommended therapies for UI or falls (referred to as maximal treatment), QIs for that condition were excluded. Finally, participants who described fear of falling but did not fall before or during the observation period were excluded if they denied concern for falling on the FES.

Summary Quality Scores (Simple and Common Pathway)

For this participant-level analysis, summary quality scores were developed for each participant based on the individual QIs measured in ACOVE-2. A simple summary score was first calculated for each participant for falls, UI care, or both, calculated as the number of QIs passed divided by the number of QIs triggered, ranging from 0 to 100%.

Simple summary scores for participants with UI were based on four to six UI QIs per participant, but in contrast to the UI analysis, most of the falls sample (82%) triggered only one or two QIs. This smaller number of falls QIs per participant was a result of specific eligibility criteria for the treatment QIs (4 and 5). An abnormal gait or balance examination triggered these QIs, so participants had to pass an examination QI (2 or 3) as a prerequisite. Because two-thirds of the falls sample (224/328) were not examined, few participants overall were evaluated for care related to treatment. Considering the care of falls as a pathway from diagnosis to treatment, the simple summary scores for falls insufficiently captured the full pathway of care quality for this sample. Therefore an alternative scoring method that would restore evaluation of treatment for this participant-level analysis was proposed. Because the physical status of the unexamined participants was not known, which treatment indicators participants would be eligible for was ambiguous: QI 4 for balance problem, QI 5 for strength problem, both problems, or no problem. QIs 4 and 5 were combined into a single Common Pathway QI (CPQI) (Table 3, 3 rightmost columns). Participants who did not receive an examination were presumed to have an undetected physical problem and were scored accordingly on the CPQI. Those who were examined and found to have an abnormality (n = 58) triggered one CPQI instead of QI 4, QI 5, or both. The overall effect of employing the

Table 3. Relationship Between Falls Efficacy Scale (FES) Change Score and Whether Individual Falls Quality Indicators (QIs) Were Passed or Failed

		FES Change Score (N, Number Who Trigged QI)			
		Original Method		Common Pathway'' Criteria for QIs 4 and 5[†]	
QI	Falls Quality Indicator	Passed	Failed	Passed	Failed
1	If a person aged 75 and older reports a fall, then a falls history should be performed.	1.8 (62)	1.6 (82)	1.8 (62)	1.6 (82)
2	If a person aged 75 and older reports a fall, then a falls physical examination** should be performed.	3.3* (56)	0.6* (88)	3.3* (56)	0.6* (88)
3	If a person aged 75 and older reports fear of falling or a gait, mobility, or balance problem, then he or she should have a gait, mobility, and balance examination.	0.7 (68)	0.3 (153)	0.7 (68)	0.3 (153)
4	If a person aged 75 and older is found to have impaired balance, proprioception, or increased postural sway, then an intervention (exercise or physical therapy, assistive device) should be recommended.	4.1 (7)	3.1 (30)	3.9* (30)	0.7* 269
5	If a person aged 75 and older is found to have impaired gait or decreased strength or endurance, then an exercise program should be recommended.	4.3 (26)	1.7 (7)		

The FES score ranges from 10–40 points. For ease of interpretation, the FES change scores in this analysis have been presented so that a higher FES change score indicates more improvement in FES.

* $P < .05$, two-tailed *t*-test on change scores between patients who failed and those who passed QI.

[†] The common pathway scoring method combines QIs 4 and 5 into a common QI (resulting in 12 fewer eligible cases) and makes participants without documented falls examinations eligible for the new combined treatment QI (resulting in 241 additional eligible cases).

** For QI 2, the falls physical examination required at least three of the following five components: gait, balance, orthostatic blood pressure measurement, vision (any element or vision specialist referral), and neurological examination (any element or neurologist referral).

Falls QIs could be triggered more than once, so the number of participants was slightly lower than the number of QIs triggered. The number of participants who passed versus failed were 60 versus 81 for QI 1, 54 versus 87 for QI 2, 66 versus 152 for QI3, 7 versus 29 for QI 4, 25 versus 7 for QI 5, and 29 versus 247 for the common pathway QI.

