Predictors of variation in office visit interval assignment

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Abstract

Objective. Despite the important influence of ambulatory appointment revisit intervals (RVI) on access to care, physicians receive no formal training in this area and research indicates that there is significant practice variation. Our objective was to examine whether predictors of RVI assignment that we had assessed using vignettes were also significant in the actual patient care setting.

Data sources and study design. A cross-sectional survey of 59 internal medicine residents collected at the end of office visits for patients with hypertension or diabetes. Two hundred and twenty-eight patients seen in 1997 for continuity care in two academic clinics in New Orleans, Louisiana.

Data collection. The main outcome was RVI in weeks. We assessed the relationship between physician, visit, and patient-level covariates, and RVI assignment in univariate and multivariate analyses using hierarchical linear models.

Principal findings. The mean RVI was 12.4 weeks (range 1–42 weeks) and was similar for patients with diabetes and hypertension. The final model accounted for 35.7% of the variance in RVI assignment and included: perceptions of the patient’s systolic blood pressure, disease stability, and compliance; comorbidity, physician age, sex, and identity; and changing therapy for the primary diagnosis. The identity of the physician was the largest contributor to the variance, accounting for 14.7%.

Conclusions. Intrinsic characteristics of physicians and their subjective interpretations of their patients’ disease stability are the most important determinants of ambulatory RVI assignment. Intervening to reduce this variation in practice is challenging because limited research is currently available on the optimum RVI for patients with chronic illnesses such as diabetes and hypertension.

Keywords: appointments, gender, office visits, physician practice patterns, revisit interval, schedules

Office visits are a limited health care resource and access to them is strongly influenced by physicians’ assignments of revisit intervals (RVI) for their patients with chronic disease. Unnecessarily short RVIs may inappropriately restrict access to the health care system for those who need care. Inappropriately long RVIs may adversely impact patient outcomes. Despite the importance of this common decision, physicians receive no formal training in the assignment of RVI, and there is limited literature to guide their decision-making. Setting the most effective clinic RVIs for common primary care diagnoses requires understanding physician decision-making and practice patterns.

Prior research has considered physician decision-making regarding RVIs using mostly surveys and vignettes [1–5]. However, we are aware of only one study that has examined the predictors of RVI assignment as the primary study focus in actual practice [1]. In the study, the predictors of office visit interval assignment comprised a combination of physician, patient, and visit-related characteristics, with physician identity being the most important.

The objective of this study was to examine influences on the assignment of routine ambulatory appointments by house staff seeing patients with diabetes or hypertension in their usual clinical setting. We selected predictors previously studied in physicians practicing in diverse settings and those we knew to be predictors for house staff RVI assignment from our study using vignettes.

