Open-Access Appointment Scheduling in Family Practice: Comparison of a Demand Prediction Grid With Actual Appointments

Samuel N. Forjuoh, MB, ChB, DrPH, William M. Averitt, DO, Don B. Cauthen, MD, Glen R. Couchman, MD, Barbalee Symm, RN, MS, and Mike Mitchell

Background: **Inadequate access to their primary care physician remains a major reason for patient dissatisfaction in ambulatory care. The concept of open-access appointment scheduling has been found to accommodate patients' urgent health care needs while providing continuous, routine care. We describe the development of a demand prediction grid for future appointments, compare it with one developed by Kaiser Permanente, and compare the predictions with actual appointments made and held in our clinic.**

Methods: **Using adjusted 1999 appointments based on historical data for the Scott & White Killeen Clinic (>75,000 annual appointments; 13 family physicians), we computed appointment predictions for calendar year 2000 by day of the week and by month of the year. We then compared our predictions with those of Kaiser and actual appointments for the first half of 2000.**

Results: **Our data and the Kaiser data agreed on the day of week, but they were different for the summer and winter months. Overall, actual appointments made and held at our clinic for January through June 2000 were within 6% of the predictions. Appointments for January and February were 18% and 4% more than the predictions, respectively, while appointments for March were 3% less than the predictions. Appointments for April through June were 3% to 7% more than the predictions. Few daily variations were observed between actual appointments and predictions.**

Conclusions: **We conclude that the Kaiser data might be tempered by a different climate, underscoring the need for each practice to develop its own demand prediction grid. That our actual appointments were 6% more than predicted overall but fluctuated month by month reemphasizes the need for continuous monitoring of the adjustment factor for prediction. (J Am Board Fam Pract 2001;14:259–65.)**

Physicians who practice in ambulatory primary care are currently facing tremendous challenges in meeting the high demand for instant access to health care. This demand is clearly reflected in both ambulatory care standards[1] and managed care standards.[2] Inadequate access to their primary care physician remains a major reason for patients' dissatisfaction in ambulatory primary care.[3,4] In the United States, the average waiting period for a routine medical appointment is at least 3 weeks.[5] The concept of open-access appointment scheduling has been recognized as one way to accommodate patients' urgent health care needs while providing continuous, routine care as demanded in primary care, enriching service, using better available physician time, and improving the use of other provider resources.

Open access is the practice of scheduling patient appointments so that appointment slots are deliberately left vacant for daily access on demand. These appointment slots can then be used by patients in the physicians' panels at the clinic. The aim of this concept is to provide patients, if they wish, an appointment with the provider of their choice on the day that they call. The basis of the open-access concept is the assumption that demand for same-day appointments can be predicted in any practice,[6,7] and this demand prediction can be used to determine actual patient appointments by day of the week and by month of the year. In general, an open-access appointment-scheduling system should result in improved patient access to health care in a timely fashion.

Submitted, revised, 5 January 2001.

From the Department of Family Practice (SNF, WMA, DBC, GRC, BS, MM), Scott & White Memorial Hospital, and Scott, Sherwood and Brindley Foundation, Texas A&M University System Health Science Center College of Medicine, Temple. Address reprint requests to Samuel N. Forjuoh, MB, ChB, DrPH, Scott & White Santa Fe Center, 1402 West Avenue H, Temple, TX 76504.

Using the open-access appointment-scheduling concept requires aggressive management to predict accurately patient volume and the required staffing patterns.[8] A prediction grid for forecasting same-day appointment demand is critical for implementation. Unfortunately, however, many providers who want to start open access do not have the demand prediction grid, particularly in the absence of a sophisticated electronic medical records system. Developing a prediction grid can be challenging. Although it is possible to depend on a prediction grid developed in a practice other than one's own, it is important to consider certain differences that can exist between practices. For example, many practices might be tempted to use a prediction grid developed by Kaiser Permanente (personal communication, Sue Herriott, RN, MA, Carle Clinic, Champaign, Ill, 1 and 2 October 1997), which, to our knowledge, is the only one available.

In this article, we describe the development of a patient appointment demand prediction grid for one of the 18 regional family practice clinics of the Scott & White Health Care System. We then compare this grid with one developed by Kaiser by day of the week and by month of the year, as well as with actual patient appointments made and held at our clinic during a 6-month period.