CPQI was that all participants except those who had normal physical examinations were evaluated for at least one treatment QI (n = 66 without gait, strength, or balance abnormality, consistent with the original ACOVE-2 scoring method).

Analysis

QI-Level Tests

For each of the individual falls and UI QIs, the mean IQOL and FES change scores of those who passed were compared with the scores of those who failed the QI under consideration. For falls, QIs 4 and 5 were evaluated separately and then according to the CPQI described above. Two tailed *t*-tests were performed to compare mean IQOL and FES scores.

Participant-Level Tests

Next, the relationship between participants' summary UI or falls quality scores and IQOL or FES change scores, respectively, were tested using unadjusted linear regression. Multivariable regressions were then performed, controlling for the following variables, chosen because of their potential effect on clinical outcomes: age, sex, number of ACOVE indicators triggered for all conditions (a proxy measure of comorbidity), and time between interviews. To address confounding according to disease severity, number of UI or falls QIs triggered was controlled for (for each analysis). Whether the participant received care at an intervention versus control practice was also controlled for, and an interaction term between quality of care and intervention assignment was tested. Because 36 primary care physicians performed participants' care, final multivariable models were modeled as hierarchical random effects models, with participants clustered within physicians.

For UI analyses, change in overall IQOL scores and change in the three subdomain scores were considered to be the main outcomes. For the falls analyses, all analyses were performed using the simple summary score and the CPQI methods. Final results were retested for sensitivity to imputed scores by limiting the sample to those with complete IQOL and FES scores. Intercooled Stata version 11.0 (Stata Corp., College Station, TX) was used for all statistical analyses.

RESULTS

Of 2,671 individual aged 75 and older who were screened for UI and falls or fear of falling, 235 (9%) answered positively for new or bothersome UI symptoms, 500 (19%) answered positively for fear of falls or falling (Figure 1), and 115 (4.3%) answered positively for UI and falls or fear of falling. For the UI sample, 32 (14%) were unable to complete the baseline IQOL surveys, and another 40 (20%) were lost to follow-up or had incomplete follow-up IQOL surveys. During quality measurement for UI care, 30 individuals (18%) were excluded based on ACOVE QI criteria. The analytical sample for the UI analysis was 133 individuals evaluated for 650 UI QIs. For the falls sample, 89 (18%) individuals were excluded because of missing baseline FES surveys and 66 (16%) because of missing follow-up or incomplete FES surveys. Of the remaining 345 individuals, 17 were not evaluated for falls quality based on ACOVE QI criteria. The analytical sample for

