

# Assessing the Association Between Receipt of Dental Care and Diabetes Outcomes: An Example from Kaiser Permanente Northwest (KPNW)

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# Today's Objectives

- Within the KPNW Dental Program:
  - Discuss the association of ongoing receipt of dental care with: 1) clinical outcome measures and 2) cost measures among population with diabetes-mellitus (DM)
  - Briefly discuss future dental-medical interventions/evaluations to improve care for adults with DM

# Background

- Diabetes imposes a large burden on the U.S. health care system.
  - 2013: \$116 billion in medical costs and \$59 billion in reduced worker productivity.
- Prior research has shown a two-directional relationship between periodontal disease and diabetes.
  - Diabetes exacerbates severity of periodontal disease.
  - Periodontal disease, in turn, contributes to poor metabolic control, which can increase diabetes-related complications.
- Regular receipt of dental care can reduce the effects of periodontal inflammation, thereby improving glycemic control.
  - Few studies have been done at the population level that also analyze key utilization and cost measures.

# Dental-Diabetes-Mellitus (DM) Study Objectives

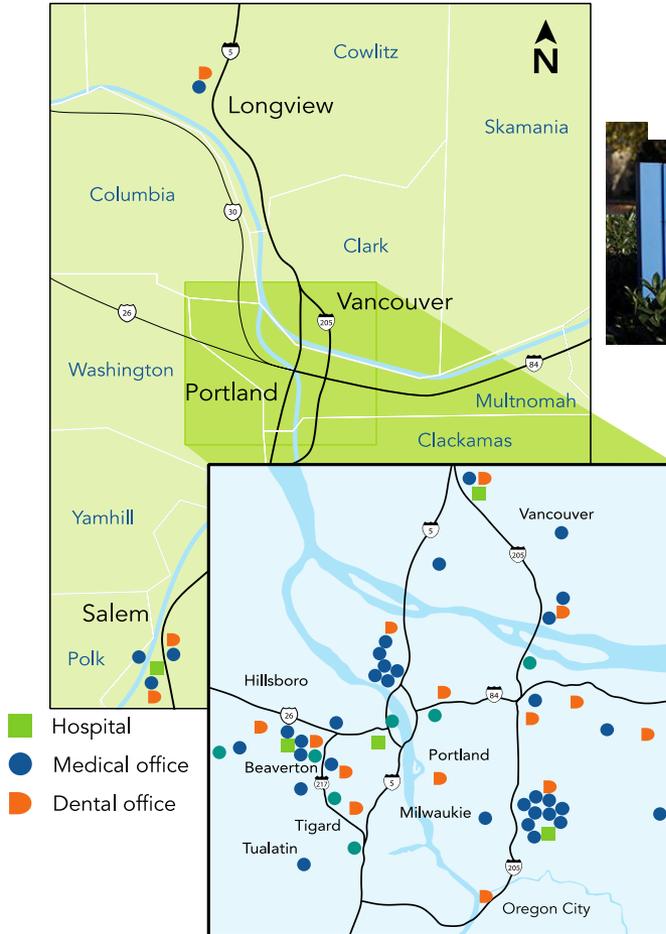
- Among adults with DM, determine association of regular receipt of dental care with the following outcomes:
  - Good glycemic control
  - DM-specific utilization
    - Hospital admissions, emergency department (ED) visits
  - Medical costs
    - Total costs
    - Hospital costs
    - ED costs

# Study Setting

- Kaiser Permanente Northwest (KPNW)
  - Serves 499,000 members in Portland metro area (includes southwest Washington).
  - Group model health maintenance organization (HMO).
  - Includes a medical and dental health plan.
- One of seven Kaiser Permanente (KP) regions
  - Large integrated health system providing comprehensive, prepaid health care services to 10 million individuals.
- KPNW Dental Program serves 229,000 members
  - Capitated; prepaid payment model
  - 17 dental clinics; half co-located with KPNW medical offices
  - 90% of KPNW dental members also have KPNW medical insurance

# Geographic location of KPNW Dental and Medical Services

## KAISER PERMANENTE DENTAL + MEDICAL FACILITIES



# Use of Panel Support Tool (PST) in KPNW Dental Clinics: Population Health Approach

KAISER PERMANENTE

Name: SMITH, TOM  
HRN: XXXXXXXX

Primary Care Physician: Merrill Ahrens (0149E)

These recommendations are based on information regarding your general health, your age, and national guidelines for preventive care. Your clinician may determine that you need these tests more or less frequently.  
Our records indicate you are due for the following:

**Lab tests—Please bring this chart with you to any Kaiser Permanente laboratory. Most medical offices provide lab services between 8 a.m. and 5 p.m. Monday through Friday. Fasting is not required for any of these recommended lab tests. Your clinician may schedule additional tests for you. Please check with a lab representative when you come in.**

Test	About this test	Test code - for lab use
<b>Blood tests</b>		
Diabetes monitoring test (HbA1c)	This test measures average blood glucose levels. Generally lower levels are better, and for most patients a level under 7 is best.	2921552
<b>Urine/stool tests</b>		
Colon cancer screening test	A simple home stool test (FIT) can detect colon cancer at an early stage, when treatment can save your life. The test should be repeated yearly. Any positive test should be further evaluated with an examination of your colon. To request a FIT kit, please call us toll-free at 855-517-8382.	18734273

**Vaccinations--Please go to any Nurse Treatment Room located in most primary care buildings to get your vaccinations (shots). First, please check in at the registration desk.**

Vaccine	About this vaccine
Tetanus (Tdap)	Tetanus, diphtheria, and pertussis vaccine is a one-time vaccination for everyone age 7 and over. Regular tetanus booster shots should follow every 10 years.