Methods

Following approval by the Institutional Review Board, internal medicine house staff affiliated with the same residency program were sampled during their continuity clinics at the...
Veterans Affairs Medical Center of New Orleans (VAMC) and the Medical Center of Louisiana at New Orleans (MCLNO). At both clinics, residents care for indigent, chronically ill patients. Approximately 70% of the patients have hypertension, and 40% have diabetes [6]. Residents see approximately four patients per clinic session as interns, five patients as junior residents, and six patients as senior residents. Based upon this volume, interns [post-graduate year of training (PGY) 1] are assumed to have a smaller panel size than junior (PGY 2) and senior residents (PGY 3). A one-page datasheet was attached to the medical record of all patients attending one of the clinics by the intake nurse prior to the patient’s appointment. At the time of the study, both clinic sites were using paper medical records. All residents attending a clinic during the study interval were invited to complete the data collection sheet, but were not informed of the objective of the study. Eighty percent of eligible residents participated in the study. Those who participated differed from those who did not only with respect to year of training. They completed the datasheet at the end of routine clinical patient encounters over a 2-month period in 1997. The datasheet included space for the residents to indicate their assigned RVI in weeks in an open-ended fashion. Other information collected on this datasheet included potential predictors that we had evaluated in our prior work as well as those gleaned from the work of others [1,2,4]. These included patient-level, visit-level, and physician-level characteristics. Patient-level characteristics included physiological measures of disease stability, physician perceptions of disease stability and patient compliance, and comorbidities listed by the physician. Physicians were asked to rate the patient’s primary diagnosis as unstable, stable, or well controlled from these preset response options. Physician-recorded physiological markers of stability included systolic and diastolic blood pressure and glycosylated hemoglobin. Physicians indicated their perceptions about the patient encounter, including perceptions of the patient’s compliance with the treatment regimen and the stability of the patient’s condition related to their primary diagnosis at that visit. Physician interpretation of patient compliance with the treatment regimen and disease stability was not based upon pre-specified parameters. Physicians were allowed to write in up to five secondary diagnoses for each patient. The list of secondary diagnoses was transformed into a summary variable, categorizing patients as having no comorbidity, one comorbidity, or two or more comorbidities. All secondary diagnoses listed by the physicians were entered into the database. Our a priori assumption was that any secondary diagnosis listed by the physician on the data collection sheet must have been significant enough to impact the visit and therefore may have influenced the RVI. For example, congestive heart failure was given equal weight to viral syndromes. Visit-level predictors included the primary diagnosis and whether the physician changed therapy for the main diagnosis or ordered diagnostic tests, and whether the medical chart was available. Physician-level predictors included demographic information such as age, year of residency training, year of graduation from medical school, sex, and physician identity. The main outcome was the physician-assigned RVI until the patient’s next appointment. Potential predictors were evaluated for their effect on altering the RVI in univariate analyses using parametric and non-parametric tests of means or correlation as appropriate. A mixed regression model was utilized to determine the relationship between RVI and predictors. The dependent variable in the linear model was the RVI, which was log-transformed to account for skew. Predictors were grouped as patient-, physician-, and visit-level variables. Predictor variables were selected for the final model if they were significant when entered into a stepwise linear regression model created for each block (P = 0.20 to enter and P = 0.20 to stay). The variance of the RVI accounted for by each block was estimated. Those variables meeting statistical criteria for inclusion in the individual block models were forced into the final model. As a final step, we entered the selected variables into a random effects model that accounted for the potential effects of patient clustering by physician. In this model, we assessed the contribution of the individual physician’s identity to the variance in RVI assignment, and evaluated variance in RVI assignment across physicians [7,8]. We adjusted the RVI for the group and for each provider in a linear model. For each physician with four or more patient encounters, we compared their adjusted means to assess for patterns in RVI length. We evaluated their adjusted means across distinct visit types: visits at which physicians changed therapy, those at which they treated patients with multiple comorbid conditions, and those where they perceived patient disease to be stable. All comparisons were two-sided, with a P-value < 0.05 considered significant. All analyses were performed using SAS version 8.1 for Windows.

Results

Fifty-nine physicians completed data sheets on 228 encounters with patients. The mean age of the respondents was 31 years [range of 26–54 years] and one-third were female. Most were in their first 2 years of training, and the median year of graduation from medical school was 2 years prior to the study date inception. The encounters were divided unequally between the physicians and ranged from one to 12 observations. Nineteen physicians had only one encounter, and 22 had four or more. Physician respondents in the study were similar to those in our residency program [6].

The most frequently selected return visit intervals were 12 and 24 weeks, representing 16% and 13% of the assigned RVIs, respectively, followed by 4- and 8-week RVIs (Figure 1). All frequently selected intervals corresponded to intervals easily described in months, such as 3 or 6 months. There was wide, although not statistically significant variation in the assignment of the RVI between physicians (test of covariance, P = 0.09).