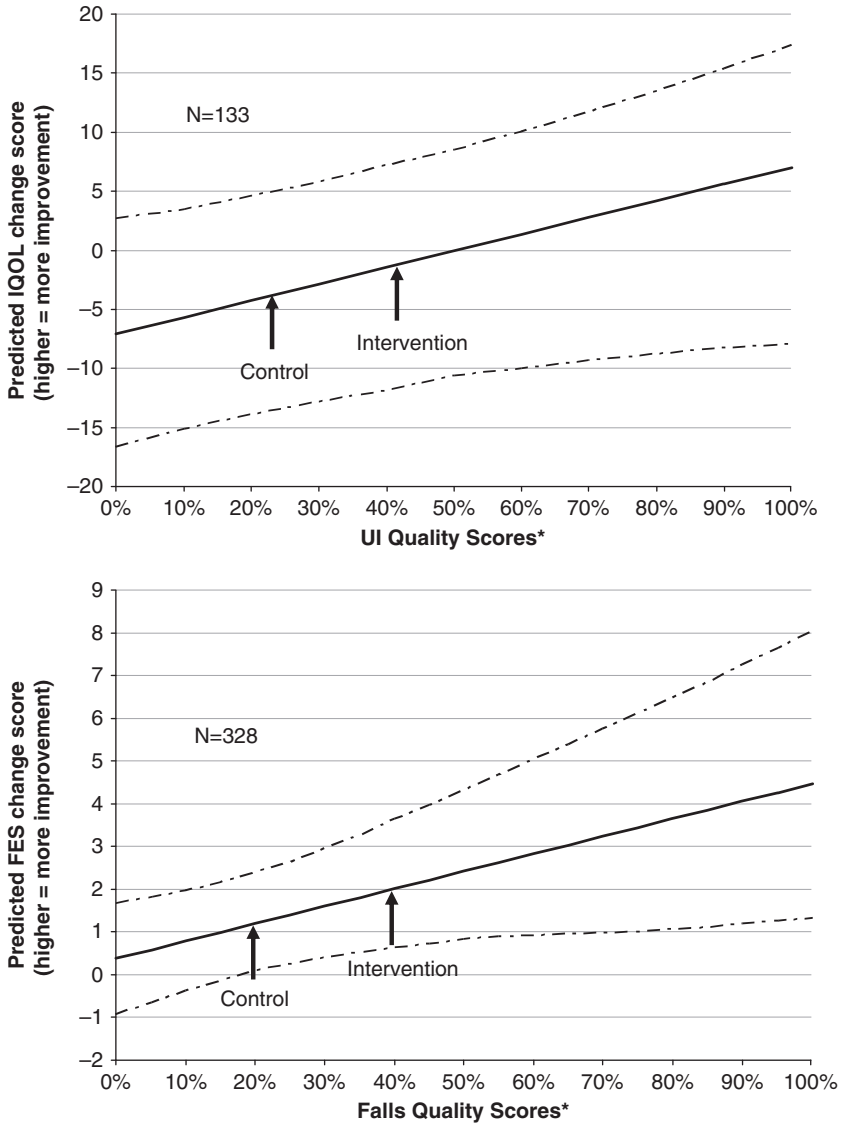

Figure 2. Predicted participant-reported urinary incontinence (UI) and falls outcomes in relation to UI and common pathway falls quality scores. The Incontinence Quality of Life Score (QOL) ranges from 0 to 100. On this figure, a higher IQOL change score (higher on the *y*-axis) corresponds to more improvement (or less worsening if a negative number). A 5–percentage point difference in IQOL was correlated in a past study of incontinence outcomes with those who reported at least 25% improvement in incontinence episode frequency.[27] The Falls Efficacy Scale (FES) score ranges from 10 to 40. On this figure, a higher FES change score (higher on the *y*-axis) corresponds to more improvement (or less worsening if a negative number). A 1.4-point difference in scores was reported in a prior multipronged intervention to prevent falls.[9] *Both regression models are controlled for age, sex, number of falls or UI QIs, number of Assessing Care of Vulnerable Elders Study-2 (ACOVE-2) QIs (a proxy for overall level of comorbidity), time difference, and fixed effects of primary care physician. The falls analysis employed the Common Pathway Quality Indicator (CPQI) scoring method that combined the two falls treatment QIs into a single QI (expanded to include all participants regardless of whether a falls examination was performed, and passed if either treatment was recommended). An interaction term between quality score and intervention effect was tested and retained in the falls model (less effect in the intervention group, $P = .10$) but not the UI model ($P = .8$). 95% confidence intervals are the 5th and 95th percentile predicted scores obtained by bootstrapping the multiple imputed data 1,000 times. Predicted FES and IQOL change scores are for an 80-year-old woman (modal sex) receiving care at a control practice over the mean observation time (9.8 months for UI, 10.4 months for falls), the mean number of falls or UI QIs triggered (4 for UI, 3 for falls), and the mean number of QIs triggered for all ACOVE-2 conditions (38 for UI, 22 QIs for falls). The arrows correspond to the mean quality scores achieved in the ACOVE-2 intervention for intervention versus control groups. The improvement in the CPQI score for falls (20% intervention, 40% control) was associated with a response of 0.8 FES points, whereas the improvement in UI quality score (23% vs 41%) was associated with a response of 2.5 IQOL points.

the falls analysis was 328 participants who were evaluated for 579 QIs. The mean follow-up time was 9.8 months (range 4.2–14.6) for UI and 10.4 months (range 4.2–17.0) for falls. The final analyses contained 55 participants (41% of the UI sample and 17% of the falls sample) who were considered in both samples.