- Nearly **100 percent** of our dental providers (**137** KPNW dentists and **191** dental providers) are using the Patient Support Tool (PST) routinely
- #4 in care gap closure assists (assisted in closing 23,000 care gaps in 2013) among KPNW departments
- Example of dental-medical integration on population health level

# Study Methods: Diabetes Population

- Data-only analysis with the following inclusion criteria:
  - On KPNW diabetes registry by 12/31/05 with type II diabetes diagnosis.
  - Continuous medical and dental coverage between 1/1/2005 and 12/31/2007.
  - Between ages 18–80 as of 12/31/2005.
  - $\geq 1$  outpatient visit each calendar year between 1/1/2005 and 12/31/2007.
- Retrospective cohort research design
  - Dental population received  $\geq 2$  dental-related hygiene and/or periodontal visits each calendar year between 1/1/2005 and 12/31/2007.
  - Non-dental population did not receive ANY dental care between 1/1/2005 and 12/31/2007.
  - Matched exactly on gender, age (within 1 year), and ED utilization/hospital admissions (during 2005).
- Outcome measures and cost information tracked in 2007

# Population Process Flow: DM Population

Total population that met dental and medical insurance eligibility requirements and were listed on diabetes registry between 1/1/2005 and 12/31/2007 (N=4,331)

**Dental Use:** Total population that met criteria for dental hygiene and/or periodontal visits (N=537; 12.4%)

**No Dental Use:** Total population with no dental visits over study period (N=747; 17.2%)

**Excluded Population:** Total population who had some dental visits that did not meet threshold (N=3,047; 70.4%)

**Final Analytic Sample (N=986)**

**Dental Use** = 493 of 537 (91.8%) patients matched to non-dental population

**No Dental Use** = 493 of 747 patients match to dental population with regard to sex, age (within one year), 2005 emergency department visits, and 2005 hospital admissions

# Outcome Measures: Glycemic Control, Utilization and Medical Costs

- HbA1c control (2007)
- Utilization (2007)
- Medical costs, per patient per month:
  - Total costs (2007)
  - Inpatient costs (2007)
  - ED costs (2007)
  - Costs based on CPT-4 intensity weighted procedure codes

# Covariate Measures

- Matched variables
  - Age (within 1 year; as of 12/31/2005)
  - Sex
  - Diabetes-specific ED utilization (2005)
    - 1+ visits vs. none
  - Diabetes-specific hospital admissions (2005)
    - 1+ admissions vs. none
- Non-matched variables
  - Race/ethnicity (white vs. non-white)
  - HbA1c (< 7% vs.  $\geq$  7%; closest value to 12/31/2005)
  - Charlson comorbidity score (CCI; continuous)
  - Periodontal risk factors (moderate vs. elevated)
  - Body mass index ( $\geq$  30 vs. < 30)
  - Yearly primary care utilization (2005-2007; continuous)

# Population Characteristics (Diabetes Population)

Characteristic – Matched Variables	Dental Group <sup>1</sup> N=493	Non-Dental Group <sup>2</sup> N=493
Age (mean +/- S.D.)	61.4 +/- 9.0	61.3 +/- 9.0
Female (%)	58.0	58.0
2005 ED Use (% with 1+ visits)	6.7	6.7
2005 Hospital Utilization (% with 1+ admissions)	9.1	9.1

<sup>1</sup> Received  $\geq 2$  dental-related hygiene and/or periodontal visits each calendar year between 1/1/2005 and 12/31/2007.

<sup>2</sup> Received no dental contact between 1/1/2005 and 12/31/2007.

# Population Characteristics (DM Population)

Characteristic: Non-Matched Variables	Dental Care Group <sup>1</sup> N=493	Non-Dental Care Group <sup>2</sup> N=493
White (%)	86.0%	88.0%
2005 HbA1c values < 7%	54.8%	43.2%
<b>Health Status Measures</b>		
Charlson comorbidity index score (mean +/- SD)	0.41 +/- 0.71	0.47 +/- 0.81
Body Mass Index (mean +/- SD)	32.9 +/- 6.6	34.9 +/- 7.5
Moderate periodontal risk (diabetes only, %)	79.3%	74.2%
Elevated periodontal risk (diabetes + smoking, %)	20.7%	25.8%
<b>Primary Care Utilization</b>		
2005 primary care visits (mean +/- SD)	2.8 +/- 2.0	2.8 +/- 2.2
2006 primary care visits (mean +/- SD)	2.8 +/- 2.0	2.8 +/- 2.2
2007 primary care visits (mean +/- SD)	2.8 +/- 2.0	3.0 +/- 2.6
<b>HbA1c Testing</b>		
Receipt of HbA1c testing (% ≥ 1 tests, 2005)	97.8%	99.2%
Receipt of HbA1c testing (% ≥ 1 tests, 2006)	99.2%	99.2%
Receipt of HbA1c testing (% ≥ 1 tests, 2007)	99.6%	98.4%

<sup>1</sup> Received ≥ 2 dental-related hygiene and/or periodontal visits each calendar year between 1/1/2005 and 12/31/2007. <sup>2</sup> Received no dental contact between 1/1/2005 and 12/31/2007.