The mean RVI for all encounters was 12.4 weeks (range 1–42 weeks). In two-thirds of the encounters the primary diagnosis was hypertension (67%), with a mean RVI of 12.8 weeks (range 1–36 weeks). For those with diabetes as the
primary diagnosis (33%), the mean RVI assigned was 11.4 weeks (range 1–42 weeks). The difference in mean RVI for hypertension and diabetes did not reach statistical significance ($P = 0.293$).

Patients seen in the encounters were demographically and clinically similar to those in our patient population at these clinics [6,9]. As a continuous variable, systolic and diastolic blood pressure measures were significantly, inversely correlated with RVI assignment (SBP, $r = -0.161$, $P = 0.02$; DBP, $r = -0.157$, $P = 0.03$). However, glycosylated hemoglobin was only weakly correlated with RVI ($r = -0.194$, $P = 0.12$).

For clinical simplicity, we dichotomized the blood pressure and glycosylated hemoglobin values into ‘controlled’ and ‘uncontrolled’ based upon commonly accepted guidelines from the Sixth Report of the Joint National Committee on prevention, detection, evaluation, and treatment of high blood pressure, and upon our own institution reference range for the glycosylated hemoglobin. The results of univariate analyses of physiological parameters, dichotomized to reflect ‘controlled’ and ‘uncontrolled’ disease, are presented in Table 2.

One-quarter of diabetic patients had hypertension listed as a secondary diagnosis, and 14% of hypertensive patients had diabetes as a secondary diagnosis. Other common comorbidities included coronary artery disease, hyperlipidemia, arthritis, and hypothyroidism. Also listed were more acute illnesses such as pharyngitis and ‘abnormal mammogram’. The mean assigned RVI for patients with no comorbidity was 10.4 weeks compared with 13.8 weeks for those with one comorbidity, and 12.1 weeks for patients with two or more comorbidities listed (ANOVA, $P = 0.08$).

Patients perceived by their physician to have unstable disease (29%) had a RVI that was 6.2 weeks shorter than for those perceived to be stable ($P < 0.001$). Patients perceived to be non-compliant with medical therapy (18%) had a mean RVI that was 3.1 weeks shorter than those perceived by their physician to be compliant ($P = 0.014$).

Visit characteristics associated with shortening of the RVI are also shown in Table 2. In 50% of the encounters, physicians elected to change therapy for the main diagnosis, and this was the only significant predictor of RVI assignment.

The year of training of the physician respondents was not a significant predictor of RVI assignment ($P = 0.34$). Physician age and year of graduation from medical school were not significantly correlated with RVI assignment.

In univariate analysis, female physicians assigned significantly shorter RVIs ($P = 0.039$). The mean RVI for patients seen by female physicians was 9.9 weeks (range 1–24 weeks) compared with 13.1 weeks for those seen by males (range 1–36 weeks). Objective markers of patient disease severity did not vary by physician sex, and male and female physicians did not vary in any other area including practice patterns and visit-level predictors. The only difference in covariate distribution between sexes was distribution of residency training year, with fewer female residents than male residents in the senior resident group ($P = 0.002$).

In multivariate analysis of the patient-level predictors, variables meeting the inclusion criteria for the final model included: systolic blood pressure ($P = 0.14$), perceived disease stability ($P = 0.005$), and perceived patient compliance with therapy ($P = 0.13$), and the presence of comorbidity ($P = 0.08$) explained 12% of the variance in RVI assignment. Changing therapy for the primary diagnosis ($P = 0.005$) was selected for in the visit-level block and accounted for 4% of the variance. Physician-level variables selected in stepwise regression included physician sex ($P = 0.09$) and age ($P = 0.03$), and accounted for 5% of the variance.
Table 1  Characteristics of physician–patient encounters