Relationship Between Process and Outcome for UI

The mean age of the UI sample was 80. Four-fifths were female, and mean baseline IQOL score was 87. On average, participants worsened with respect to their UI symptoms over the 10-month observation window. This was consistent when measuring change in overall IQOL score (mean decline of 3.4 ± 16.3 points ($P = .02$) and two of the three subscales (avoidance behavior: mean decline 3 ± 17.7 points, $P = .045$; psychological quality of life: mean decline 1.6 ± 18.6 points, $P = .006$)). There was a nonsignificant decline of 1.8 ± 18.8 points ($P = .3$) for the embarrassment subscale.)

The unadjusted relationship between change in IQOL score and whether individual UI QIs were passed or failed is displayed in Table 2. For each of the six QIs, the direction of effect was positive (i.e., the mean IQOL change score was better for those who passed than those who failed), but only QI 1 was associated with statistically significant (*t*-test $P < .05$) improvement in overall IQOL and QI 2 with subscale change scores.

The mean summary UI quality score was 32.6 ± 29.9%, with a mean score of 40.6% in the intervention group versus 23.0% in the control group. A 10% increment in unadjusted participant-level composite UI quality score was associated with an improvement in overall IQOL score of 1.23 points ($P = .01$) and improvement in two of the three subdomain scores (avoidance 1.06, $P = .07$; psychological 1.30, $P = .03$; embarrassment 1.41, $P = .001$).

Multivariable random-effects models (controlling for age, sex, comorbidity, intervention group, and time between interviews) showed that better UI quality was associated with improvement in UI-related quality of life. An improvement of 10 percentage points in UI quality was independently associated with a 1.4-point improvement ($P = .01$) in the overall IQOL score and two subscales (embarrassment, $\beta = 1.6$, $P = .008$; psychological, $\beta = 1.5$, $P = .02$). There was no significant interaction between quality of care and group status (intervention vs control) in predicting any of the UI outcomes ($P = .6$–$.8$). Results were robust to limiting the sample to those with complete IQOL scores (n = 120).

The predicted outcomes were calculated for a hypothetical 80-year-old woman over the full range of quality of care delivered in this study (Figure 2, upper graph) using the final multivariable fixed-effects model. Providing none, half, or all recommended care for UI was predicted to result in a 7-point decrease, no change, and 7-point improvement, respectively, in IQOL score over a mean 10-month follow-up. Applying these results to a group-level clinical practice improvement scenario, the expected improvement in mean IQOL for a group of older individuals after improving UI care from 23% to 41% of recommended care (the mean summary scores for intervention vs control groups in the ACOVE-2 study) would be 2.5 IQOL points, a small but validated improvement in global UI symptoms.[20,27]

Relationship Between Process and Outcome for Falls

The mean age of the falls sample was 81. Three-quarters were female, and mean baseline FES score was 19 ± 7.5. Over the 10-month observation period, the overall change in concern for falling as measured according to FES score was essentially unchanged (mean improvement of 0.6 ± 6.7 points, $P = .1$).

The unadjusted relationship between change in FES scores and individual falls QIs was tested (Table 3). For each QI, mean improvement in FES change score was greater for subjects passing the QI than for those failing the QI, but statistical significance ($P < .05$) was associated only with performing a falls examination (QI 3, 3.3- vs 0.6-point improvement, $P = .03$) and the CPQI (3.9- vs 0.7-point improvement, $P = .02$).

Most of the participants in the sample (n = 292, 89.0%) had a single fall or fear of falling event, triggering one to four QIs (mean 1.5) according to the simple scoring method and one to three QIs (mean 2.2) according to the CPQI method instead of separate QIs 4 and 5. Thirty-six people (11.0%) had two or more events. The mean simple summary falls score was 31.3% (39.8% in the intervention group, 21.0% in the control group) and slightly lower using the CPQI method (30.3% overall mean, 39.2% intervention, 19.6% control). Neither the simple nor the CPQI score was related to unadjusted FES change scores (for both scores, $\beta = 0.12$ per absolute 10-percentage point improvement in quality, $P = .2$).