# Multivariate results: HbA1c Control and Health Care Utilization<sup>1</sup>

	HbA1c < 7%**		ED Utilization**		Hospital Admissions**	
	OR	95% CI	OR	95% CI	OR	95% CI
Receipt of regular dental care	1.29	0.97-1.72	0.61	0.40-0.92*	0.61	0.39-0.95*
Non-receipt of dental care	1.00	NA	1.00	NA	1.00	NA

\*  $p < .05$

<sup>1</sup> Mosen DM, Pihlstrom DJ, Snyder JJ, Shuster E. Assessing the association between dental care, diabetes control measures and health care utilization. JADA 2012; 143(1):20-30.

\*\* Models adjusted for age, sex, baseline DM-specific ED utilization, DM-specific hospital admissions, race/ethnicity, baseline HbA1c value, charlson comorbidity index (CCI), periodontal risk factors, obesity status, and primary care utilization 2005-2007

# Cost Results: Cost Analysis (in dollars) – Receipt of Dental Care vs. Non-Receipt

Population	Total costs per patient per month (2007; mean +/- SD)
Dental Care	740 +/- 1,119
No Dental Care	1,002 +/- 1,665
p-value	0.004
Population	Total inpatient costs per patient per month (2007; mean +/- SD)
Dental Care	110 +/- 526
No Dental Care	269 +/- 906
p-value	0.009
Population	Total ED costs per patient per month (2007; mean +/- SD)
Dental Care	27 +/- 76
No Dental Care	43 +/- 110
p-value	0.008

# Cost Results: Multivariate Regression Results (adjusted per patient per month costs)

Cost Metrics: per patient per month	Receipt of Dental vs. Non Receipt <sup>1</sup> Beta coefficients +/- SE	p-value <sup>2</sup>
Total	-129 +/- 82	.500
Inpatient	-101 +/- 44	.011
ED	-13 +/- 6	.008

<sup>1</sup> Models adjusted for age, sex, baseline DM-specific ED utilization, DM-specific hospital admissions, race/ethnicity, baseline HbA1c value, charlson comorbidity index (CCI), periodontal risk factors, obesity status, and primary care utilization 2005-2007

<sup>1</sup> Beta coefficients reported in absolute dollars.

<sup>2</sup> p-values assessed using log-transformed costs.

# Conclusions: DM Outcomes and Costs

- HbA1c control
  - Dental group not statistically significant from non-dental group; but trended in the anticipated direction
- Utilization
  - Dental group had lower DM-specific hospital admissions and ED visits compared to non-dental group, adjusting for patient characteristics
- Medical costs
  - Dental group had \$101 lower inpatient costs and \$13 lower ED costs per patient per month compared to the non-dental group, adjusting for patient characteristics

# Limitations

- Differences in outcomes may be due to patient differences between two groups; rather than receipt of dental care (e.g. lifestyle choices, adherence to treatment regimens, diet, etc.)
- Limited information regarding adherence to diabetes medications
- Because of differences in dental/non-dental population, cost extrapolations to entire population should be interpreted with caution
- Despite limitations, analysis adjusted for a comprehensive set of covariate measures

# Next Steps: Target Outreach to Adults with Diabetes Who Do Not Utilize Dental Care



# Pilot Intervention: Outreach to DM Population Not Seen for Dental Care in Previous 15 months

- KPNW conducting pilot to reach adults with DM who are overdue for dental visits
  - Two groups targeted:
    - Group 1: receiving letter mailing + targeted follow-up by live caller to schedule dental visit (while on phone)
    - Group 2: usual care
- Key outcome metrics
  - Scheduled and/or completion of dental visit (90 days post mailing)
  - Longer-term outcomes (12 months post mailing)
    - Changes in periodontal risk status
    - Changes in HbA1c values
    - DM-specific hospital admissions and ED visits

# Future Integration Research: DM Population

- Develop innovative interventions to reduce care gaps in the dental setting
  - Develop targeted interventions to reduce DM and non-DM care gaps in the dental setting
    - “Warm transfer” to medical centers to complete needed labs (HbA1c tests, LDL-c tests)
    - For population with no recent primary care utilization, help to schedule primary care visit and provide linkage to needed DM care management services
- Develop targeted interventions in medical offices
  - Identify members with no dental utilization in previous 12-24 months and schedule dental visit during primary care visit
  - Develop “Dental PST” and flag dental care gaps for DM population