Methods

The Scott & White Killeen Clinic is one of 18 regional clinics of the Scott & White Health Care System. Scott & White is a large integrated health care delivery system that includes a 600-physician multispecialty clinic with more than 1.2 million outpatient visits per year, a 166,000-member managed care program, and 18 regional clinics. Killeen Clinic is located in a dynamic, thriving area of west Bell County in Central Texas and serves residents of Coryell, Lampasas, and Bell counties. It also draws patients from the nearby Fort Hood military base. Opened in September 1980, the clinic has recently been expanded to better meet the needs of patients. Primary care for all patients – from newborn to senior citizens – is available under one roof, with 13 family physicians, 9 family practice residents, 2 pediatricians, 1 pediatric nurse practitioner, and 1 occupational medicine physician. This clinic recorded 76,584 patient visits in 1999.

Among the components of the highly sophisticated Scott & White computer-based information system is a data warehouse, which aggregates and makes available data from the billing system and the appointment system, as well as patient demographic data, including patient scheduling data from all 18 regional clinics. The data reside in an Oracle database and can be accessed by any of 40 managers and administrators who have been selected to represent all departments in the organization. These managers and administrators have been given special training in the use of the software system used to access the data warehouse.

The appointment demand prediction grid was generated by defining, within the data warehouse, the variables available for analysis, the types of appointments required, and the types of date and time data required. We defined a same-day appointment as one made and held within 24 hours. The actual numbers of same-day appointments made and held at the Killeen Clinic by day of the week and month of the year for the calendar year 1999 were downloaded from the Scott & White data warehouse onto a spread sheet (Table 1). We then computed the average number of same-day appointments per day made and held for 1999. Using this statistic and the actual appointments extracted from the data warehouse, the percentage of same-day appointments needed by day of the week and month of the year was computed to complete the appointment demand prediction grid (Table 1).

Predicted appointments for calendar year 2000 by day of the week and month of the year were computed using the historical data generated from the grid and an adjustment factor based on subjective forecasting of whether the clinic will experience growth, decline, or be stagnant. For instance, to make predictions for January 2000, the appointments made for the last 6 months were studied, along with the historical data for the month of January (eg, January 1998 and January 1999). Additionally, growth in panel size from managed care payers was considered. The adjustment factor selected and applied to predict appointments for January through March 2000 was 5%. This factor, however, varied depending on the degree of deviation of actual appointments from that predicted. The initial data were copied to an Excel spreadsheet for analysis, and the demand was graphed over time.

We compared our grid with one developed by Kaiser by day of the week and month of the year.

Table 1. Same-Day Appointments by Day of Week and Month of Year, Scott & White Killeen Clinic, 1999.

Month	Monday No. (%)	Tuesday No. (%)	Wednesday No. (%)	Thursday No. (%)	Friday No. (%)	Average No. (%)
January	143 (127)	128 (114)	117 (104)	114 (101)	110 (98)	122 (109)
February	147 (131)	128 (114)	117 (104)	111 (99)	117 (104)	124 (110)
March	160 (142)	129 (115)	129 (115)	121 (107)	112 (99)	130 (116)
April	152 (135)	111 (99)	109 (97)	100 (89)	100 (89)	114 (102)
May	114 (101)	107 (95)	94 (83)	98 (87)	97 (86)	102 (90)
June	117 (104)	95 (84)	77 (68)	88 (78)	87 (77)	93 (82)
July	126 (112)	105 (93)	81 (72)	87 (77)	86 (76)	97 (86)
August	122 (108)	93 (83)	80 (71)	84 (75)	88 (78)	93 (83)
September	124 (110)	97 (86)	97 (86)	98 (87)	128 (114)	109 (97)
October	145 (129)	101 (90)	99 (88)	106 (94)	108 (96)	112 (99)
November	151 (134)	118 (105)	105 (93)	105 (93)	119 (106)	120 (106)
December	166 (147)	137 (122)	124 (110)	132 (117)	116 (103)	135 (120)
Average	139 (123)	113 (100)	102 (91)	104 (92)	106 (94)	113 (100)

Note: Numbers in parentheses represent percent of the average same-day appointments per day of 113.

We then compared our predictions with actual patient appointments made and held in our clinic for January through June 2000. Actual patient appointments made and held for calendar year 2000 were computed as the mean of the number of same-day appointments and those made within 24 hours of the appointment. The chi-square test for trend was used to check for statistical significance in trends.

Results

Appointment Demand Prediction Grid

From the historical data obtained from the data warehouse, the actual same-day appointments made and held by day of the week and by month of the year for calendar year 1999 are displayed in Table 1. The average number of same-day appointments per day made and held for 1999 was subsequently computed to be 113. Based on this statistic, the percentage of same-day appointments needed by day of the week and by month of the year for 1999, which would be needed for future predictions, was computed as shown in parentheses in Table 1.