However, the multivariable random-effects analyses showed that the CPQI score was related to better FES change score ($\beta = 0.41$ FES points per 10-percentage point increment in quality, $P = .01$), whereas the simple summary score was not ($\beta = 0.21$, $P = .20$). Predicted outcomes for the CPQI model are displayed in Figure 2 (lower graph). For an 80-year-old woman, providing 0%, 50%, or 100% of the recommended care would result in an improvement of 0.4, 2.4, and 4.5 FES points, respectively, over the 10-month follow up period. Applying these results to a clinical practice quality improvement scenario, an improvement from 20% to 40% of recommended care would be expected to result in mean improvement of 0.8 FES points. This response was approximately two-thirds of the improvement in FES (1.4 points) associated with a multidisciplinary home-based controlled intervention to decrease falls.[9] Results of the falls analysis were also robust to limiting the sample to those with complete FES scores (n = 312).

DISCUSSION

In this secondary analysis of the ACOVE-2 practice-based quality improvement study, it was hypothesized that better adherence to evidence-based QIs would improve participant-reported outcomes for falls and UI. A small but clinically meaningful improvement in incontinence quality-of-life (2.5 points) was found over 10 months in response to a 15–percentage point quality improvement for UI, a realistic level of improvement in quality that was achieved in the ACOVE-2 practice-based intervention.[19] The IQOL response observed in this analysis corresponds to prior studies of people with UI with a small improvement in global self-reported UI symptoms and half the improvement of those with a substantial decrease in incontinent episode frequency.[20,27] A small improvement in falls efficacy (0.8-point improvement in the FES) associated with better quality of care for falls was also found (the 20–percentage point improvement achieved in the ACOVE-2 study). The

response observed was approximately two-thirds the effect on FES found in an intensive home-based falls-reduction intervention.[9]

The results of the current study shed further light on understanding of ambulatory care for geriatric conditions. For falls and UI, the analysis extends prior interventional research by measuring the full spectrum of office-based care that includes diagnostic processes (history taking and physical examination) and treatment. In this study, the broader practice-based approach was modestly linked with better outcomes although not as tightly linked as in clinical intervention trials that improved falls efficacy[9,13,31,32] and incontinence[7–16] (e.g., pharmacological or behavioral therapy).

Although the individual QI-level falls scores appeared to be positively related to better FES, the participant-level simple summary score was not. The simple summary score was an inadequate measure of comprehensive falls care because so many individuals in the sample did not receive physical examinations. For these individuals, gait and balance abnormalities could not be identified, and therefore appropriate treatment could not be directed at improving their falls outcomes. These results suggest that the association between process and participant-level outcomes for falls was restored by scoring with the CPQI, which assigned those without a physical examination an additional penalty for failure to treat. To the knowledge of the authors, this is the first report to test an alternative scoring method that addresses serial care measures in which failing to perform an early care process results in exclusion from eligibility for downstream QIs. The CPQI scoring modification addresses this problem, emphasizing the importance of performing high-quality comprehensive care from screening to diagnosis to treatment to follow-up. These findings regarding falls care demonstrate that participant-level quality measures obfuscate detection of poor comprehensive care and should be avoided in future QI design.

Although the ACOVE-2 intervention improved UI and falls quality of care at two intervention clinical practices,[19] there remained substantial room for improvement. The quality of care delivered to individual participants was a better predictor of participant-reported UI- and falls-related outcomes than whether a participant was seen at an intervention or a control practice.

IQOL scores of the UI sample as a whole worsened over the short follow-up interval (10 months), which was inconsistent with other studies that have found better IQOL scores as people age and adapt to their UI symptoms.[20] Rather than improving the quality of life for the sample, it appears that better quality of care attenuated a natural decline that occurred in the sample over 10 months, with only a small subset of participants (those with $>75\%$ of indicators passed) experiencing symptom improvement. The decline in IQOL may reflect the advanced age of the sample, which contrasts with prior IQOL studies that focused on younger populations. Some individuals in this older sample may also have thought that their symptoms were a normal part of aging at baseline but developed more concern about symptoms as a result of increased labeling and medical attention.[33]

A strength of the study design is that clinically detailed quality-of-care data on older outpatients were used that are not available in administrative data sets. Measures of condition-specific symptom severity were also administered before and after the delivery of care. The data were collected prospectively in a community-based sample of older participants with falls and UI symptoms, although the findings should be viewed in light of the limitations of the ACOVE-2 sample, which was not ethnically diverse and was assembled from only two medical groups. The results also cannot be generalized to individuals who cannot self-report their FES or IQOL. Clinical outcomes were not collected in the ACOVE-2 study, for example, frequency and severity of subsequent falls and number of incontinence episodes. Clinical severity measures would complement participant-reported outcomes in future quality improvement studies.