<table>
<thead>
<tr>
<th>Patient characteristics</th>
<th>Hypertension as primary diagnosis</th>
<th>Diabetes as primary diagnosis</th>
<th>Mean systolic blood pressure(^2)</th>
<th>Mean diastolic blood pressure(^2)</th>
<th>Mean HgbA1C(^3)</th>
<th>Associated comorbidity</th>
<th>Physician characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>66%</td>
<td>34%</td>
<td>147 mmHg (SD ± 22.6)</td>
<td>86 mmHg (SD ± 13.8)</td>
<td>10.0% (SD ± 2.62)</td>
<td>None 26%</td>
<td>Female sex 29%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>One 39%</td>
<td>Age, mean (range) 31 (26–54)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Two or more 35%</td>
<td>Year of residency training PGY I 45%</td>
</tr>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Primary diagnosis stable 70%</td>
<td>PGY II 40%</td>
</tr>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Patient compliant 82%</td>
<td>PGY III 15%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Visit characteristics Therapy changed 50%</td>
<td>Year of graduation from medical school 1993 (1967–1996)</td>
</tr>
</tbody>
</table>

Table 2  Univariate predictors of clinic revisit interval assignment

<table>
<thead>
<tr>
<th>Mean RVI (weeks)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patient characteristics block</td>
<td></td>
</tr>
<tr>
<td>Patient has diabetes</td>
<td>11.4 12.8 0.29</td>
</tr>
<tr>
<td>Systolic blood pressure &gt;140 mmHg(^2)</td>
<td>11.6 13.1 0.18</td>
</tr>
<tr>
<td>Diastolic blood pressure &gt;90 mmHg(^2)</td>
<td>10.0 13.5 0.009</td>
</tr>
<tr>
<td>Glycosylated hemoglobin &gt;7.8%(^3,4)</td>
<td>12.9 13.1 0.54</td>
</tr>
<tr>
<td>Comorbidity present</td>
<td>13.0 10.4 0.06</td>
</tr>
<tr>
<td>Patient perceived to be unstable</td>
<td>8.2 14.4 &lt;0.001</td>
</tr>
<tr>
<td>Patient perceived to be non-compliant</td>
<td>9.9 12.9 0.014</td>
</tr>
</tbody>
</table>

| Visit characteristics block | |
| Change therapy | 10.0 14.8 0.001 |
| Order diagnostic tests | 11.8 14.0 0.17 |
| Chart unavailable | 11.7 12.6 0.69 |
| Physician characteristics | |
| Female | 9.9 13.1 0.04 |
| PGY I | 12.4 12.3 0.94 |

\(^1\)Univariate comparison of mean revisit interval in weeks for patients with and without key covariates.
\(^2\)As defined by the Joint National Committee on Hypertension VI and the American Diabetes Association [22].
\(^3\)Hemoglobin A1C not in use at the time of study.
\(^4\)The normal range for glycosylated hemoglobin at our institution is up to 7.8%.

In a random effects model, adding a dummy variable for the identity of the physician accounted for an additional 14.7% of RVI variance (\(P=0.001\)). This final model, including the aforementioned seven variables plus physician identity, accounted for 35.7% of the total variance RVI (Figure 2). Variables significant in this final model included physician perceptions about patient stability (\(P=0.04\)), comorbidity (\(P=0.01\)), physician age (\(P=0.06\)), changing therapy for chronic disease (\(P=0.03\)), systolic blood pressure (\(P=0.10\)), patient compliance with therapy (\(P=0.09\)), and physician sex (\(P=0.06\)).

The final model including the eight variables was tested on the subgroup of 22 physicians with four or more encounters. Of these, eight had three or more encounters for each visit type evaluated. The model explained 25% of the variance in RVI in this subgroup. Adding the identity of the physician contributed an additional 12.5% for a total explanatory power of 37.5% in the final model. In this subgroup, secondary comorbidity was no longer a significant predictor of RVI assignment, but all other covariates from the final model for the entire sample remained significant.