Predicted Appointments for Calendar Year 2000

Based on the generated appointment demand prediction grid displayed in Table 1, the predicted appointments for calendar year 2000 were computed using an adjustment factor of 5% to 8%; 5% for January through March, 8% for April and May, and 5% for June (Table 2).

Comparison of the Scott & White Killeen Clinic Grid with the Kaiser Grid

For each week, the demand prediction for same-day appointments in our clinic generally decreased dramatically from Mondays to Wednesdays and tapered off through Fridays. The decrease from Mondays to Tuesdays was significantly higher than the decrease from Tuesdays to Wednesdays ($P < .01$). On the whole, however, our data agreed with the Kaiser data by the day of the week (Figure 1).

Regarding month of the year, our demand prediction was highest for the months of March and December, and lowest for the months of June and August. Comparing our data with the Kaiser data showed a difference for the summer and winter months. While our appointment demand prediction dropped for the months of June through August and rose between October and December, the Kaiser grid remained fairly constant during the 12 months (Figure 2).

Comparison of Predictions with Actual Appointments

Overall, actual patient appointments made and held for January through June 2000 in our clinic were 6% more than the predicted numbers. Actual appointments made and held for January and February were 18% and 4% more than the predicted numbers, respectively, while appointments for March were 3% less than the predicted numbers, although the adjustment factor for this period was

Table 2. Comparison of Predicted and Actual Appointments Made by Patients.

Month of the Year 2000	Day of the Week	Predicted Appointments for 2000*	Actual Patient Appointments Made and Held for 2000			Difference (Actual-Predicted)		Percent Difference
			Same-Day	Within 24 h	Average	Daily	Average	
January	Mon	150	188	190	189	39	29	18
	Tues	134	159	189	174	40		
	Wed	123	137	157	147	24		
	Thurs	120	129	150	140	20		
	Fri	116	126	147	137	21		
February	Mon	154	162	165	164	10	5	4
	Tues	134	125	150	138	4		
	Wed	123	127	159	143	20		
	Thurs	117	104	127	116	(1)†		
	Fri	123	108	128	118	(5)†		
March	Mon	168	171	171	171	3	(4)†	(3)†
	Tues	135	118	157	138	3		
	Wed	135	104	130	117	(18)†		
	Thurs	127	110	136	123	(4)†		
	Fri	118	101	129	115	(3)†		
April	Mon	164	166	166	166	2	7	5
	Tues	120	118	155	137	17		
	Wed	118	108	134	121	3		
	Thurs	108	98	122	110	2		
	Fri	108	104	131	118	10		
May	Mon	123	133	133	133	10	8	7
	Tues	116	121	149	135	19		
	Wed	102	100	131	116	14		
	Thurs	106	94	117	106	0		
	Fri	105	94	116	105	0		
June	Mon	123	118	119	119	(4)†	3	3
	Tues	100	97	131	114	14		
	Wed	81	76	97	87	6		
	Thurs	92	87	105	96	4		
	Fri	91	78	96	87	(4)†		

*Inflated by 5% adjustment factor for January through March, by 8% for April and May, and by 5% for June.
†Denotes negative numbers.

5%. Appointments for April through June were 3% to 7% more than the predicted numbers. The adjustment factor for this period was 8% for April and May, and 5% for June (Table 2).

On average, the number of daily appointments made and held were 8% more than predicted during the 6-month period. The highest daily variation occurred in January, where, on average, there were 29 more actual appointments made and held than predicted. The least daily variation was observed in March and June where, on average, there were 4 fewer actual appointments made and held (March) and 3 more actual appointments made and held (June) than predicted (Table 2).

Discussion

Access to health care in a timely manner has been the subject of much discussion, particularly in the primary care setting. Previously defined in terms of

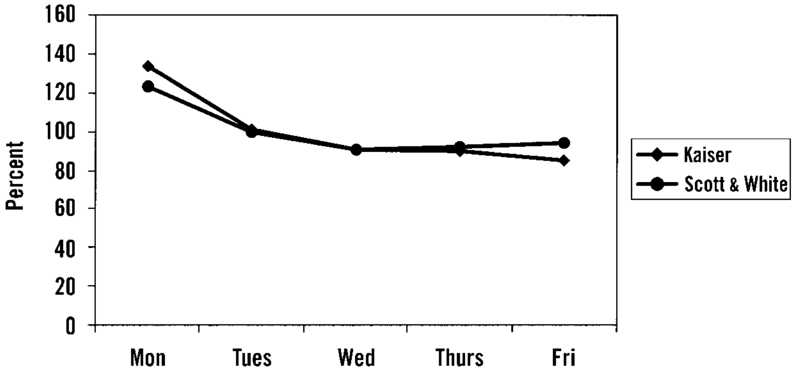

Figure 1. Comparison of same-day appointments by day of the week: Kaiser (1995) versus Scott & White (1999) grids.