In conclusion, the current study found that the quality of care for falls and UI was associated with improvement in falls efficacy and UI-related quality of life. The link between better primary care for these conditions and better outcomes should provide impetus for strengthening efforts to enhance care of these conditions within primary care practices.

ACKNOWLEDGMENTS

Conflict of Interest: Dr. Min is supported by the Agency for Healthcare Research and Quality (R21 HS017621); a Research Career Development Core award from the University of Michigan Claude Pepper Older Americans Independence Center; and the Geriatric Research, Education, and Clinical Care Center at the Veterans Administration Healthcare System in Ann Arbor. Dr. Min was on the University of California at Los Angeles (UCLA) faculty during the writing of this manuscript, supported by the UCLA Claude Pepper Older Americans Independence Center (NIA-UCLA K12 AG001004). Dr. Ganz is funded by the U.S. Department of Veterans Affairs (VA), Veterans Health Administration, VA Health Services Research and Development (HSR&D) Service through the VA Greater Los Angeles HSR&D Center of Excellence (Project VA CD2 08-012-1).

Author Contributions: Lillian C. Min: study concept and design, analysis and interpretation of data, and preparation of manuscript. David B. Reuben, Paul G. Shekelle, David A. Ganz: study concept and design, acquisition of subjects and data, analysis and interpretation of data, and preparation of manuscript. John Adams: study concept and design, analysis and interpretation of data, and preparation of manuscript. Carol P. Roth: acquisition of subjects and data, analysis and interpretation of data, and preparation of manuscript. Neil S. Wenger: study concept and design, acquisition of subjects and data, analysis and interpretation of data, and preparation of manuscript.

Sponsor's Role: The original ACOVE-2 study was supported by a contract from Pfizer Inc to RAND. Pfizer did not serve a role in the design, analysis, or preparation of this retrospective analysis.

REFERENCES

1. Centers for Disease Control and Prevention. Fatalities and injuries from falls among older adults–United States, 1993–2003 and 2001–2005. MMWR Morb Mortal Wkly Rep 2006;55:1221–1224.
2. Cigolle CT, Langa KM, Kabeto MU et al. Geriatric conditions and disability: The Health and Retirement Study. Ann Intern Med 2007;147:156–164.

