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Short Communication

# Factors associated with appointment-keeping in an American University's dental clinic system: toward practice-based population health

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In oral healthcare settings, there is a significant need for research on the relationship between access to care and appointment-keeping, and to better understand the relationship between appointment-keeping, psychosocial challenges, and need for care. Taken as a whole, the current body of dental appointment-keeping intervention research describes appointment-keeping behavior with limited acknowledgment of its complexity and its connection with equitable access; however, general dental research findings suggest that appointment-keeping barriers are multifactorial, related to social issues, and not reducible to problems with remembering.[1] Because no-shows also have an adverse financial impact on dental providers, psychosocial outreach to improve attendance is a coveted example of simultaneously improving access, quality, and profitability. Practice-based population health (PBPH) offers one promising avenue for improving attendance in dental settings. Defined as 'the proactive measurement and management of the panel of patients in an individual practice,'[2] PBPH can guide dental practices in (1) identifying patients at risk for broken appointments and (2) implementing and tracking outreach to improve attendance. Dental no-show interventions have attempted to improve attendance through universal reminders, sometimes in combination with a policy which terminates patients from services after a certain number of broken appointments.[1] To our knowledge, none has used PBPH to identify patients at risk for no-shows in the interest of targeting outreach to those who need it most.

The current study investigated factors associated with appointment-keeping in an American university's dental clinic system with the goal of exploring PBPH's potential to improve attendance. Past research suggests that variables associated with non-attendance or underutilization of available appointments in American settings include self-pay, having a resident as the provider, rural residence, adolescent age,[3] lower health literacy,[4] greater number of decayed tooth surfaces, use of public assistance, significant debt, greater distance from home to clinic, lower educational attainment, and race, with non-whites having higher no-show rates than the whites.[5] Some studies suggest that Medicaid-insured patients break appointments at a higher rate[6,7] and other studies do not.[3,4,8] In conducting the current

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study, our particular interest was to explore whether variables that are easily extracted from administrative records—and therefore of potential utility in PBPH—are associated with appointment-keeping.

The University of Michigan Institutional Review Board approved this study (HUM00100204). De-identified 2014 data were extracted from a large American university's dental clinic system. The clinics are training sites serving patients of all ages, including students and community members. One clinic is community-based, largely serving low-income patients. Dentists, dental hygienists, dental and dental hygiene students, and residents staff the clinics.

Appointment-keeping data are kept separate from health and billing records. Thus, only a limited set of relevant variables were useable: a patient identifier; appointment date, time, and length; age; sex; insurance; student vs faculty clinic; and the outcome of interest: whether the appointment was attended, canceled, or failed. 'Canceled' means the patient contacted the clinic, while 'failed' means 'no-show, no call.'

Statistical analyses were conducted with Stata version 13, using a 0.05 significance level. Appointment date and time were used to create categorical variables for season and time of day. Categorical variables were also created from the insurance list, to indicate whether the patient was uninsured, insured by Medicaid, or insured by any other. Date of birth was used to create categorical variables for age. Logit odds ratios were calculated for a binary outcome (appointment was attended or not attended), and multinomial logit odds ratios were calculated for a trinary outcome (appointment was attended, canceled, or failed).

The data contained 180,437 appointments for 45,985 patients. Seventy-three percent of appointments were attended, while 21.3% were canceled and 5.8% were failed. Canceled and failed appointments followed differing patterns. The highest cancellation percentages were found in student clinics (29.5%) and in appointments more than 2 h long (28.9%), while the highest fail percentages were found among children 0–5 years old (13.1%), adults 18–25 years old (11.3%), and for appointments less than 1 h long (11.2%). Within seasons of the year, summer months had the highest fail percentage (7.2%), while winter months had the highest cancellation percentage (24.3%) and the lowest rate of attendance (69.2%). Compared to Medicaid-insured and privately insured individuals, uninsured individuals had the highest rates of canceled (25.6%) and failed (9.5%) appointments.

Table 1 presents logit odds ratios for the binary outcome and multinomial logit odds ratios for the trinary outcome. Appointments with missing variables were dropped, resulting in 158,763 appointments for 42,761 patients. Multinomial logit odds ratios enabled comparisons between patient and appointment characteristics and the trinary outcome (attended, canceled, or failed appointment), relative to defined reference categories.

Age: patients under 6 years old, 6–10 years old, and 11–17 years old were more likely to cancel than attend, relative to the adult reference category of 26–64 years old. In contrast, patients aged 18–25 years and over 65 years were less likely to cancel than attend, relative to the adult reference category. For failed appointments, patients who were under 6 years old, 6–10 years old, and 18–25 years old were more likely to fail than attend, relative to the adult reference category, while patients who were aged 11–17 years and over 65 years were less likely to fail than attend, relative to the adult reference category.

Appointment time: appointments between 10 am and 4 pm, and appointments after 4 pm, were more likely to be canceled than attended, relative to the reference category of appointments between 8 am and 10 am. For failed appointments, the opposite is true. Appointments between 10 am and 4 pm, and appointments after 4 pm, were less likely to be failed than attended, relative to the early reference category.

Student clinics: appointments in student clinics were more likely to be canceled than attended but less likely to be failed than attended, relative to appointments in non-student clinics.

Appointment length: appointments 1- to 2-h long and more than 2-h long were more likely to be canceled than attended, relative to the reference category of appointments less than 1-h long. For failed appointments, the opposite is true. Appointments 1- to 2-h long and more than 2-h long were less likely to be failed than attended, relative to appointments less than 1-h long.

Insurance: appointments for Medicaid-insured patients were more likely to be canceled than attended and more likely to be failed than attended, relative to patients with other insurance. Uninsured patients follow the same pattern. They were more likely to be canceled than attended and more likely to be failed than attended, relative to patients with other insurance.

Research evidence suggests variables of potential utility in developing PBPH for appointment-keeping. Some have already done so in non-dental settings; for example, Huang and Hanauer used a predictive logistic regression model in administrative data to calculate attendance probability for pediatrician visits.[9] Our model explained a small amount (about 4%) of the variability in our data. Despite this limitation, our work uncovered statistically significant results that suggest directions for future research, with small but statistically significant differences within all seven tested variables. Our results were consistent with those from an appointment-keeping study with a similar population,[3] particularly in that uninsured patients had the highest rates of failed and canceled appointments.[3,8] We also found that among certain categories (age, appointment time, student clinics, appointment length), canceled and failed appointments followed distinct or even opposite patterns, suggesting that different psychosocial issues underpin these appointment-keeping behaviors, and suggesting that different types of preventive measures could be designed for patients at risk for each.

The June 2015 Institute of Medicine report entitled Transforming Health Care Scheduling and Access encourages research on appointment-keeping.[10] Critical to this enterprise is the availability of high-quality data from practice settings. Many variables of interest to our research, such as income, distance from clinic, and race, were available only using proxies, or were altogether unavailable. Routinely collecting psychosocial data on patients, and making that data accessible to data analysts, would help clinics move in the direction of leveraging PBPH to stratify their patient population in the interest of targeting outreach to those who need it most.