the ease with which insured persons received care, access has been redefined as "the ability to seek care from the provider of choice at the time a patient chooses."[6] Consequently, several methods to improve access to health care have also recently been described. Although the open-access appointment-scheduling concept has been touted as one of the acceptable and promising methods, it is still in a developmental stage. Based on the premise that demand for health care is predictable, we sought to develop a patient appointment demand prediction grid for future appointments at one of our 18 regional clinics. The grid we chose was similar to those developed by pioneers of the open-access appointment-scheduling concept. Actual appointments made and held in our clinic overall for the 6 months were 6% more than our demand predictions but compared well with an 8.1% prediction accuracy reported in one clinic setting in Denver, Colo, which used a simple prediction equation.[9]

In our prediction grid, we selected 5% as the adjustment factor for the first 3 months. The choice of 5%, although somewhat arbitrary, was partly based on the change in our health plan population, which accounts for about 70% of all visits to this clinic. Although the overall actual appointments made and held for the first quarter of 2000 was 6% more than our demand predictions, a statistic which is higher than our adjustment factor, we decided to use a higher adjustment factor for predicting the demand for subsequent months. This decision was based on the gradual drop from 18% more than our predictions in January to 3% less than our predictions in March. We believe that our predictions for January might have been inaccurate because we did not factor in the major holiday before the first Monday in January. Not surprisingly, when we increased the adjustment factor to 8% for April and May, the actual appointments made and held started to top our predictions again, leading us to revert to a 5% adjustment factor for June. Because of the acceptance of the concept by our physicians, however, even when demand exceeded predictions, we were generally able to see all

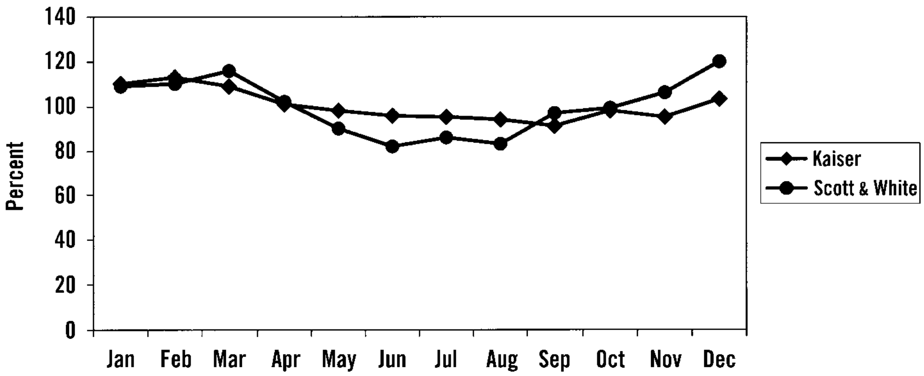

Figure 2. Comparison of same-day appointments by month of the year: Kaiser (1995) versus Scott & White (1999) grids.

Table 3. Summary of Key Points and Issues in Developing and Implementing Open-Access Appointment Scheduling.

- Patient demand in primary care can be predicted
- Many benefits can be realized from implementing open access
  - Increased patient access
  - Improved patient satisfaction (patients get in whenever they desire)
  - Increased continuity of care (patients are more likely to see their own physician)
  - Decreased future visits (physicians do preventive care during acute care visits)
  - Decreased telephone calls
  - Decreased nursing hours as a result of fewer telephone calls
- Open access requires a philosophical shift to do today's work today
- Start by assessing panel size and determining the average number of SDAs in the practice, keeping in mind the seasonal variation for SDAs (in our own situation, April and October were the months closest to the average number of SDAs for the year)
  - Inquire from your HMO about the number of patients in your panel
  - Ask your receptionist to start a manual count of SDAs
  - Count active charts to get a rough estimate of panel size
- With an estimated average SDA, multiply by percentage of SDAs (shown in parenthesis of Table 1) to obtain future predictions
- Adjust numbers accordingly using your knowledge of expected growth in your panel
- Continue to monitor closely

SDA = Same-day appointments.

accessing patients the same day without any of them being turned away at any day.