We further evaluated the effect of visit type on physician assignment of RVI. We calculated adjusted mean RVIs for patient visits characterized by: patients whose disease was perceived as stable by their physician; a change in therapy for the primary diagnosis; and the presence of comorbidity. Figure 3 displays the adjusted means, by physician, for these select visit types for the eight physicians with four or more patient encounters and at least three encounters per visit type. The figure demonstrates that most physicians are consistent in assigning RVI, irrespective of visit and patient characteristics. Physicians consistently assigned longer or shorter RVIs across these visit types relative to their peers. Each physician is represented by a line on the graph. We solved for the adjusted means in a regression model to reflect an average patient with the specified characteristic. Physician-assigned means display a pattern of consistently assigning shorter or longer intervals than their colleagues, irrespective of patient characteristics or visit type. The physicians clustered in the ‘short revisit interval group’ (Drs A, B, and G) consisted of two male and one female physician. The physician with the most consistently long RVI was a female physician (Dr E).
patients with routine ambulatory problems. Objective measures of patient stability, such as blood pressure and glycosylated hemoglobin, did not contribute significantly to RVI assignment.

One of our objectives in this study was to determine whether vignette-derived predictors of RVI assignment found in our previous study were also predictors in actual practice. Physician practice patterns, as measured by vignettes, are known to correlate closely with their practice in the actual clinical setting [10]. In our previous study, we gave house staff vignettes representing typical cases of DM and HTN that they might see in their clinical setting [2]. As anticipated, we did find that the key predictors of RVI assignment on vignettes were also important in actual practice. In both studies, patient disease stability, changes in medical therapy, and the decision to order diagnostic tests all significantly shortened the RVI. Changing therapy for the primary diagnosis would lead to shorter RVI assignment, as physicians look to evaluate the response to therapy. It is also logical that physicians would assign shorter RVIs to patients for whom they had ordered diagnostic tests to follow-up on the results of these studies.

Also in the previous study by the current authors, we found that female physicians allocated significantly shorter RVIs irrespective of other management, patient, or demographic characteristics [2]. Other studies have not found an association between physician gender and RVI assignment [4]. In the current study, we again found a significant association between physician sex and RVI. Studies have shown practice styles in other areas do vary between male and female physicians. Females have been shown to focus more on preventive care during their patient interactions compared with male practitioners [11]. Women have also been shown to be more vigilant about screening for colon cancer through ordering more fecal occult blood tests and performing more rectal exams than their male counterparts [12]. The implications for patient outcome and the reasons for this difference are unclear, but warrant further study.

Similar to previous research in practicing physician populations, the identity of the physician was the most powerful predictor of RVI assignment [1,4,13]. Physicians demonstrated a pattern of RVI assignment that was consistent across visit types and patient characteristics relative to their peers. For example, some physicians consistently assigned shorter RVIs compared with others. This practice variation existed despite training and practicing at the same institution. This finding implies that a significant amount of practice variation is subject to modifiable forces and can be impacted upon by feedback to physicians about their individual practice patterns.

This variation is not explainable by panel size or financial incentives. Physicians following a greater number of total patients may have less free time available in their schedule and may therefore postpone revisits. Seeing patients more frequently may also benefit physicians financially if they are compensated per visit. However, despite senior residents having larger panel sizes than interns, no difference in RVI assignment was noted with respect to post-graduate year. In addition, financial incentives do not explain the variation as

**Discussion**

This study adds to the literature evaluating predictors of RVI assignment by studying a large number of physicians with homogeneous training and practice environments. Additionally, we assessed RVI assignment by physicians seeing patients in their routine setting. The identity of the physician and physician perceptions of disease stability were the most important factors influencing RVI assignment for their
residents have no financial incentives to see patients more frequently. Even if they did, previous research has shown that even in a closed system like the VAMC, without financial incentives for seeing patients more often, provider variation in the assignment of RVIs still exists [14]. Perhaps physicians merely develop their own consistent practice pattern that is based not on the site of their training, but rather through emulating specific faculty mentors that they admire. Since previous research has shown the importance of physician identity in RVIs assignment among practicing physicians, faculty mentors are likely to have their individual preferences for RVIs and may pass those tendencies on to trainees. Future research will need to elucidate this potential relationship further.