3. Anger JT, Saigal CS, Litwin MS. The prevalence of urinary incontinence among community dwelling adult women: Results from the National Health and Nutrition Examination Survey. J Urol 2006;175:601–604.
4. Anger JT, Saigal CS, Stothers L et al. The prevalence of urinary incontinence among community dwelling men: Results from the National Health and Nutrition Examination survey. J Urol 2006;176:2103–2108, discussion 2108.
5. Cho CY, Alessi CA, Cho M et al. The association between chronic illness and functional change among participants in a comprehensive geriatric assessment program. J Am Geriatr Soc 1998;46:677–682.
6. Nuotio M, Tammela TL, Luukkaala T et al. Urgency and urge incontinence in an older population: Ten-year changes and their association with mortality. Aging Clin Exp Res 2002;14:412–419.
7. Tinetti ME. Clinical practice. Preventing falls in elderly persons. N Engl J Med 2003;348:42–49.
8. Cumming RG, Salkeld G, Thomas M et al. Prospective study of the impact of fear of falling on activities of daily living, SF-36 scores, and nursing home admission. J Gerontol A Biol Sci Med Sci 2000;55A:M299–M305.
9. Tinetti ME, Baker DI, McAvay G et al. A multifactorial intervention to reduce the risk of falling among elderly people living in the community. N Engl J Med 1994;331:821–827.
10. Tinetti ME, Baker DI, King M et al. Effect of dissemination of evidence in reducing injuries from falls. N Engl J Med 2008;359:252–261.
11. Chang JT, Morton SC, Rubenstein LZ et al. Interventions for the prevention of falls in older adults: Systematic review and meta-analysis of randomised clinical trials. BMJ 2004;328:680.
12. Beswick AD, Rees K, Dieppe P et al. Complex interventions to improve physical function and maintain independent living in elderly people: A systematic review and meta-analysis. Lancet 2008;371:725–735.
13. Zijlstra GA, van Haastregt JC, van Rossum E et al. Interventions to reduce fear of falling in community-living older people: A systematic review. J Am Geriatr Soc 2007;55:603–615.
14. Haeusler G, Leitich H, van Trotsenburg M et al. Drug therapy of urinary urge incontinence: A systematic review. Obstet Gynecol 2002;100:1003–1016.
15. Holroyd-Leduc JM, Straus SE. Management of urinary incontinence in women: Scientific review. JAMA 2004;291:986–995.
16. Hay-Smith EJ, Dumoulin C. Pelvic floor muscle training versus no treatment, or inactive control treatments, for urinary incontinence in women. Cochrane Database Syst Rev 2006: CD005654.
17. Wenger NS, Solomon DH, Roth CP et al. The quality of medical care provided to vulnerable community-dwelling older patients. Ann Intern Med 2003;139: 740–747.
18. Gnanadesigan N, Saliba D, Roth CP et al. The quality of care provided to vulnerable older community-based patients with urinary incontinence. J Am Med Dir Assoc 2004;5:141–146.
19. Wenger NS, Roth CP, Shekelle PG et al. A practice-based intervention to improve primary care for falls, urinary incontinence, and dementia. J Am Geriatr Soc 2009;57:547–555.
20. Patrick DL, Martin M, Bushnell DM. The I-QOL: A Quality-of-Life Instrument Specific to Persons with Urinary Incontinence: User's Manual and Scoring Diskette for United States. Seattle, WA: Health Research Associates, Inc., 1999.
21. Tinetti ME, Richman D, Powell L. Falls efficacy as a measure of fear of falling. J Gerontol 1990;45:239–243.
22. Reuben DB, Roth C, Kamberg C et al. Restructuring primary care practices to manage geriatric syndromes: The ACOVE-2 intervention. J Am Geriatr Soc 2003;51:1787–1793.
23. Wagner TH, Patrick DL, Bavendam TG et al. Quality of life of persons with urinary incontinence: development of a new measure. Urology 1996;47: 67–71, discussion 71-62.
24. Liu-Ambrose T, Khan KM, Donaldson MG et al. Falls-related self-efficacy is independently associated with balance and mobility in older women with low bone mass. J Gerontol A Biol Sci Med Sci 2006;61A: M832–M838.
25. Powell LE, Myers AM. The Activities-specific Balance Confidence (ABC) Scale. J Gerontol A Biol Sci Med Sci 1995;50A:M28–M34.
26. Kressig RW, Wolf SL, Sattin RW et al. Associations of demographic, functional, and behavioral characteristics with activity-related fear of falling among older adults transitioning to frailty. J Am Geriatr Soc 2001;49: 1456–1462.
27. Patrick DL, Martin ML, Bushnell DM et al. Quality of life of women with urinary incontinence: Further development of the incontinence quality of life instrument (I-QOL). Urology 1999;53:71–76.
28. Royston P. Multiple imputation of missing values: Update of ice. Stata J 2005;5:527–536.
29. Buchner DM, Hornbrook MC, Kutner NG et al. Development of the common data base for the FICSIT trials. J Am Geriatr Soc 1993;41:297–308.
30. Solomon DH, Wenger NS, Saliba D et al. Appropriateness of quality indicators for older patients with advanced dementia and poor prognosis. J Am Geriatr Soc 2003;51:902–907.
31. Campbell AJ, Robertson MC, Gardner MM et al. Randomised controlled trial of a general practice programme of home based exercise to prevent falls in elderly women. BMJ 1997;315:1065–1069.
32. van Haastregt JC, Diederiks JP, van Rossum E et al. Effects of a programme of multifactorial home visits on falls and mobility impairments in elderly people at risk: Randomised controlled trial. BMJ 2000;321:994–998.
33. Macdonald LA, Sackett DL, Haynes RB et al. Labelling in hypertension: A review of the behavioural and psychological consequences. J Chronic Dis 1984;37:933–942.