A few limitations in our method deserve mention. First, we believe that our own methodology will change and improve as our data warehouse improves. Definitions of computer fields change with the regular process of problem identification within our medical informatics framework. The development of an appointment demand prediction grid without the use of an electronic data system might well be possible, and, if done rigorously, might even better reflect the true demand. Second, our data collection and analysis were centered around the practice of family physicians. Although we believe that the same principles might eventually be applied to other specialties and subspecialties, we have no data at this time to support that assertion. Third, we do not know whether all the appointments made and held were truly necessary visits.

The ability of the physicians to accept a change in the philosophy of scheduling will have implications to the success or failure of a change of this magnitude. Acceptance from the senior staff was sought, but not measured, as we developed and implemented our open-access appointment-scheduling plan. We have continued to monitor the morale of the physicians during this time, however, and physicians are self-reporting their morale at a level of 4.5 on a simple 5-point Likert scale. This change requires a commitment from the whole staff and willingness on the part of the physicians to exercise less direct control of their daily schedules. We have observed that any one physician has the potential to dampen the success of the program.

Since accurate prediction of patient volume should allow for improved staffing and satisfaction, future studies should incorporate an evaluation component to assess patient and provider satisfaction with the open-access appointment-scheduling concept, paying attention to such outcomes as patient complaints as well as the number of patients leaving without being seen. Our experience is that aggressive daily management of appointment slots is required to capitalize on available physician time. In addition, attention should be given to factors such as the day before or after a major holiday and weather variations.

We have experienced other changes as a result of having implemented open-access appointment scheduling. Because inadequate access to care is one of the major reasons for patient dissatisfaction,[3,4] we believe the vastly improved access now available to our patients has greatly increased our patient satisfaction, although this outcome has not been measured and could be slightly premature to report at this time. Nevertheless, patient satisfaction is one key reason to make patient appointment available on demand. The physicians report, experientially, that they are getting to see their own patients more often. We have increased the number of patient visits significantly since the implementation of the open-access appointment scheduling, although this increase is, we believe, also affected by other minor changes we have made to become more efficient. The volume of patients requiring assistance after hours was reduced substantially because of open access. Another dramatic improvement we have experienced since the implementation of open-access appointment scheduling is the reduction of the number of nurses on telephones. There is less demand for triage services by a registered nurse in a clinic using an open-access appointment system.

Conclusions

We believe that there is some seasonality reflected in the comparison of our data with the Kaiser data. Although our climate is mild, we believe that the Kaiser data reflect an even milder climate. These results underscore the need for each practice to develop its own demand prediction grid for future appointments, if possible. Nonetheless, practices might still depend on a prediction grid developed in other practices, such as that developed by Kaiser or reported in this article, provided due consideration is given to practice differences. That our actual appointments were 6% more than the predicted numbers overall, with month-to-month fluctuations, reemphasizes the need for continuously monitoring the demand for visits[8] and for a prediction adjustment factor in the implementation of an open-access appointment scheduling.

For those who would like to put such a system in place in their own setting, particularly in the absence of a computerized system, we summarize the key points and issues involved in its development and implementation (Table 3).

References

1. Comprehensive accreditation manual for ambulatory care. Oakbrook Terrace, Ill: Joint Commission on Accreditation of Healthcare Organizations, 2000-1.
2. Health plan employer data and information set. Washington, DC: National Committee for Quality Assurance. http://www.ncqa.org/pages/policy/hedis/h00meas.htm. Accessed 3 July 2000.
3. Kaiser Permanente competitor analysis survey. Sacramento, Calif: Kaiser Permanente, 1995.
4. Partnering for value. Washington, DC: Washington Business Group on Health, 1997.
5. Murray M, Tantau C. Must patients wait? Jt Comm J Qual Improv 1998;24:423–5.
6. Murray M, Tantau C. Redefining open access to primary care. Manag Care Q 1999;7:45–55.
7. Herriott S. Reducing delays and waiting times with open-office scheduling. Fam Pract Manage 1999;4:38–43.
8. Heffernan JJ, Parker RA, O'Neill S, Greenberg D. Implementing "open access" to primary care in a hospital-based academic practice. J Gen Intern Med 2000;15(Suppl 1):231.
9. Batal HA, Adams JC, Mehler PS. Prediction of daily patient volume. J Gen Intern Med 2000;15(Suppl 1):226.