Physician perception about the stability of the patient’s disease was also an important predictor of RVI assignment. This perception seems to reflect a generalized, subjective interpretation of a patient’s disease control that is only moderately influenced by objective measures. Glycosylated hemoglobin was the only physiological measure predictive of physician perception of stability. The only other significant predictor of physician perception was changing therapy, which is logical. If a physician perceives that a patient’s disease is unstable, they will develop an action to improve that state. Part of the action plan may include seeing a patient more frequently.

Physicians assigned longer RVIs for patients with increasing numbers of secondary comorbidities. This result was in contradistinction to our assumption that increased comorbidity would shorten the RVI as shown in previous research [4]. We would have expected that the secondary problem, particularly if acute or uncontrolled, would require attention in a shorter time interval leading to shortening of the RVI.

This difference in findings in our data may have occurred because we included acute illness and also because we studied trainees. The propensity to lengthen RVI for patients with multiple comorbidities may unfortunately reflect the resident’s desire to see the patient less often. Alternatively, the shorter RVI for patients with only one comorbid condition listed may reflect such significant complexity in caring for the primary condition that the physician either did not have time to attend to or list secondary diagnoses on the data collection sheet.

Indeed, while it is clear that practice variation between physicians in assigning RVIs does exist, what is less clear is how this impacts upon patient outcomes. Currently, there is little data addressing how visit frequency affects disease outcomes and what is the most optimal visit frequency for achieving optimal outcomes [15,16] in patients with chronic diseases. Kaufman et al. retrospectively evaluated children with type 1 diabetes. They found that glycemic control correlated with increasing visit frequency to their clinic. Those patients seen three to four times per year had lower mean hemoglobin A1C than those seen one to two times per year [17]. Conversely, Smith et al. intervened in adults with diabetes to increase clinic visit frequency, but were unable to demonstrate an impact on utilization and hospitalizations [18]. Weinberger et al. demonstrated that increased access to primary care increased rather than decreased the rate of rehospitalizations for veterans with chronic disease, including diabetes [19]. Further research must assess the impact of RVIs on outcomes for a variety of disease states so that quality improvement initiatives can adequately address the variation in practice patterns [16,20].

Our study has several limitations. Firstly, we studied physicians in training at one institution, which limits generalizability. However, most of our findings are consistent with other studies, and studying RVI assignment among a group of residents in the same program limits the confounding influence of training styles across residency programs. Secondly, we did not randomly sample patient encounters in the clinic, and only two-thirds of the physicians in the training program completed data sheets on their patients. Yet, patient and physician characteristics were consistent with the characteristics of the residency program [6,9,21]. Thirdly, we had a limited number of patients per physician, which probably limited our power to effectively analyze patients clustered within physicians. When we did limit the analysis to those physicians with at least four patient encounters, our model was relatively stable.

Finally, while we did account for a significant amount of the variance, we still have explained <50%. This suggests that other factors yet to be defined may be predictors of RVI assignment. Other potential sources of variation include patient-specific characteristics not captured in the design of our project, including socioeconomic status, severity of comorbid conditions, literacy skills, available transportation, and distance lived from the clinic. Physician-related issues that may contribute to the variance include interpersonal skills, concurrent in-patient workload, changing therapy for a comorbid condition, cultural competency, and self-assurance with skills.

Intrinsic characteristics of physicians and their subjective interpretations of their patients’ disease stability are the most important determinants of ambulatory RVI assignment. More objective characteristics, such as physiological measurements, contribute much less to RVI decision-making. Intervening to reduce this variation in practice is challenging because limited research is currently available on the optimum RVI for patients with chronic illnesses such as diabetes and hypertension.

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